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Protection Agency

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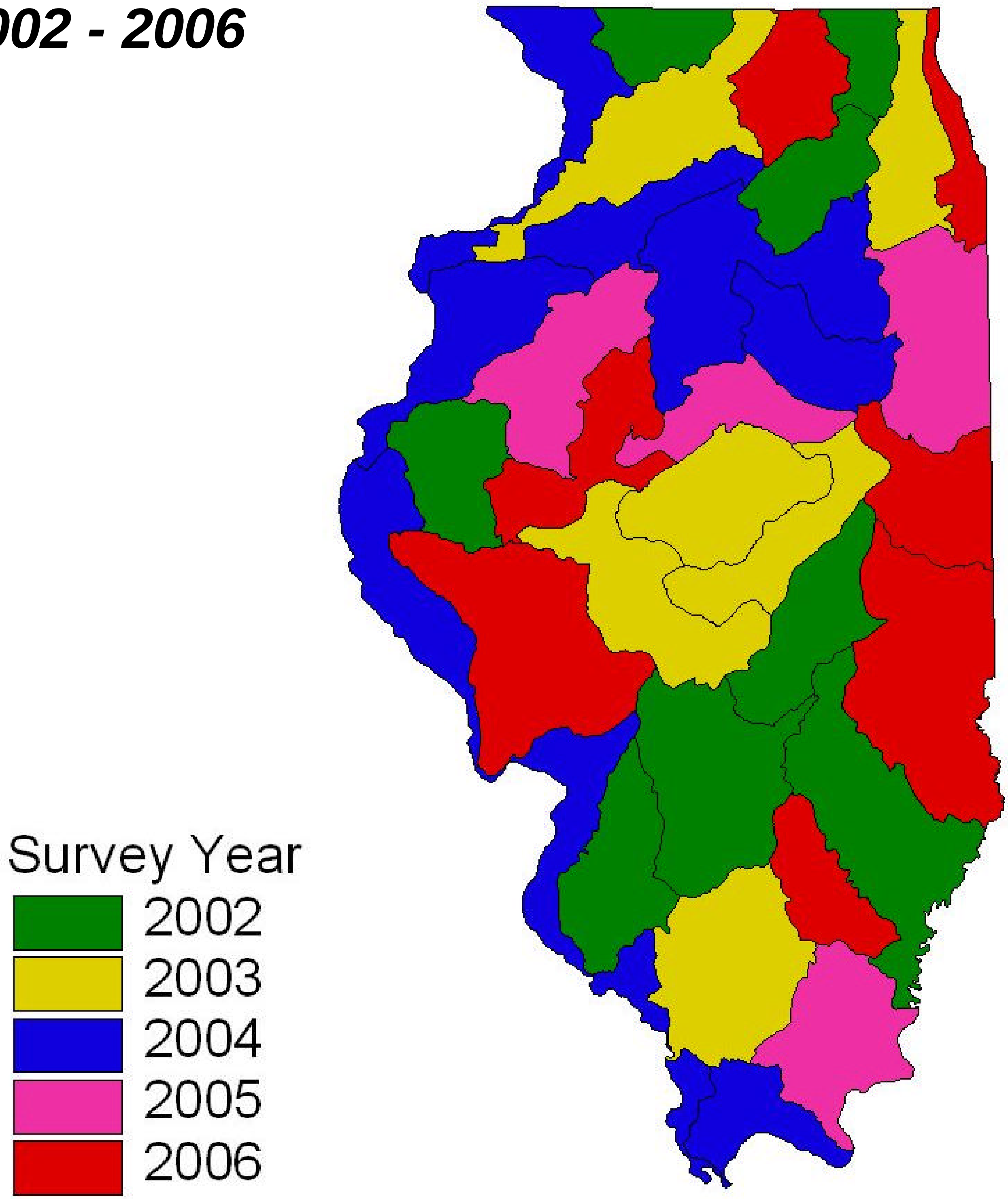
WATER MONITORING STRATEGY 2002 - 2006



WATER MONITORING STRATEGY

2002 - 2006

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
BUREAU OF WATER

AUGUST 2002

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SECTION I. EXECUTIVE SUMMARY

- **Background.** In July 2002, the Illinois Environmental Protection Agency (Illinois EPA) Bureau of Water (BOW) conducted a review of Agency water monitoring programs and developed a water monitoring strategy for the 2002-2006 monitoring cycle. The 2002-2006 Monitoring Strategy document was developed to assess the effectiveness of current water monitoring programs and fulfill an Agency commitment made in the 2001 Environmental Performance Partnership Agreement (EnPPA) between the Region 5 U.S. Environmental Protection Agency (U.S. EPA) and the Illinois EPA, to develop a "Surface Water Monitoring Strategy" for the next five-year monitoring cycle. This BOW Water Monitoring Strategy addresses all Illinois EPA water monitoring programs funded by Federal Clean Water Act (CWA) Section 106 funds for the period of 2002 through 2006 and describes major surface and groundwater programs within the framework of U.S. EPA guidance developed for state monitoring and assessment programs.

- **Water Monitoring Programs.** The Illinois EPA conducts a variety of lake and stream monitoring programs that will continue with over the next five years. Ongoing BOW stream monitoring programs include: a 213-station Ambient Water Quality Monitoring Network; an Intensive Basin Survey Program that covers all major watersheds on a five-year rotation basis; and a Facility-Related Stream Survey Program that conducts approximately 20-30 stream surveys each year.

  The Illinois EPA Lake Monitoring Program will maintain program activities at a level similar to the previous monitoring cycle. Lake programs will include: an Ambient Lake Monitoring Program that samples approximately 50 lakes annually; an Illinois Clean Lakes Program that typically monitors three to five projects each year; a Volunteer Lake Monitoring Program that encompasses over 170 lakes each year; and a Lake Michigan Monitoring Program jointly conducted by the Agency and the City of Chicago at over 70 Lake Michigan sites.

  The Agency also conducts several other significant water monitoring programs that will continue in the next monitoring cycle. These programs include: an intensive Community Water Supply Groundwater Monitoring Program; Whole Effluent Biomonitoring and Point Source Monitoring of municipal and industrial wastewater treatment facility discharges; and a Fish Contaminant Monitoring Program of selected Illinois lakes and streams.

- **Quality Assurance.** Quality assurance has received considerable emphasis to ensure environmental programs and decisions are supported by data of the type and quality needed. In conjunction with the development of a BOW Quality System over the past several years, the BOW developed a Quality Assurance Project Plan and Field Methods Manual for water monitoring programs. In 2001, the Agency developed the BOW Quality Management Plan (QMP), and designated a full-time Quality Assurance Officer to oversee BOW QA activities. The Quality Assurance section of this Monitoring Strategy document provides a description of the BOW QMP and Quality System goals that ensure environmental data collected, analyzed and/or compiled by the BOW is of a quality to meet the needs of in-house data users, senior management, and the Agency's external customers and stakeholders.

- **Programmatic Evaluation.** Periodic reviews of water monitoring programs and activities are necessary, to assess the effectiveness of monitoring programs and the environmental information they provide. The primary goals of this Water Monitoring Strategy are to: 1) review the appropriateness of existing water monitoring programs; and 2) assess the effectiveness of water monitoring programs to determine attainment of designated uses of the State's waters and integrate this information into the decision process to ensure BOW programs result in maintaining and improving the State's significant water resources for the citizens of Illinois.

  In the monitoring strategy development process, traditional monitoring approaches of the past must be reviewed and modified as appropriate to improve existing programs, meet the challenges of monitoring new contaminants in the water environment, while also adopting to emerging issues of the future. This process may include the revision/refinement of current programs or new monitoring initiatives. Some of the significant goals and challenges to improve BOW monitoring and assessment programs over the next five-year monitoring cycle include:

  - **Continued improvement of the 305(b) assessment process**. BOW goals to improve Clean Water Act (CWA) 305(b) assessments include completion and implementation of two new biotic indices and development of applicable impairment thresholds to improve aquatic life assessments. It is expected that the process by which potential causes and sources of water resource impairment are identified will also be significantly improved over the 2002-2006 monitoring cycle. This activity may require developing a combination of new monitoring and assessment techniques for both the field and office.

  - **303(d) list and TMDL initiatives**. As the reporting of impaired waters required under CWA Section 303(d) is directly linked to 305(B) reporting, improvements in 305(b) assessments will result in improvements in 303(d) list development and the process by which the Agency selects waters for Total Maximum Daily Load (TMDL) studies.

  - **Development of a TMDL monitoring strategy.** As the TMDL process evolves from study to implementation phase, it will be necessary to assess the effectiveness of Best Management Practices designed to improve lake and stream quality. It is expected that a strategy to implement such monitoring activities will be developed over the 2002-2006 monitoring cycle.

  - **Enhancing data management capabilities**. Timely and accurate water resource assessments are contingent upon the availability of enormous quantities of biological, chemical, and physical data that currently reside in a variety of databases (e.g., STORET). Over the next five-year period it is a BOW goal to develop a detailed data-management plan that: 1) identifies current data storage and retrieval problems; 2) provides solutions for resolving these problems; and 3) recommendations for enhancing the management of Illinois water resource data.

  - **Use of Outside Data.** Concurrent with the need to improve in-house data management is the need to more effectively use the data produced by other monitoring groups. To augment monitoring coverage in the future, the Agency will place greater reliance on the data collected by other agencies or entities who have demonstrated the ability to collect quality data

  - **Nutrient standards development.** The Agency is currently developing nutrient standards for Illinois surface waters. Development of such standards will require considerable data that are applicable to the wide range of lakes and streams that occur in the state. Over the next monitoring cycle, the BOW will continue to monitor special parameters (e.g., chlorophyll *a*) in support of nutrient standards development.

SECTION II. INTRODUCTION

BACKGROUND AND RATIONALE

To accomplish State and federal mandates and to assess the effectiveness of water pollution control programs, the Agency has maintained an effective and efficient surface water monitoring program since its inception in 1970. Over this 30-year period, adjustments and additions to the monitoring effort (e.g., groundwater monitoring) have been undertaken to keep pace with technological advances, broadening environmental concerns, and the need for collaboration with other agencies and public partners. Periodic reviews of water monitoring programs and activities are necessary, however, to assess the effectiveness of monitoring programs and the environmental information they provide. Periodic reviews are also warranted to assure monitoring data collected are fulfilling the specific needs of the Agency and to assist cooperating agencies and other partners carry out their environmental responsibilities.

In June 1996, the Illinois Environmental Protection Agency (Illinois EPA) Bureau of Water (BOW) conducted such a review of Agency water monitoring programs and published the first comprehensive document describing a surface water monitoring strategy for the 1996-2000 period (Illinois EPA 1996). This second BOW Water Monitoring Strategy addresses all Illinois EPA water monitoring programs funded by Federal Clean Water Act (CWA) Section 106 funds for the period of 2002 through 2006 and describes major surface and groundwater programs within the framework of United States Environmental Protection Agency (U.S. EPA) guidance for state monitoring programs (U.S. EPA 2001a).

REPORT ORGANIZATION

Excluding the executive summary and introduction, the 2002-2006 Monitoring Strategy is organized into four main sections:

Section III provides a brief overview and summary of State and federal mandates which establish the legal basis and necessity for water monitoring programs, and a brief overview of existing Illinois EPA water monitoring projects and activities.

Section IV provides a description of current water monitoring programs and new monitoring initiatives planned over the ensuing five-year period. These program descriptions are supplemented by more detailed water monitoring program information in applicable Appendices of this document. In the description of water monitoring programs, applicable elements of the U.S. EPA Adequate State Ambient Water Monitoring and Assessment Program (U.S. EPA 2001a) are addressed to the extent possible.

Section V provides a summary of the BOW Quality System goals, objectives, and current initiatives being implemented under the Quality System.

Section VI provides a programmatic assessment of the effectiveness of the Bureau of Water Monitoring strategy, and specifically addresses the following issues:

- How water monitoring programs determine the extent designated uses of State waters are being achieved;
- How impaired waters are identified and targeted for improvement via inclusion on the Clean Water Act (CWA) Section 303(d) list; and
- How water information is utilized and integrated into the decision process to ensure BOW programs result in maintaining and improving the State's significant water resources for the citizens of Illinois.

SECTION III. WATER MONITORING PROGRAM OVERVIEW

LEGISLATIVE MANDATES

State of Illinois

Illinois Environmental Protection Act. Monitoring of Illinois' surface water resources has been conducted by various state and federal agencies for most of the last century. These efforts were directed at characterizing the aquatic resources and water quality problems of the State; this basic direction remains valid today. The passage of the State of Illinois Environmental Protection Act in 1970 established a clear mandate for controlling pollution problems and the agencies responsible for this control. The stated purpose of the Act is "... to establish a unified, statewide program ... to restore, protect and enhance the quality of the environment..." in order to protect health, welfare, property, and the quality of life (State of Illinois 1993). The Act established the Illinois Environmental Protection Agency (Illinois EPA) and authorizes it to conduct activities as necessary to carryout purposes of the Act, including monitoring of environmental quality.

Groundwater Protection Act. In 1987, the Illinois General Assembly passed the Groundwater Protection Act (IGPA). Although this act is directed toward protection of groundwater as a natural resource, special provisions target drinking water wells. The IGPA responds to the need to protect groundwater quality and established a unified groundwater protection program that includes the establishment of groundwater protection zones and provides for monitoring surveys, mapping and assessments.

Federal

Federal Water Pollution Control Acts. Subsequent federal legislation, primarily the Federal Water Pollution Control Act Amendments of 1972 and Clean Water Acts of 1977 and 1987, established a nation-wide mandate for water pollution control programs. The objective of the Clean Water Act is "... to restore and maintain the chemical, physical, and biological integrity of the Nation's waters". One of the goals for achieving this objective is providing "... wherever attainable, ... water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water..." (Senate Committee on Environment and Public Works, 1977). Section 106(e)(1) of the Clean Water Act requires states to carry out as part of their program, the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, and to compile and analyze data on (including classification according to eutrophic condition), the quality of navigable waters and to the extent practicable, ground waters including biological monitoring; and provision for annually updating such data and including it in the report required under section 305 of this Act.": Section 305(b) of the Clean Water Act requires a biennial report which assesses water quality conditions, use attainability, and the effectiveness of pollution control programs. Under Section 303(d) of the CWS, states are required to identify waters which will not attain applicable water quality standards with technology-based controls and establish a priority ranking for such waters (Illinois EPA 1998).

FEDERAL/STATE INITIATIVES

Performance Partnership Agreement.

On an annual basis, the Agency and the United States Environmental Protection Agency (U.S. EPA) Region 5 office in Chicago participate in the development of an agreement to achieve environmental goals in Illinois. The 2001 Performance Partnership Agreement (PPA) between Illinois EPA and Region 5, U.S. EPA (Illinois EPA 2001b) specifically identifies program elements designed to achieve both State and federal clean water goals. One of the significant Agency commitments made in the 2001 PPA was to develop a "Surface Water Monitoring Strategy" for the 2002-2006 monitoring cycle. In subsequent U.S. EPA/Agency discussions regarding the development of this strategy, U.S. EPA requested that the Illinois EPA monitoring strategy address all water monitoring programs and the 10 Elements of an Adequate State Ambient Water Monitoring and Assessment Program (U.S. EPA 2001a).

MONITORING PROGRAMS

Agency water monitoring program descriptions are briefly summarized below by the monitoring program elements (e.g., monitoring objective, core indicators, quality assurance, etc.) suggested in the 2001 U.S. EPA State monitoring program guidance document (U.S. EPA 2001a). As each water monitoring program is designed and implemented to meet specific environmental, programmatic and legislatively mandated goals, a more detailed description of each major water monitoring program is provided in Section IV.

Program Goals and Monitoring Design

Since its inception in 1970, The Illinois EPA has developed and currently conducts a wide range of Clean Water Act mandated monitoring programs to assess the quality of the State's waters and evaluate the effectiveness of Agency water pollution control programs. Collectively, monitoring required by the CWA requires state agencies to conduct water monitoring programs which address the following basic questions:

- What is the overall quality of the waters in the State;
- To what extent is the water changing over time;
- Where are the problem areas and areas needing protection; and
- How effective are clean water programs.

Existing programs range from comprehensive ambient lake and stream monitoring programs, intensive basin surveys and groundwater monitoring programs to specialized programs that assess wastewater quality for compliance or facility performance objectives. Each water-monitoring program is designed specifically for the type of waterbody to be assessed (e.g., lake, stream, groundwater) and the goals and objective of that program. The sampling design and approach for each monitoring program is therefore unique, as is station selection, monitoring frequency, and parameter coverage. A complete list of the Agency monitoring water programs currently operated and expected to be continued over the next five-year period along with the environmental and program goals each program addresses is presented in Table 1. An overview of the monitoring approach for selected water monitoring programs is shown in Table 2.

Core Indicators

To achieve the broad range of environmental goals the Agency is mandated to meet, current water monitoring programs utilize a combination of biological, chemical and physical indicators to monitor and assess water quality conditions and long-term trends. Each water-monitoring program utilizes an array of these indicators to assess water quality standards attainment and designated use support for in-house programmatic needs and reporting required under the CWA. A summary of the chemical, physical and biological indicators used in Agency monitoring programs is presented in Table 3. A complete list of laboratory and field parameters assessed for each BOW monitoring program is provided in Appendix 1.

Quality Assurance

In 1994 the Agency Bureau of Water and Division of Laboratories submitted the Quality Assurance Project Plan (QAPP), Integrated Water Monitoring Program Document (Illinois EPA 1994). This QAPP, which was approved by U.S. EPA in 1997, included detailed BOW Field Sampling Procedures in Appendix 1 of this QAPP. Over the past year, the emphasis on quality assurance activities has increased significantly with the development of an Agency Quality System, BOW Quality Management Plan (QMP), creation of a full-time quality assurance officer for the Bureau, and the appointment of quality assurance officers for BOW sections with water monitoring responsibilities. Many of the field sampling Standard Operating Procedures (SOP's) submitted with the 1994 QAPP were quickly out of date as new monitoring techniques became available and efforts are currently in place to update these SOP's. A more detailed summary of the BOW Quality System goals, objectives, and current initiatives being implemented under the Quality System is provided in Section V. An overview of BOW project organization and QA responsibilities for sample collection and data validation is provided in Table 4.

Table 1. Summary of Illinois EPA water monitoring programs that address healthy biological community, safe fish, swimming, drinking water, and critical habitat goals.

	Bureau of Water Program Element									Office of Chemical Safety
Section:	**Surface Water Section**				**Great Lakes Program**	**Field Operations Section**		**Ground Water Section**	**Mine Pollution Control**	**Toxicity Assessment Unit**
Program:	Intensive Basin Surveys	Facility-Related Stream Surveys	Water Quality Monitoring Network	Ambient & Clean Lake Monitoring Program	Lake Michigan	Municipal/ Industrial Effluent Monitoring	Toxicity Testing (Bioassays)	Ground Water Monitoring	Mine Effluent Sampling	Fish Contaminant Program
Environmental Goal										
Healthy Biological Communities	●	●	●	○	○	○	●	○	○	○
Safe Fish	○			○	○					●
Safe Swimming/ Recreation			○	●	●					●
Safe Drinking Water			○	○	●			●		
Critical Habitats	○									
Programmatic Goal										
CWA Reporting	●	○	●	●	●			●		●
BOW Program Evaluation	○	○	○	○	○	○	○	○	○	○
Compliance/Permits/ Enforcement		○				●	●		●	
Facility Performance		●				●	●		●	

● **Primary Goal**

○ **Secondary Goal**

Table 2. IEPA water monitoring program design summary.

Monitoring Program/Activity	Sampling Approach	No. of Stations/ Surveys/Year	Special Field Equipment Needed	Summary/Comments
Fixed Station Monitoring				
Ambient Water Quality Monitoring Network (AWQMN) Core Pesticide Stations Mississippi River	Water Chemistry	213 Sites Statewide/ year	Hydrolabs, USGS cranes, suspended sediment point samplers, peristaltic pumps, filtering equipment, bacteria incubators, split churn, weighted bottle sampler.	AWQMN sampling is conducted out of the Marion (66 sites), Springfield (67), and Des Plaines Regional Offices (68). Each site is sampled 9 times per year on a cycle of once every 6 weeks (see Appendix 2). An additional 10 sites on the Mississippi River are monitored quarterly.
Ambient Lake Monitoring Program (ALMP) Ill. Clean Lakes Prog. (ICLP) Vol. Lake Mont. Prog.(VLMP)	Water chemistry/lake quality assessments	ALMP 50 Lakes/ year ICLP varies annually VLMP 180 lakes/yr	Hydrolabs, Kemmerer sampler, Petite Ponar, weighted bottle sampler, Secchi disk, Chlorophyll filtering equipment, 16' boat, and 4WD vehicle	14 to19 Lakes are sampled annually in each region. Each lake is sampled 5 times: April, June, July, August, and October. Sampling may include shoreline erosion and macrophyte assessments and other indicators of lake quality.
Great Lakes Program	Water Chemistry Fish Contaminants	77 Water Chemistry 7 Fish Contaminant	City of Chicago sampling vessel IDNR electrofishing gear	Water chemistry is sampled monthly March through November per a memorandum of agreement with the City of Chicago. Fish sampling is accomplished spring and fall through IDNR.
Point Source				
Facility-Related Stream Surveys (FRSS)	Water Chemistry, effluent, habitat quality macroinvertebrates, and occasionally, fish	20 to 30 surveys/year 7 - 15 surveys/yr by each regional monitoring office	Aquatic dip nets, No. 30 sieves, hip boots and waders, Price Standard Current meter or Gurley Meter.	Each FRSS consists of sampling conducted upstream and downstream of wastewater treatment plants and the number of sites may vary from three to seven or more. Sampling may be conducted in response to legal, CSO, TMDL, WQ standards issues, or plant performance & toxicity issues.
Intensive/Special Surveys				
Intensive Basin Surveys	Water chemistry, habitat quality, fish, macroinvertebrates, sediment chemistry, fish tissue	Six to eight basins annually; one to three surveys in each regional office (Des Plaines, Marion, and Springfield)	Electric seine, back pack shocker, seines, sport yak, 1800 watt generator, scale/ measuring board, aquatic fish/dip nets, hip boots/waders, 30 mesh sieve, sediment sampling equipment, Price Standard Current meter / Gurley meter.	Basin surveys are conducted on a 5-year cycle cooperatively with the Illinois Department of Natural Resources (IDNR); each basin survey may consist of approximately 10 to 35 stations.
Special Surveys	Metric/parameter coverage as necessary for survey objectives	Variable	As required	Special surveys may consist of mini-intensive surveys, sediment chemistry or fish contaminant surveys, lake quality assessments, livestock waste sampling, toxic contaminants, or monitoring to satisfy conditions of grant-funded projects.
TMDL Monitoring	Metric/parameter coverage as necessary for survey objectives	Variable	As required	Surveys may consist of mini-intensive surveys or surveys of specific 303(d)-listed water body segments to determine causes/sources of impairment, or water chemistry characteristics for developing waterbody loadings, or stream improvements following TMDL implementation.
Groundwater				
Ambient Network of Community Water Supply Wells (CWS Network)	Water Chemistry	350 Sites Statewide/ biannually	Hydrolabs	CWS Network sampling is conducted out of the Rockford Regional Office and Springfield Central Office. Each site is sampled 1 time per year on a biennial rotation with the Rotating Monitoring Network.
Rotating Monitoring Network	Water Chemistry	350 Sites Statewide/ biannually	Hydrolabs	Rotating Monitoring Network sampling is conducted out of the Rockford Regional Office and Springfield Central Office. Sampling stations are varied based upon program needs and are sampled 1 time per year on a biennial rotation with the CWS Network.
Nonpoint Source (NPS) Assessments	Watershed land use data collection	In conjunction with intensive surveys and/or as needed	Topographic maps, aerial photographs, Natural Resources Conservation Service (NRCS) data	No water sampling conducted. Staff collect information on land use and critical areas within a watershed which contribute to NPS water quality impairments.

Table 3. Summary of chemical, physical, and biological environmental indicators used in Illinois EPA water monitoring programs.

	Bureau of Water Program Element								Office of Chemical Safety
Bow Section:	Surface Water Section				Great Lakes Program	Field Operations Section	Ground Water Section	Mine Pollution Control	Toxicity Assessment Unit
Program:	Intensive Basin Surveys	Facility-Related Stream Surveys	Water Quality Monitoring Network	Ambient & Clean Lake Monitoring Program	Lake Michigan	Municipal/ Industrial Effluent Monitoring	Ground Water Monitoring	Mine Effluent Sampling	Fish Contaminant Program
Environmental Indicator									
Chemical									
Water [1]	X	X	X	X	X	X	X	X	
Surficial Sediment	X			X[2]	X				
Fish Tissue	X[2]			X[2]					X
Algae									
Phytoplankton Identifications				X	X				
Phytoplankton Counts				X	X				
Chlorophyll *a*	X		X[2]	X	X				
Macroinvertebrates									
Identifications	X	X	X[2]						
Counts	X	X	X[2]						
MBI	X	X	X[2]						
Fish									
Identifications	X	X[2]	X[2]						
Counts	X	X[2]	X[2]						
Index of Biotic Integrity (IBI)	X	X[2]	X[2]						
IBI Metrics	X	X[2]	X[2]						
Stream Habitat Quality									
11-Transects	X	X[2]	X[2]						
Stream Habitat Assmt Proc (SHAP)		X[2]							
Microbiological									
Fecal Coliform bacteria, Total			X			X			
Toxicity Testing (Bioassays)									
Daphnid, Acute Toxicity 48-hr Test						X			
Fathead Minnow, Acute Toxicity 96-hr Test						X			
Daphnid, Chronic Toxicity 7-Day Sur & Reproduction Test						X			
Fathead Minnow, Chronic Toxicity 7-Day Survival & Growth						X			

1 Laboratory and field parameters are listed for specific programs in Appendix 1.

2 Collected at selected sites.

Table 4. Summary of quality assurance, data management, analysis and reporting responsibilities for Bureau of Water monitoring programs.

PROGRAM ELEMENT:	CORE INDICATORS	LABORATORY ANALYSIS	DATA MANAGEMENT	DATA ANALYSIS AND REPORTING
SURFACE WATER MONITORING - FIXED STATIONS				
Ambient Water Quality Monitoring network (AWQMN)	Routine collections for chemical, physical and bacteriological parameters by regional Bureau of Water (BOW) Surface Water Section (SWS) staff.	Routine analysis for chemical constituents in water, metals in surficial sediment, and Chlorophyll a by IEPA Champaign Laboratory; organics in water by IEPA Springfield Lab; fecal coliform bacteria by SWS field staff, IL Dept. of Public Health Lab. in Springfield, the IEPA Champaign Lab. and the City of Carbondale Lab, and Suburban Labs Hillsdale.	Water chemistry data verified by IEPA Laboratory staff prior to entry into the Laboratory Information Management System (LIMS); data validated by SWS staff prior to entry in STORET.	AWQMN data retrieved from STORET and analyzed by SWS headquarters and regional office staff for 305(b) and Intensive Basin reports, and data requests by the general public.
Fish Contaminant Monitoring Program (FCMP)	Collection of whole fish and fillet composite samples by IL Dept of Natural Resources (IDNR).	IEPA Springfield Organics Laboratory for Organic parameters and IEPA Champaign Laboratory for Mercury; or contractual laboratories as designated.	Fish tissue data validated and entered into STORET by BOW Surface Water Section staff; fish contaminant database maintained by IEPA Office of Chemical Safety staff.	Fish consumption advisories issued via a cooperative arrangement with Fish Contaminant Monitoring Program workgroup (IEPA, IDNR, IDPH & IDA).
Ambient and Clean Lakes Monitoring Programs (ALMP) & (ICLP)	Routine collections for chemical, physical, biological, and sediment chemistry parameters by regional BOW Surface Water Section staff.	Routine analysis for chemical constituents in water, metals in surficial sediment, and Chlorophyll *a* by IEPA Champaign Laboratory; organics in water and surficial sediment at IEPA Springfield Laboratory. Phytoplankton identification and enumeration by contractual arrangement.	Water chemistry and Chlorophyll data verified by IEPA Laboratory staff prior to LIMS entry; all data validated by BOW SWS Section Lakes staff prior to final STORET entry.	ALMP and Clean Lake data assessed by BOW SWS Section Lake Program staff for special Clean Lake reporting, trophic status assessments, diagnostic feasibility studies, lake classification and impairment, and use attainment assessments for 305(b) reports.
Lake Michigan Monitoring	Routine collections for chemical, physical, and biological parameters by IEPA BOW Surface Water Section staff and City of Chicago Water Quality Surveillance Section.	General water chemistry analysis performed by Chicago Water Purification Division Laboratory; additional analyses by IEPA Champaign/Springfield Laboratories. Chlorophyll analysis by IEPA Champaign Laboratory.	Water chemistry/chlorophyll data verified by IEPA Champaign Laboratory; additional data analyzed and validated by City of Chicago Laboratory and BOW SWS staff prior to STORET ENTRY.	Lake Michigan data assessed by IEPA BOW regional SWS staff and City of Chicago Water Quality Surveillance Section for preparation of Lake Michigan WQ reports and by IEPA for 305(b) reporting.
INTENSIVE BASIN / SPECIAL SURVEYS (BIOSURVEYS)				
Intensive / Special Surveys	Collection of water chemistry, fish and macroinvertebrate communities, habitat quality, stream discharge and sediment chemistry samples by IEPA regional SWS staff in cooperation with IDNR. Fish tissue samples collected for contaminant analysis when possible.	Analysis of routine chemical constituents and metals in surficial sediments performed at IEPA Champaign Laboratory. Analysis for organic compounds in surficial sediments at IEPA Springfield Organics Laboratory. Macroinvertebrate ID's at IEPA regional SWS labs or by contractual arrangement.	All Water and sediment chemistry data verified by IEPA Lab staff prior to LIMS entry; all chemical data validated by BOW SWS staff prior to STORET entry. QA for macroinvertebrate ID's provided by outside taxonomists and BOW SWS regional office staff. QA for BIOS data entry provided by SWS staff. Fish ID's and data QA performed by IDNR staff, university ichthyologists, and IEPA SWS staff.	Intensive data assessed by IEPA SWS staff. Data used for 305(b) aquatic life use support assessments, determination of point and nonpoint source impairment sources for 305(b) reports, intensive basin reports, and Biological Stream Characterization (BSC) ratings.

Table 4 . (Con't) Summary of QA, data management, analysis and reporting responsibilities for Bureau of Water monitoring programs.

PROGRAM ELEMENT:	CORE INDICATORS	LABORATORY ANALYSIS	DATA MANAGEMENT	DATA ANALYSIS AND REPORTING
Facility-Related Stream Surveys (FRSS)	Chemical, physical, and biological data collected by regional IEPA BOW SWS staff.	Analysis of selected chemical constituents conducted at IEPA Champaign Laboratory.	Water chemistry data verified by IEPA Laboratory staff prior to LIMS entry; all chemical data validated by BOW SWS staff prior to STORET entry. QA for macroinvertebrate ID's and data quality provided by SWS regional office staff.	FRSS data interpreted by IEPA regional SWS staff. Data used for assessment of point source impacts to receiving waters, success of pollution control programs, and 305(b) reporting.
VOLUNTEER MONITORING				
Volunteer Lake Monitoring (VLMP)	Collection of Secchi transparency, suspended solids, nutrients and field observations by citizen volunteers trained by IEPA or regional planning commission staff; Chlorophyll a and zebra mussel monitoring conducted as selected	Analysis of solids, nutrients, and Chlorophyll a for selected lakes by IEPA Champaign Laboratory	Water chemistry data verified by IEPA Laboratory staff prior to LIMS entry; all data reviewed by BOW SWS Lake Program staff prior to STORET entry.	Annual statewide report prepared by BOW SWS which summarizes VLMP data.
POINT SOURCE MONITORING		.		
Effluent Monitoring	Collection of effluent samples at municipal and industrial wastewater treatment facilities by IEPA regional Field Operations Section (FOS) staff.	Analysis of routine effluent constituents performed at IEPA Champaign Laboratory.	Water chemistry data verified by IEPA Laboratory staff prior to LIMS entry.	Data reviewed by IEPA Compliance Assurance and regional FOS staff for compliance with facility NPDES Permit limits, evaluation of facility performance, and operation and maintenance improvements.
Toxicity Monitoring	Collection of bioassay samples at municipal and industrial wastewater treatment facilities by IEPA regional FOS staff.	Acute and chronic toxicity tests are performed by contractual arrangement.	Toxicity data reviewed by Bow Standards Section staff prior to distribution.	Bioassay data reviewed by BOW Standards and SWS staff and provided to Permits, FOS, and SWS staff for review of effluent toxicity and bioassay monitoring requirements in applicable discharger permits.
GROUNDWATER MONITORING				
Groundwater	Collection of samples from water supply wells by IEPA Public Water Supply (PWS) Groundwater Section staff in Springfield or regional PWS staff.	Analysis of inorganic compounds and heavy metals by IEPA Champaign Laboratory; Volatile Organics and Pesticide compounds by IEPA Springfield Organics Laboratory.	Data verification by Public Water Supply Groundwater Section in Springfield.	Data received by Groundwater FOS staff to determine the extremity to which nitrates, pesticides, and other contaminants pose a threat to water supplies; mapping of aquifers and recharge areas; augmentation of the State groundwater database; and preventative response measures.

Data Management and Analysis

Water, Surficial Sediment, and Fish Tissue Data. Data management procedures emphasize the use of STORET , U.S. EPA's computerized data storage and retrieval system. Each data processing step is accompanied by a QA/QC check to assure the availability of an accurate database(s). All data are verified from original keypunch forms and data printouts. Corrections are made, checked and the procedure repeated until an error-free copy is obtained. All fixed station network data and data from other monitoring programs (e.g., Facility-Related Stream Surveys, Intensive Basin Surveys, etc.) are entered into STORET as soon as possible.

Physical and Biological Data. Illinois EPA has developed and uses a database called BIOS that allows for storage and retrieval of biological and physical-habitat data that are compatible in format with the BIOS/STORET system. The BOW SWS is currently working to convert this database from a mainframe environment to a more-useable PC environment (e.g., Access database). Currently, SWS staff are working to link the BIOS data to GIS information as well. The BOW will continue to use the BIOS database to attain efficient storage and retrieval of biological and physical-habitat information, which will facilitate the assessment of surface-water resource quality and the reporting thereof (e.g., 305(b) report).

Reporting

CWA Required Reporting. The Bureau of Water annually produces a variety of reports that are based on ongoing water monitoring programs. Many of the reports issued such as the Illinois Water Quality Report, or 305(b) Report, are based on federal CWA reporting requirements. Summaries of reporting required under the CWA are provided in Table 5.

Table 5. Reporting required under the Federal Clean Water Act or other federal mandates.

Report	Source	Timeframe	Comments
305(b) Water Quality Report	40 CFR 130.8 and 130.10	Written report in even numbered years (e.g., 2002, 2004) and an electronic update of water quality data in odd numbered years (e.g., 2001, 2003)	Serves as the primary assessment of state water quality; leads to development of water quality management plans. Serves as the annual water quality report under 205(j). In even numbered years, draft report is due January 1; final report due April 1. In odd numbered years, electronic updates due April 1.
Section 205(j) certification	40 CFR 130.10	Annual	Will be replaced by the 305(b) report.
303 (d) List	130.7(d) 130.0	Biennial, due April 1 of even numbered years. Due April 1 of every fourth year, beginning in 2002.	Consists of a list of waters, pollutants causing impairments, and the priority ranking including waters targeted for TMDL development. Based on guidance received in October 2001, 303(d) reports may be integrated into the 305(b) reporting cycle.
Monitoring Strategy	Performance Partnership	Written report every five years	First water monitoring strategy covered 1996-2000. Second strategy covers 2002-2006.
Quality Assurance	40 CFR 31.45	Ongoing	See Section V.

Section 305(b). The most significant and comprehensive monitoring report generated by the BOW is the report on the *Condition of The State's Waters*. As required by Section 305(b) of the Clean Water Act, Illinois is required to conduct chemical, physical and biological monitoring programs and report to what extent designated uses are met on a biennial basis (Table 5).

Section 303(d). The 303(d) report fulfills requirements of Section 303(d) of the CWA and the Water Quality Planning and Management regulation at 40 CFR Part 130. This report is submitted to the U.S. Environmental Protection Agency (U.S. EPA) for review and approval of Illinois' list of water quality limited waters. It provides the State's supporting documentation required by 40 CFR Part 130.7 (b)(6) and rationale in fulfilling Section 303(d) requirements.

Other Reporting. In addition to required reporting, all chemical, biological, and physical data from fixed-station, intensive basin, Facility-Related Stream Surveys, and Special Stream Surveys are tabulated and compiled into applicable reporting formats (Table 6). All stream, lake, and groundwater monitoring survey data are considered public information and are available upon request. The Agency therefore routinely provides water-monitoring data in the form of STORET data retrievals or published reports to Region 5, cooperating State agencies, and the general public. All surface water monitoring site descriptions are documented by latitude/longitude coordinates in accordance with the policy established by the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC). The Bureau of Water also maintains a summary of state-wide water conditions on the Agency Web site: http://www.epa.state.il.us/water/surface-water/index.html) .

Table 6. Summary of BOW Water monitoring program reporting.

Report Component	Description	Applicable Reports/Comments
State Water Quality Conditions • Trends • Problems Areas & Areas Needing Protection	A description of the water quality of all waters of the United States and the extent to which the quality of waters provides for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allows recreational activities in and on the water.	Biannual 305(b) Report
Water Quality Improvements	An estimate of the extent to which CWA control programs have improved water quality or will improve water quality for the purposes of paragraph (b)(1) of this section, and recommendations for future actions necessary and identifications of waters needing action.	Covered in 305(b) Report. Also, See Section V: Program Effectiveness
Economic Cost/Benefits	An estimate of the environmental, economic and social costs and benefits needed to achieve the objectives of the CWA and an estimate of the date of such achievement.	Covered in 305(b) Report. Also, See Section V: Program Effectiveness
Nonpoint Source Pollution	A description of the nature and extent of nonpoint source pollution and recommendations of programs needed to control each category of nonpoint sources, including an estimate of implementation costs.	Covered in 305(b) Report.
Lake Assessments	An assessment of the water quality of all publicly owned lakes, including the status and trends of such water quality as specified in section 314(a)(1) of the Clean Water Act.	Covered in 305(b) Report. Also see: Section IV: Ambient and Vol. Lake Monitoring-Reporting.
	Conditions of Illinois Water Resources	Summarized on Agency Web Site www.epa.state.il.us/water/surface-water
	Limnological data for Individual Illinois lakes	Lake fact sheets
Streams Assessments	Stream quality impairment assessments, including identification of potential causes and sources of impairment.	Use attainment in 305(b) Report.
	Conditions of Illinois Water Resources	Summarized on Agency Web Site www.epa.state.il.us/water/surface-water
	A description of the chemical, physical, and biological data collected from major Illinois river basins.	Intensive Basin Survey Reports (Section IV).
	Stream surveys to assess impacts from municipal and industrial point source discharges.	Facility-Related Stream Survey (FRSS) Reports (see Section IV).
	Biological stream quality and classification.	Biological Stream Characterization (BSC)

SECTION IV. 2002-2006 WATER MONITORING PLAN

All Bureau of Water monitoring programs are described below using applicable elements of the U.S. EPA water monitoring program recommendations document titled: *Elements of an Adequate State Water Monitoring Program and Assessment Program* (U.S. EPA 2001a) as the general framework for discussion. Where changes in the monitoring program or activity are planned or anticipated over the next five years, they are described under the appropriate program element.

AMBIENT WATER QUALITY MONITORING NETWORK (AWQMN)

Background

Historically, stream water quality data in Illinois has been collected by a number of state and federal agencies including the Illinois State Water Survey (ISWS), the Illinois Department of Public Health, the Illinois EPA and the United States Geological Survey (USGS). This monitoring has resulted in a rich data set covering streams ranging in size from small agricultural drainage ditches to the Mississippi River. Since October 1977, the Illinois EPA has operated the most widespread, active long term monitoring network in Illinois, known as the Ambient Water Quality Monitoring Network (AWQMN). The current AWMQN network was preceded by a 538-station network operated by the Illinois EPA between Water Years 1972 and 1977 (note water years run from October 1 through September 30). Evaluation of the older data was presented in a series of reports prepared by the Illinois Water Information System Group, headed by Ronald Flemal and Donovan Wilkin (Peckham, 1980). Of the 538 original stations, 108 were incorporated into the current network. The change in stations in October 1977 reflected in part, the adoption of USGS sampling methodologies. Older stream water quality data, (i.e., from 1945 through 1971), has also been collected by the Illinois State Water Survey and the Illinois Department of Public Health at many of these stations (Winget, 1976).

Monitoring Objectives

The goals of Illinois EPA surface water monitoring programs are to identify causes of pollution (toxics, nutrients, sedimentation) and sources (point or nonpoint) of surface water impairments, determine the overall effectiveness of pollution control programs and identify long term resource quality trends. The AWQMN is utilized by the Illinois EPA to provide baseline water quality information, to characterize and define trends in the physical, chemical and biological conditions of the state's waters, identify new or existing water quality problems and to act as a triggering mechanism for special studies or other appropriate actions. Additional uses of the data collected by the Illinois EPA through the AWQMN program include the review of existing water quality standards and establishment of water quality based effluent limits for NPDES permits. The AWQMN is integrated with other Illinois EPA chemical and biological stream monitoring programs which are more regionally based (specific watersheds or point source receiving stream) and cover a shorter span of time (e.g. one year) to evaluate compliance with water quality standards and determine designated use support as required in Section 305(b) of the Clean Water Act.

Design & Implementation

The present AWQMN design was initiated in October 1977 and through September 1996, consisted of 209 stations. The ambient network was operated in cooperation with the USGS through September 1992. As of September 2001, the AWQMN is considered to consist of a total of 213 stations (Figure 1). This network consists of 201 stations on interior streams sampled by the Illinois EPA nine times a year on a six-week rotation. An additional 12 stations are monitored by the Agency on the Mississippi (11 sites) and Wabash Rivers. The monitoring of the three large river systems bordering Illinois is discussed in more detail under Great River Boundary Waters. A comprehensive description of the Illinois EPA AWQMN program and list of monitoring network stations are provided in Appendix 2.

Core Indicators

The Universal parameter group (ASN01) consisting of field parameters (air and water temperature, dissolved oxygen, pH, conductivity, and turbidity, nutrients, metals and conventional constituents is collected at all AWQMN stations. Additional inorganic and organic constituents are collected at selected stations. A complete list of current AWQMN parameter coverage is provided in Appendix 2. Effective with the 2002 Water Year starting October 1, 2001, total Kjeldahl nitrogen (TKN) and mercury were added as a universal parameter at all AWQMN sites, and Chlorophyll *a* at selected stations.

Quality Assurance

Existing AWQMN sampling techniques are based on methods developed and used by the USGS in 1977. These water quality sampling procedures are described in Section B of the Bureau of Water Quality Assurance and Field Methods Manual (Illinois EPA 1994).

Over the past 25 years, however, significant improvements have been made to water quality sampling procedures, advances have been made in the area of laboratory analysis precision and accuracy, and new environmental contaminants are present. Because of these changes, over the next five-year period, the Agency will review current AWQMN sampling techniques, core parameters, and implement changes to applicable SOP's as necessary to enhance collection methods and resultant data quality. This review will include an assessment of whether the BOW should implement new "clean hands sampling techniques" for trace metal sampling to assure metal data reported reflects true environmental levels versus values that possibly reflect contamination resulting from sample methods. The BOW will also review recent advances in method development and refinement by the USGS and other agencies and build on these improvements.

Data Management

Data management and analysis procedures emphasize the use of STORET (and SAS), U.S. EPA's computerized data storage and retrieval system. Each data processing step is accompanied by a QA/QC check to assure the availability of an accurate database. All data are verified from original field sheets and data printouts. Corrections are made, checked and the procedure repeated until an error-free copy is obtained. All stations are entered into STORET as soon as possible.

Data Analysis/Assessment

Water quality data from the AWQMN is assessed and used by the Illinois EPA on an annual basis for use support assessments developed for the Illinois Water Quality Report mandated under Section 305(b) of the CWA. For stream segments where biological data is not available and AWQMN stations are present, water chemistry data is used for development of use attainment assessments (Illinois EPA 2002). AWQMN data is also routinely reviewed and used by the Agency to review the adequacy of existing General Use Water Quality Standards, water quality based effluent limit determinations for permits, and nondegradation decisions.

Reporting

Data collected by the Illinois EPA from 1978 through the 1992 water years were published by the USGS as part of the series, "Water Resources Data: Illinois Volumes 1 and 2." Results of concurrent and split samples collected by the two agencies during this time period have also been published (Melching and Coupe 1995). More recent data, since October 1992, have not been published by the USGS but are available upon request from the Illinois EPA. Data is also available through STORET on the Internet (www.epa.gov/storet). Although no longer a cooperator with the USGS, the Illinois EPA has continued to transfer ambient water quality data to the USGS for inclusion in their databases.

In 1999, the Agency released a report titled "*Baseline loadings of Nitrogen, Phosphorus, and Sediments from Illinois Watersheds*" (Short 1999). This report provided the most recent and thorough analysis of AWQMN data for selected nutrients and sediment as it related to loadings from Illinois watersheds. A separate publication that summarizes the AWQMN Program is currently under preparation by the BOW (see Appendix 2). AWQMN data is also periodically reported in Intensive Basin Survey Program reports developed for specific basin surveys conducted on a five-year rotational basis.

New AWQMN Program Initiatives

Water chemistry data from AWQMN stations are used for a variety of purposes including evaluation of water quality standards. Over the next five-year period it is anticipated AWQMN data will be used for the review and development of new standards such as nutrient standards, or the adequacy of an existing standard such as dissolved oxygen. The current dissolved oxygen standard developed by the Pollution Control Board in the early 1970's, for example, requires review and updating as many Illinois lotic waters, most notably those in southern Illinois, frequently do not meet the minimum 5.0 mg/l standard in warm weather months, but biological data may not indicate impairment. To evaluate the appropriateness of existing standards and other issues relevant to the AWQMN Program, several new studies have been initiated or proposed for the next monitoring cycle:

- The BOW has initiated a Continuous Monitoring Pilot Study with the U.S. Geological Survey (USGS) at eight Illinois EPA AWQMN sites located across the state to obtain real time water chemistry data (Appendix 3).

- The current AWQMN Program strategy (station sitting, monitoring frequency, parameter coverage, and sample collection methods) has changed little since their adoption in the late 1980's. The BOW is actively pursuing a review of this program and has solicited and received several proposals from USGS to evaluate and develop recommendations for selected AWQMN program elements.

GREAT RIVER BOUNDARY WATERS

Illinois is surrounded by over 900 miles of great rivers on the west, south and southeast sections of the state that constitute significant public water supply, economic, recreational, and aquatic life resources. Historically, water quality and biological monitoring has been conducted on great rivers bordering Illinois by a number of state and federal agencies for a variety of purposes. Unfortunately, this data was not always of the quality required nor was it collected in the suitable locations for Illinois EPA to use for assessing the quality of these waters to assure these important designated uses were being met.

Objectives and Monitoring Design

Great River boundary water monitoring is considered a subset of the stream Ambient Water Quality Monitoring Network (AWQMN) described above. However, because these waters constitute interstate boundaries and their tremendous size requires significant staff resources and often different monitoring techniques, selected program elements that differ from the AWWQN are described below by major river.

Mississippi River. Until 1999, the Illinois EPA maintained only four active Ambient Water Quality Monitoring Network stations. Three monitoring locations including stations at Fulton, Illinois (M 04), Elsah, Illinois (J 05), and Thebes, Illinois (I 84) were initially sampled on a six-week frequency but switched to quarterly while K 04 at Keokuk, Iowa, was collected nine times per year. All water quality monitoring at the Thebes I 84 site has always been conducted by the Missouri USGS for the Agency. Through the Long Term River Monitoring Program (LTRM) and National Ambient Water Quality Assessment (NAWQA) programs, USGS also conducts monitoring on the Mississippi River that overlaps Illinois EPA AWQMN stations. USGS currently has LTRM stations in Pool 12 (Bellevue, Iowa), Pool 26 (Brighton, Illinois), and the open river at Jackson, Missouri. Sampling frequency varies from weekly to monthly with supplemental stratified random samples.

To enhance monitoring coverage on the Mississippi River, the BOW Surface Water Monitoring Section added seven additional ambient monitoring stations on the Mississippi in 1999. The addition of these seven stations placed monitoring locations at approximate 50-mile intervals. Above St. Louis these stations are located at lock and dams while the river below St. Louis is sampled from existing boat access ramps. All stations are sampled on a quarterly basis. Table 7 provides the location of each Mississippi River lock and dam and boat access ramp sampled in conjunction with the AWQMN.

Table 7. Current Great River Boundary Water Quality Monitoring Locations.

Water Quality Station Code IEPA	USGS	ORSANCO	River Miles	Sampling Frequency	Core Indicators	Agency	Illinois County	Reach/Station Description
Mississippi R.			***580***					***Cairo Illinois to Illinois-Wisconsin Boarder***
M 03	-			Quarterly	WQ, M	IEPA	Dubuque	Lock and Dam 11 at RM 583, 2 mi NE of Dubuque, IA
M 04	05420500 [1]			Qtr/Mo	WQ, M	IEPA/USGS	Whiteside	Lock and Dam 13 at RM 522.5, 1.5 mi NE of Fulton
M 02	-			Quarterly	WQ, M	IEPA	Rock Island	Lock and Dam 15 at RM 482.9, Arsenal Island, Rock Island
L 04	-			Quarterly	WQ, M	IEPA	Mercer	Lock and Dam 17 at RM 437, 2 mi NW of New Boston
K 04	05474500			Quarterly	WQ, M	IEPA	Lee	Lock and Dam 19 at RM 364, E edge of Keokuk, IA
K 17	-			Quarterly	WQ, M	IEPA	Adams	Lock and Dam 21 at RM 325, 0.75 mi SW of Quincy
K 21	-			Quarterly	WQ, M	IEPA	Pike	Lock and Dam 24 at RM 273.5, Clarksville, MO
J 05	05587555			Monthly	WQ	USGS	Jersey	RM 214.6 near Elsah (Grafton, IL)
J 98	-			Quarterly	WQ, M	IEPA	Madison	Lock and Dam 26 at RM 200.8, 1 mi S of Alton
J 36	-			Quarterly	WQ, M	IEPA	Monroe	RM 162.2, upstream of the Meramec R. confluence
I 05	-			Quarterly	WQ, M	IEPA	Randolph	RM 111, Chester, 1 mi upstream of highway bridge
I 84	07022000			Monthly	WQ, M	USGS	Alexander	RM 44 in Thebes at the ferry landing, 0.75 mi W of Rt 3
Wabash River			199					***Confluence with the Ohio River to Indiana State Line***
B-06	03341920			9 X Year	WQ	IEPA	Crawford	Route 154 Bridge at Hutsonville, Illinois
B-07	03378500	WA9295M [2]		Monthly	WQ	USGS	White	New Harmony, Indiana
B-03	03378605	WA325M		Bimonthly	WQ	ORSANCO	Gallatin/White	IL Route 141 Bridge West of Mt. Vernon, Indiana
Ohio River			133					***Cairo Illinois to Confluence with the Wabash River***
A-06	03612500			Monthly	WQ	USGS	Pulaski	North end of Dam 53 East of Olmstead
A-02		OR42.1M		Bimonthly	WQ	ORSANCO	Massac	Lock and Dam 52 at RM 938.9, Brookport, Illinois
Total Sites: 18	Total River Miles		912					

WQ – Water Quality
F - Fish Community
FT - Fish Tissue
M - Macroinvertebrates

1 Sampled monthly by USGS at RM 511.8, Clinton, IA
2 Monitored by ORSANCO thru 1997

***Ohio River*.** The Illinois EPA participates in surface water monitoring activities of the Ohio River mainstem via cooperation with the Ohio River Valley Sanitation Commission (ORSANCO) and participation on the ORSANCO Monitoring Strategy and Biological Water Quality Subcommittees. Illinois EPA staff also participate in the collection of fish community samples from the Ohio River mainstem at the Corps of Engineers Smithland Lock and Dam, the review of Ohio River fish tissue contaminant data, and the development of standard operating procedures for biological sampling.

Wabash River. The Illinois EPA BOW currently conducts monitoring at one site on the Wabash River in conjunction with the AWQMN. This AWQMN station (B-06) is located at the Route 154 Bridge at Hudsonville, Illinois (see Appendix 2). Additional water quality monitoring is conducted by ORSANCO at the Route 142 Bridge east of Mt. Vernon, Indiana.

Core Indicators

Chemical water quality constituents collected at Great River monitoring locations are identical to other AWQMN sites with Core parameter coverage (i.e., the Core 1 parameter group). Starting in summer 2001, biological sampling, using macroinvertebrate community structure for water quality inferences will be added at all Mississippi River sites used by the Agency for 305(b) reporting purposes (see Table 3).

Quality Assurance

Water quality sampling at Great River AWQMN stations is conducted using applicable procedures described in Section B of the Bureau of Water Quality Assurance and Field Methods Manual (Illinois EPA 1994). As some stations require the use of watercraft for water quality monitoring, certain sampling techniques have been modified as necessary to accommodate this sampling approach and will be reflected in revisions of Section B planned to be completed over the next five-year monitoring cycle.

Data Analysis/Assessment and Reporting

Water quality data generated from Great River sites will be handled and assessed similar to other AWQMN data as described above. It is expected that macroinvertebrate data collected from Mississippi River sites will be entered into the internal Agency BIOS database. New data assessment and impairment threshold protocols for quantitative macroinvertebrate data collected with artificial substrates will need to be developed for use in aquatic life use attainment assessments of great river systems.

INTENSIVE BASIN SURVEYS

Monitoring Objectives

The chemical, physical and biological quality of selected Illinois streams are assessed statewide by an annual stream monitoring program conducted by the Illinois Environmental Protection Agency (Illinois EPA) and the Illinois Department of Natural Resources (IDNR). As the Intensive Basin Survey Program (INTB) is a cooperative interagency monitoring program, it is designed to meet the needs of both agencies. Major Illinois EPA and IDNR basin survey objectives include the following:

1. Assess the level of attainment of designated use support categories in Illinois streams and the cause and source of impairments for reporting required under Section 305(b) of the Clean Water Act.

2. Assess the success of Agency water pollution control programs to achieve CWA healthy biological community, safe fish, swimming and drinking water goals.

3. Determine the presence of contaminants in fish tissue to facilitate the development of fish consumption advisories for applicable Illinois streams.

4. Facilitate planning and prudent allocation of limited state resources in the monitoring and evaluation of all significant interior Illinois river systems.

5. Determine the potential for sport fishing opportunities and fisheries management, assess the status of Illinois lotic resources, identify where those resources exist, and determine the need for legislation for their protection.

6. Establish an aquatic resource database for agencies with regulatory authority and responsibility for environmental management and focus greater emphasis on the importance of Illinois aquatic resources via Biological Stream Characterization (BSC) system (Illinois EPA 1996b) activities.

Design and Implementation

Intensive basin surveys are conducted on a five-year cycle developed by the Illinois EPA and IDNR on the basis of reporting needs and staff resources available to conduct such surveys. In cooperation with IDNR, the Agency recently developed a strategy for implementing statewide basin coverage on a five-year cycle from 2001 through 2005. Based on this agreement, the schedule for completion of basin surveys projected through 2006 is provided in Table 8. Under this cooperative agreement, approximately 100 sites will be monitored annually for biological, chemical and physical indicators of water resource quality. Implementation of this strategy is contingent upon the availability of Illinois EPA and IDNR staff resources and adequate 106 or 104(b) funding.

Targeted Monitoring Approach. Intensive basin survey monitoring sites have traditionally been selected on the basis of specific Agency program needs, and thus have been a mix of different types of sites. The Illinois EPA has historically targeted existing AWQMN stations as INTB program monitoring sites, and IDNR has selected historic fishery monitoring locations. A number of criteria are involved in the selection of INTB sites (see Section D, Illinois EPA 1994), but the most important criteria for site selection are:

- the stream reach selected to be sampled must be representative of the stream;
- the site must have suitable habitat and flow at the time of sampling; and
- the stream must be accessible for sampling, particularly for fish sampling equipment.

TABLE 8. Intensive Basin Survey monitoring and reporting schedules for the 2002 – 2006 monitoring strategy cycle.

CYCLE YEAR	INTB DATA YEAR	ASSMT YEAR	YEAR OF REPORT	MAJOR BASIN NUMBER	MAJOR WATERSHED	RIVERS/STREAMS INCLUDED IN USGS CATALOG UNIT AND INTB	USGS CATALOG UNITS (CU)	REPORTING FORMAT TO USEPA
1st	2002	2003	2004	7	Pecatonica River	Pecatonica River & tributaries	7090003	Electronic update of 305(b)/303(d) assessments accompanied by full hard copy of integrated water quality monitoring and assessment report
				17	LaMoine River	LaMoine River & tribs.	7130010	
				3 & 4	Fox River	Fox River & tribs.	7120006 & 07	
				23 & 24	Upper Kaskaskia River	Kask. R. & tribs upstr Becks Cr.	7140201	
				25	Lower Kaskaskia River	Kask. R. & tribs to Shoal Cr.	7140202	
				31	Little Wabash River	L. Wabash R. excluding Skillet Fk	5120114	
2nd	2003	2004	2005	6	Rock River	Rock River & tribs	7090005	Electronic update of water quality monitoring and assessment report with abbreviated narrative summary report
				2	Des Plaines River	Des Plaines River & tribs	7090001	
				22	Salt Creek	Salt Creek & Tribs	7130009	
				21	Upper Sangamon River	Upper Sanagamon R. & tribs	7130006	
				20	Lower Sangamon	South Fork Sangamon & tribs.	7130007 & 08	
				26	Big Muddy River	Big Muddy River & tribs	7140106	
3rd	2004	2005	2006	16	Mississippi North Central	Miss. NC tribs. & Henderson Cr.	7080104	Electronic update of 305(b)/303(d) assessments accompanied by full hard copy of integrated water quality monitoring and assessment report
				8	Green	Green River & tribs.	7090007	
				11	Upper Illinois	Upper Illinois direct tribs.	7130001	
				12	Vermilion	Vermilion River & tribs	7130002	
				19	Mississippi Central	Mississippi River Central & tribs.	7110001 & 04	
				27	Mississippi South Central	American Bottoms tribs	7140101	
				28	Mississippi South	Marys River & Sexton Creek	7140105	
				33	Cache	L. Cache & tribs. to the Mississippi R. U. Cache & tribs. to the Ohio R.	7140108 5140206	
4th	2005	2006	2007	9	Mississippi North	Apple & Galena R. & Miss. N. tribs.	7060005 & 01	Electronic update of water quality monitoring and assessment report with abbreviated narrative summary report
				15	Spoon	Spoon River & tribs	7130005	
				10	Kankakee	State line to the DesPlaines R	7120001	
				10	Iroquois	Iroquois & tribs to the Kankakee	7120002	
				14	Mackinaw	Mackinaw River & tribs	7130004	
5th	2006	2007	2008	5	Kishwaukee	Kiswaukee & tribs to the Rock R.	7090006	Electronic update of 305(b)/303(d) assessments accompanied by full hard copy of integrated water quality monitoring and assessment report
				13	Middle Illinois	Illinois & direct tribs	7130003	
				1	Great Lakes	Lake Michigan tribs	4040002	
				1	Calumet	Calumet & tribs	4040001	
				30	Embarras/Middle Wabash	Embarras R. and Wabash tribs	5120112 & 11	
				29	Vermilion	Vermilion and Little Vermilion R.	5120109 & 08	
				18	Lower Illinois	Macoupin R & L. Illinois tribs	7130011 & 12	
				31	Skillet Fork	Skillet Fork and tribs	5120115	

Core Indicators

Physical habitat, chemical, and biological (fish and macroinvertebrate) data are collected to assess stream quality of representative intensive basin survey stream segments. One round of biological sampling and habitat assessments is conducted at each basin survey site. These data are used to assess steam quality conditions including aquatic life use attainment and impairment, and to the extent possible, identify the causes and sources of any impairment identified. Three water chemistry samples are collected at each basin survey site; one prior to implementation of the biological sampling, one on the same day of the biological sampling, and the third sample is collected in early fall. In addition to chemical, physical and biological monitoring, fish contaminant and sediment chemistry samples are also collected once to screen for the accumulation of toxic substances. The environmental indicators utilized by the BOW for basin surveys are routinely evaluated and refined as necessary to provide the most effective tools and use of Agency resources to quantify and remediate water resource problems.

Water Chemistry. Water chemistry constituents selected and analyzed for the BOW INTB Program are described in the BOW Quality Assurance Project Plan (Illinois EPA 1994). An updated version of the list of field and laboratory constituents is provided in Appendix 1.

Biological Indicators.

Fish Communities. The Agency has utilized the Index of Biotic Integrity, or IBI (Karr 1986) for evaluating attributes of fish assemblages as stream quality indicators for almost 20 years. In 2000, in cooperation with IDNR, the Agency completed a project to refine the IBI and revised regional expectations of stream quality based on the development of new IBI regions (Appendix 4). Modification of the IBI included development of new metrics and scoring procedures to ensure the IBI adequately depicts stream quality on a statewide basis, particularly in watersheds with known stream impairments.

Macroinvertebrates. Aquatic macroinvertebrate organisms have been used as water quality indicators in stream surveys since the Agency was created in 1970. For most of this period, stream quality inferences have been developed on the basis of tolerance values assigned to each taxon, and a Macroinvertebrate Biotic Index (MBI) value was developed for each sample that reflects a mean tolerance value for the entire sample. In cooperation with an environmental consultant employed by the Agency, a multi-metric macroinvertebrate index similar to the IBI is currently under development (Appendix 5). Semi-quantitative invertebrate data collected in conjunction with a pilot sampling effort in summer 2001 will be used to finalize metric selection and scoring calibration.

Physical Habitat. Characterization of stream habitat quality and availability remains an integral component of the INTB. Over the last INTB monitoring cycle, the Agency has utilized the 11-transect method and Stream Habitat Assessment Methodology (SHAP) at each INTB site to assess lotic habitat quality. A description of both habitat assessment techniques is provided in Section D of the BOW QA and Field Methods Manual (Illinois EPA 1994).

New Monitoring Strategy Initiatives. To improve the overall design and effectiveness of the INTB for 305(b) assessments and to refine environmental indicators used in surface water monitoring programs, and in particular the Intensive Basin Survey Program, the Agency plans to initiate and/or complete the following projects over the next five-year period:

Complete a final report for the IBI project and develop a computer program which facilitates calculation of IBI values for Agency and IDNR stream monitoring programs (see Appendix 4);

Complete the development of a multi-metric macroinvertebrate index (see Appendix 5) to enhance the power of this biological indicator and assure point and nonpoint source stream quality surveys, biological trend evaluations, and other assessments which rely on macroinvertebrate data, are based on consistent and reliable water quality indicators;

Work with the Illinois Department of Natural Resources (IDNR) and Natural History Survey to develop a stream classification system and refine fish sampling protocols (Appendix 6);

Initiate a review of the current INTB sampling design and evaluate the feasibility of incorporating some level of a probabilistic design in the selection of sampling stations; and

Initiate a student intern program with interested Illinois universities for upper level undergraduate & graduate level students to participate in the collection and management of biological, chemical, and physical data associated with the INTB.

Work with the IDNR and Natural History Survey to refine the Biological Stream Characterization (BSC) process (Bertrand et al 1996).

Quality Assurance

Guidelines applicable to the collection and management of intensive basin survey biological, chemical, and physical data are provided in applicable sections of the BOW QAPP Field Methods Manual (Sections B – G). Several of the new monitoring initiatives underway to develop new biological indices and improve field collection methods pertinent to intensive basin surveys are described above. Additional information on BOW quality assurance program initiatives is described in Section V.

Data Management

Data Availability. All chemical, biological, and physical data from fixed-station, intensive basin, and lake monitoring surveys are considered public information and are available upon request. The Agency routinely provides water-monitoring data in the form of STORET data retrievals or published reports to Region 5, cooperating State agencies, and the general public. All surface water monitoring site descriptions are documented by latitude/longitude coordinates in accordance with the policy established by the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC).

Water, Surficial Sediment, and Fish Tissue Data**.** Data management and analysis procedures emphasize the use of STORET (and SAS), U.S. EPA's computerized data storage and retrieval system. Each data processing step is accompanied by a QA/QC check to assure the availability of an accurate database(s). All data are verified from original keypunch forms and data printouts. Corrections are made, checked and the procedure repeated until an error-free copy is obtained. All fixed station network data and data from special intensive surveys, as appropriate, are entered into STORET as soon as possible.

Physical and Biological Data. Illinois EPA has developed and uses a database called BIOS that allows for storage and retrieval of biological and physical-habitat data that are compatible in format with the BIOS/STORET system. The BOW SWS is currently working to convert this database from a mainframe environment to a more-useable PC environment (e.g., Access database). Currently, SWS staff are working to link the BIOS data to GIS information as well. The BOW will continue to use the BIOS database to attain efficient storage and retrieval of biological and physical-habitat information, which will facilitate the assessment of surface-water resource quality and the reporting thereof (e.g., 305(b) report).

Data Analysis/Assessment

Traditionally, use support assessments for rivers and streams in Illinois have focused primarily on data required to assess attainment of aquatic life use. The multiple uses currently assessed in the Agency Illinois Water Quality Report (305(b) report) are based not only on biological impairment thresholds and general use water quality standards, but also on additional constituents or indicators for which no formal standard exists. These standards and assessment criteria are intended to protect such uses as aquatic life, fish consumption, swimming, drinking water supply and secondary contact and indigenous aquatic life where applicable. The assessment methodology utilized for the 2002 305(b) provides all criteria used for determining attainment of individual uses (Illinois EPA 2002).

Reporting

The chemical, biological and physical data generated from the INTB are used and/or reported in a variety of documents and media. The primary written reports include Bureau of Water Intensive Basin Survey Reports, the Illinois Water Quality Report (305(b) report), and Biological Stream Characterization.

***305(b) Reporting*.** Water, sediment, biological, and stream habitat data collected in conjunction with intensive basin survey monitoring are used to develop aquatic life use support assessments required by Section 305(b) of the Clean Water Act. These assessments are compiled in a detailed written report and provided to Region 5 U.S. EPA biannually (Table 8). Every other year assessments developed with INTB survey data are provided to U.S. EPA in electronic format.

Basin Reports. The BOW developed a very detailed format for intensive basin survey reporting with the first basin report completed in 1977. From the period of 1982 through 1997, over 30 basin reports were developed, covering virtually every major watershed in Illinois. With the second cycle of basin surveys initiated in 1996 and completed in 2000, there no longer was a need for some of the detail provided in previous reports. The accelerated five-year completion schedule also necessitated some reporting format changes, and currently Agency Intensive Basin Survey reports include an executive summary and all data collected for that survey.

***Biological Stream Characterization*.** Intensive Basin Survey data is also utilized to develop BSC ratings of stream quality. The BSC is a five-tier stream classification system predicated primarily on IBI values for fish community samples. BSC stream-quality reports jointly developed by the Illinois EPA and IDNR were published in 1989 and 1996.

FACILITY-RELATED STREAM SURVEYS

Monitoring Objectives

The BOW Facility-Related Stream Survey (FRSS) Program provides stream quality assessment information for wadeable streams that receive point source discharges. These surveys are conducted primarily to evaluate water quality impacts from municipal wastewater treatment facilities, determine the need for additional wastewater treatment controls, or document stream quality improvements following the upgrading or construction of a new treatment facility.

Design and Implementation

Candidates for FRSS are selected on numerous factors, including requests from BOW field staff to document, CWA 303(d) listings, water quality standards issues, NPDES permit expiration dates, and identification of effluent toxicity. Facility-Related Stream Surveys are also often linked with intensive basin surveys (e.g., conducted in the same time frame and watershed). Depending on staff resources available, 10 to 30 surveys may be conducted annually, usually during the period of July through September.

Core Indicators

A combination of biological, chemical and physical tools is utilized in the assessment of stream quality in the vicinity of watewater treatment facilities. Traditionally, this sampling has included the collection of biological (macroinvertebrate) and water chemistry data upstream and incrementally downstream of a specific point source discharge. In recent years an assessment of habitat quality has been conducted using the Stream Habitat Assessment Procedure (SHAP). For selected FRSS, fish community and sediment chemistry samples may also be collected.

Quality Assurance

Standardized guidelines and quality control procedures have been established for the collection, analysis, and reporting of water quality, macroinvertebrate, and physical habitat data collected in conjunction with the BOW FRSS Program. These procedures are provided in Section D-3.0 of the Bureau of Water Quality Assurance and Field Methods Manual (Illinois EPA 1994).

Data Analysis and Reporting

Based on the macroinvertebrate sample collected, a Macroinvertebrate Biotic Index (MBI) value is developed to determine the extent of stream impairment. The stream habitat data is used to evaluate overall habitat quality and similarity among the control and downstream monitoring locations. Water samples from both the facility effluent and receiving stream are submitted for laboratory analysis for determination of contaminants contributing to water quality impairments.

Survey results including recommendations are summarized in a concise staff report. Each report is reviewed by appropriate Division of Water Pollution Control staff to evaluate survey findings and recommendations. Following this review, applicable decisions are developed concerning National Pollutant Discharge Elimination System (NPDES) permit reissuance activities, wastewater treatment control requirements, and the need for additional wastewater treatment controls.

Data from all FRSS conducted are utilized in the Illinois Water Quality (303(b) Report. When a FRSS is conducted on a waterbody segment not previously identified in a 305(b) report, the newly identified waterbody segment is labeled using either the first station in the segment downstream from the discharger, or the station within the segment that indicates the worst impact. Assessment of aquatic life use for the segment is based on the FRSS station with the worst biological impact. When a facility-related stream survey indicates a discharger is not contributing to a biological impact, the discharger will not be considered a source of impairment (Illinois EPA 2002).

AMBIENT LAKE MONITORING PROGRAM (ALMP)

Monitoring Objectives

The chemical, physical, and biological quality of selected Illinois lakes and reservoirs are assessed statewide through this annual program conducted by the Illinois EPA. Objectives of the Ambient Lake Monitoring Program (ALMP) are:

1. Provide baseline information for the restoration and protection of Illinois lakes.
2. Determine long-term trends in Illinois lakes.
3. Identify areas with significant water quality problems that need further investigations or remediation.
4. Assess the level of attainment of designated use support categories in Illinois lakes and the cause(s) and source(s) of any impairment for reporting required under sections 305(b) and 303(d) of the Clean Water Act.
5. Determine the presence of toxic materials in fish, water, and sediments and the sources of any contaminants.
6. Communicate assessment results and recommendations for water resource managers to provide support and direction to water programs.

Design & Implementation

The ALMP program samples approximately 50 lakes statewide annually, of which 28 lakes are components of a Core ALMP. The Core lakes are monitored on a three-year cycle to gather long-term water quality trends. The other 25 lakes monitored annually are chosen as part of special projects, lakes that have data gaps or lakes that have had identified water quality problems. Lakes in the ALMP that are Public Water Supplies are also sampled for organic and inorganic compounds as part of the Source Water Protection Program.

Lakes are sampled five times during the sampling season; spring turnover (April or May), growing season (June, July and August) and fall turnover (October). Lakes generally have three sites identified as water quality stations. Station 1 is the deep site; a surface water sample and a deep-water sample are collected at this site. Station 2 is generally at mid-lake; only a surface water sample is collected. Station 3 is located in the headwaters area or opposite of site 2 of the lake; only a surface water sample is collected. Water samples are analyzed for nutrients, suspended solids, chlorophyll, dissolved oxygen/temperature (profiles) and various field parameters. Sediment samples are generally collected at sites 1 and 3 once during the sampling season and analyzed for organic and inorganic constituents. A more detailed description of the Illinois ALMP is provided in a recently developed Lake Notes brochure (Appendix 7).

Core Indicators

Chemical, physical and biological data are collected to characterize Illinois lakes, identify water quality conditions and evaluate designated uses. Fish contaminant and sediment chemistry sampling are also conducted to screen for the accumulation of toxic substances.

- Phosphorus, Chlorophyll a and Secchi transparency are the three core indicators used to develop a Trophic State Index (TSI) value for a lake. The TSI is the primary index used by the ALMP to assess the trophic status and overall lake quality TSI. The trophic state is a level of nutrient enrichment within a lake.

- The other key core indicator is the dissolved oxygen/temperature (DO/TEMP) profile collected at each site monitored. DO/TEMPs are collected at every two feet of the water column. This produces a profile that shows how much oxygen is available to plant and animal life throughout the water column.

Quality Assurance

Sections H 1.3.3, 4.0 and 9.0, of the Quality Assurance and Field Sampling Procedures appendix to the BOW QAPP (Illinois EPA 1994) provide standardized guidelines and quality control procedures for the collection and development of quality data.

Data Management

Data Storage, Management and Sharing. All chemical, biological and physical data from the ALMP is considered public information and are available upon request. The Agency routinely provides water monitoring data in the form of STORET data retrievals or published reports to U.S. EPA Region 5, cooperating state agencies and the general public. All lake stations are documented by latitude/longitude coordinates in accordance with the policy established by the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC).

Water, Surficial Sediment and Fish Tissue Data. Data management and analysis procedures emphasize the use of STORET (and SAS), U.S. EPA's computerized data storage and retrieval system. Each data processing step is accompanied by a QA/QC check to assure the availability of an accurate database. All data are verified from original field sheets and data printouts. Corrections are made, checked and the procedure repeated until an error-free copy is obtained. All stations are entered into STORET as soon as possible.

Data Analysis/Assessment

Lake Assessments. As indicated above, The TSI is the primary environmental indicator used by the Agency to assess trophic status and overall lake quality. Use support assessments for lakes in Illinois focus on attainment of the Overall Use Assessment. The Overall Use Assessment is an aggregation of the other 305(b) uses assessed, including aquatic life, fish consumption, swimming, drinking water, and secondary contact. These use assessments are based on current general use water quality standards and guidelines as described in the most recent assessment methodology (Illinois EPA 2002). The degree of use support attainment is described as Full, Full/Threatened ("Good"), Partial ("Fair") or Nonsupport ("Poor").

Reporting

Water, sediment and biological data collected are used to develop use assessments required by section 305(b) of the Clean Water Act. These assessments are compiled in a detailed written report and provided to Region 5 U.S. EPA biannually. Every other year assessments developed are provided to U.S. EPA in electronic format. Additionally for each of the lakes sampled a two-page report is developed and provided to the lake manager/owner. In addition to these two reports all ALMP lakes are included in the annual Volunteer Lake Monitoring Program report.

New Monitoring Strategy Initiatives

To improve the overall design and effectiveness of the ALMP for 305(b) assessments, trend analysis, and other Clean Lake Program activities, the Agency is currently evaluating options to assess ALMP data and develop recommendations for the refinement of lake quality environmental indicators.

Table 9. Illinois EPA Ambient Lake Monitoring Program List of “Core Lakes.”

Northern Illinois			Central Illinois			Southern Illinois		
Lake Name	**County**	**Size (Acres)**	**Lake Name**	**County**	**Size (Acres**	**Lake Name**	**County**	**Size (Acres**
Bluff	Lake	86	Argyle	McDonough	95.1	Cedar	Jackson	1800
Busse Woods	Cook	590	Bloomington	McLean	635	Centralia	Marion	450
Carlton	Whiteside	75.4	Charleston SCR	Coles	346	Crab Orchard	Williamson	6965
Catherine	Lake	147	Clinton	DeWitt	4895	Devils Kitchen	Williamson	810
Channel	Lake	318	Decatur	Macon	3093	Forbes	Marion	525
DePue	Bureau	524	Eureka	Woodford	30	Frank Holten # 1	St. Clair	97
Fox	Lake	1709	Evergreen	McLean	700	Frank Holten # 2	St. Clair	40
Frentress	JoDaviess	92	Glen Shoals	Montgomery	1350	Frank Holten # 3	St. Clair	80
George	Rock Island	167	Homer	Champaign	80.8	Glen O. Jones	Saline	105
Grass	Lake	1478	Jacksonville	Morgan	476.6	Glendale	Pope	79
Johnson Sauk	Henry	58	Lou Yaeger	Montgomery	1205	Gov. Bond	Bond	775
Le-Aqua-Na	Stephenson	39.5	Mattoon	Shelby	765	Highland Silver	Madison	550
Long	Lake	335	Mauvaisse Terre	Morgan	172	Horseshoe	Alexander	1890
Marie	Lake	516	Mill Creek	Clark	811	Horseshoe	Madison	2107
Nippersink	Lake	592	Otter	Montgomery	765	Kinkaid	Jackson	3475
Petite	Lake	165	Paris East	Edgar	162.8	Lake of Egypt	Williamson	2300
Pierce	Winnebago	162.2	Paris West	Edgar	56.7	Little Grassy	Williamson	1000
Pistakee	Lake	2048	Pittsfield	Pike	241	Murphysboro	Jackson	143
Powderhorn	Cook	35	Sangchris	Christian	2165	Newton	Jasper	1750
Round	Lake	228.6	Sara	Effingham	765	Olney E. Fork	Richland	935
Senachwine	Putnam	3324	Siloam Springs	Adams	58	Pinckneyville	Perry	165
Shabbona	DeKalb	318	Spring North	Tazewell	578	Raccoon	Marion	925
Wolf	Cook	419	Spring South	Tazewell	610	Sam Dale	Wayne	194
			Springfield	Sangamon	4040	Vandalia	Fayette	660
			Taylorville	Christian	1148	Washington County	Washington	295
			Vermilion	Vermilion	608			
			Weldon Springs	DeWitt	29.4			

ILLINOIS CLEAN LAKES PROGRAM (ILCP)

Monitoring Objectives

The chemical, physical and biological quality of selected Illinois lakes and reservoirs are assessed statewide by this annual program conducted by the Illinois EPA. Objectives of the Illinois Clean Lakes Program (ICLP) are:

1. Provide baseline information for the restoration and protection of Illinois lakes.
2. Diagnose current lake water quality problems.
3. Assess the level of attainment of designated use support categories in Illinois lakes and the cause(s) and source(s) of any impairment.
4. Determine the presence of toxic materials in fish, water and sediments and the sources of any contaminants.
5. Provide a basis for identifying alternative solutions to the current water quality problems.
6. Evaluate the progress and success of lake protection/restoration projects.
7. Judge effectiveness of applied protection/management measures and determine applicability/transferability to other lakes.
8. Communicate assessment results and recommendations for water resource managers to provide support and direction to water programs.

Design & Implementation

Generally three to five lakes each year are sampled as part of the ICLP. The monitoring design follows the ALMP, however, sampling frequency is enhanced for the ILCP: twice per month from April through October, and once per month November through March. Additionally, tributary samples are collected as part of the routine sampling design (analyzed for nutrients and suspended solids) and storm event tributary samples are collected during the sampling year.

Core Indicators

The key core environmental indicators for the ICLP are consistent with the ALMP: water and sediment chemistry, and phytoplankton community attributes (Table 3). Water chemistry parameters, (parameter group LAKE1) including field parameters (air and water temperature, dissolved oxygen, pH, conductivity, alkalinity, and turbidity), Secchi transparency, nutrients, and other conventional constituents are collected at all ILCP stations. However, as part of ILCP Phase I diagnostic and feasibility studies, nutrient, sediment and water budgets are also developed. Additional inorganic and organic constituents may be collected at selected ILCP study lakes. A complete list of current ILCP laboratory and field parameter coverage is provided in Appendix 1.

Quality Assurance

Sections H 1.3.3, 4.0 and 9.0, of the Quality Assurance and Field Sampling Procedures appendix to the BOW QAPP (Illinois EPA 1994) provide standardized guidelines and quality control procedures for the collection and development of quality data.

Data Management

Data Storage, Management, and Sharing. All chemical, biological, and physical data from the ICLP is considered public information and are available upon request. The Agency routinely provides water monitoring data in the form of STORET data retrievals or published reports to Region 5, cooperating state agencies and the general public. All lakes stations are documented by latitude/longitude coordinates in accordance with the policy established by the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC).

Water, Surficial Sediment, and Fish Tissue Data. Data management and analysis procedure emphasize the use of STORET and the Statistical Analysis System (SAS 1985), U.S. EPA's computerized data storage and retrieval system. Each data processing step is accompanied by a QA/QC check to assure the availability of an accurate database. All data are verified from original field sheets and data printouts. Corrections are made, checked, and the procedure repeated until an error-free copy is obtained. All stations are entered into STORET as soon as possible

Data Analysis/Assessment

Lake Assessments. The assessment of monitoring data from ICLP lake studies forms the baseline information for restoration and protection recommendations developed by this program. ILCP monitoring data is also used for use support assessments; these assessments focus on attainment of each individual use assessed as well as the Overall Use Assessment. The Overall Use Assessment is an aggregation of the individual 305(b) uses assessed, aquatic life, fish consumption, swimming, drinking water and secondary contact. ILCP lake use assessments are based on current general use water quality standards and guidelines as described in the annual assessment methodology (Illinois EPA 2002). The degree of use support attainment is described as Full, Full/Threatened ("Good"), Partial ("Fair") or Nonsupport ("Poor").

Reporting

Water, sediment, and biological data collected are used to develop use assessments required by section 305(b) of the Clean Water Act. These assessments are compiled in a detailed written report and provided to Region 5 U.S. EPA biannually. Every other year assessments developed are provided to U.S. EPA in electronic format. For each ICLP project a detailed final report is required. In this report the nutrient, sediment, and water budgets are defined for the lake. Additional information is also required detailing lake usage, historical and current, maps of the lake (bathymetric, shoreline, and macrophyte), for Phase I projects detailed recommendations for protection/restoration of the lake including costs and time schedules, and for Phase II projects details the success or failure of all practices implemented is included in the final report. In addition to these two reports all ICLP lakes are included in the annual Volunteer Lake Monitoring Program report.

VOLUNTEER LAKE MONITORING PROGRAM (VLMP)

Monitoring Objectives

This annual program conducted by the Illinois EPA assesses the chemical, physical, and biological quality of selected Illinois lakes and reservoirs statewide. Objectives of the Volunteer Lake Monitoring Program (VLMP) are:

1. Increase citizen knowledge of the factors that affect lake quality in order to provide a better understanding of lake/watershed ecosystems and promote informed decision-making.
2. Encourage development and implementation of sound lake protection and management plans.
3. Gather a historical baseline database to document water quality impacts and support lake management decision-making.
4. Determine long-term trends in Illinois lakes.
5. Assess the level of attainment of designated use support categories in Illinois lakes and the cause(s) and source(s) of any impairment.
6. Communicate assessment results and recommendations for water resource managers to provide support and direction to water programs.

Design & Implementation

Annually about 175 lakes statewide participate in the VLMP. Water quality monitoring locations for this program are determined very similar to the ALMP. Each VLMP lake generally has three sites: Station 1 is the deep site; Station 2 is at mid-lake and generally mid-depth, and; Station 3 is located in the headwater area or opposite of Station 2. A surface water sample is collected at all three VLMP stations and an additional deep-water sample is collected at Station 1. Volunteers are requested to monitor each site twice a month (once at the beginning and once at the end of each month) from May through October. Volunteers collect Secchi transparency, total depth and various field observations at each site. At 100 lakes annually volunteers also collect monthly water quality samples at Site 1. These samples are analyzed for nutrients, suspended solids, and chlorophyll. In addition to this monitoring, volunteers are given a zebra mussel sampler and trained to identify zebra mussels.

Core Indicators

Secchi transparency is primary core indicator measured at all VLMP lakes. As indicated above, at a subset of the VLMP lakes, monthly samples for nutrients, suspended solids and chlorophyll are collected.

Quality Assurance

Sections H-1.5, 4.0 and 9.0, of the Quality Assurance and Field Sampling Procedures appendix to the BOW QAPP (Illinois EPA 1994) provide standardized guidelines and quality control procedures for the collection and development of quality data.

Data Management

Data Storage, Management, and Sharing. All chemical, biological, and physical data from the VLMP is considered public information and are available upon request. The Agency routinely provides water monitoring data in the form of STORET data retrievals or published reports to Region 5, cooperating state agencies and the general public. All lakes stations are documented by latitude/longitude coordinates in accordance with the policy established by the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC).

Water Data. All field-collected data is received and entered into an Agency database (CLDMS); from this database data is uploaded annually into the U.S. EPA STORET data storage and retrieval system. All water quality data that is received from the laboratory LIMS is entered into STORET after completion of applicable QA/QC verification checks; this data is not entered into the Agency CLDMS database. Each data processing step is accompanied by a QA/QC check to assure the availability of an accurate database. All data are verified from original field sheets and data printouts. Corrections are made, checked and the procedure repeated until an error-free copy is obtained. All stations are entered into STORET as soon as possible.

Data Analysis/Assessment

Lake Assessments. Like the ALMP, the key VLMP assessment tool assessing overall lake quality and determining long-term trends is the TSI. Use support assessments for VLMP lakes focus on attainment of the each individual used assessed, as well as the Overall Use Assessment. The Overall Use Assessment is an aggregation of the individual 305(b) uses assessed: aquatic life, fish consumption, swimming, drinking water and secondary contact. These use assessments are based on current general use water quality standards and guidelines as described in the Agency assessment methodology (Illinois EPA 2002). The degree of use support attainment is described as Full, Full/Threatened (“Good”), Partial (“Fair”) or Nonsupport (“Poor”).

Reporting

Water chemistry and transparency data collected are used to develop use assessments required by Section 305(b) of the Clean Water Act. These assessments are compiled in a detailed written report (305(b), and provided to Region 5 U.S. EPA biannually. Every other year assessments developed are provided to U.S. EPA in electronic format. Additionally all VLMP lakes are included in an annual Volunteer Lake Monitoring Program report.

LAKE MICHIGAN MONITORING PROGRAM

Monitoring Objectives

The Illinois EPA conducts water quality monitoring activities in Lake Michigan as mandated by the statutory provisions of 615 ILCS 5/14a. Objectives of the Lake Michigan Monitoring Program are:

1. Provide information on the quality of water in Lake Michigan to the Governor, General Assembly, and to all interested parties as required by statute.

2. Assess the level of attainment of designated use support categories and causes and sources of any impairment for reporting required under Sections 305(b) and 303(d) of the Clean Water Act.

3. Determine long-term trends in water quality.

4. Identify and quantify new or existing water quality problems or problem areas.

5. Act as a triggering mechanism for intensive surveys or other appropriate actions.

6. Assess chemical contaminants in fish to support the issuance of fish consumption advisories.

7. Communicate assessment results and recommendations to water resource managers to provide support and direction to water programs.

Design and Implementation

Lake Michigan water quality is monitored through a cooperative agreement between Illinois EPA and the City of Chicago (updated August 1, 2001). The Lake Michigan Survey Program is conducted by the City of Chicago's Water Quality Surveillance Section and consists of 77 sites assessed in five monitoring surveys: 14 on the Lake Michigan Open Water Survey, eight on the North Shore Survey, 10 on the South Shore Survey, 23 on the Jardine Water Purification Plant (JWPP) Radial Lake Survey, and 22 on the South Water Purification Plant (SWPP) Radial Lake Survey (see Appendix 8). Water surveys are conducted from January through December each year providing there are no weather related problems. Data collection will continue at the same frequency and intensity as described in the August 2001 memorandum of agreement. The City's Water Purification Division Laboratory performs general water chemistry analyses with additional analyses performed by Illinois EPA laboratories.

Core Indicators

Chemical and fecal coliform bacteria data are collected to characterize overall water quality, identify water quality conditions, and evaluate designated uses. Fish contaminant sampling is conducted in cooperation with the Illinois Department of Natural Resources to screen for the accumulation of toxic substances.

1. The fish contaminant data provide essential information to the general public relative to contaminant concentrations in fish tissue, species affected, and risks associated with fish consumption.

2. Fecal coliform bacteria data provide the basis for protecting public swimming beaches and are used to determine beach closures.

3. Chemical parameters, including arsenic, cadmium, chromium, copper, cyanide, lead, mercury, and others used to assess aquatic life use are provided in Appendix 1.

Quality Assurance

Sections 1.3.3, 4.0, and 9.0 of the Bureau of Water's Quality Assurance Project Plan provide for standardized guidelines and quality control procedures for the collection and production of quality data. Additional quality assurance measures are implemented through a memorandum of agreement between the Illinois EPA and the City of Chicago (August 2001).

Data Management

***Data Storage, Management, and Sharing*.** All chemical and fecal coliform bacteria data from the Lake Michigan Monitoring Program are considered public information and are available upon request. By statute, this information is also published biennially in a report to the Governor and General Assembly and is available to the public. The Illinois EPA routinely provides water monitoring data in the form of STORET data retrievals or published reports to USEPA Region 5, state and federal agencies, the regulated community, environmental groups, consultants, news media, and the public. All lake stations are documented by latitude/longitude coordinates in accordance with the policy established by the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC).

Water and Fish Tissue Data. Data management and analysis procedures emphasize the use of STORET (and SAS), U.S. EPA's computerized data storage and retrieval system. Each data processing step is accompanied by a QA/QC check to assure the availability of an accurate database. All data are verified from original field sheets and data printouts. Corrections are made, checked, and the procedure repeated until an error-free copy is obtained. All stations are entered into STORET as soon as possible.

Analysis/Assessment and Reporting

Lake Michigan data are used to develop use support assessments required by Section 305(b) of the CWA. These use assessments are based on current general use water quality standards and guidelines as described in the Agency assessment methodology (Illinois EPA 2002). The Illinois EPA and the City of Chicago, biennially as required by statute, jointly prepare a separate, detailed report summarizing Lake Michigan water quality.

Interagency Coordination

The cooperative agreement with the City of Chicago for Lake Michigan monitoring and completion of the Lake Michigan Water Quality Report will continue in the future. Illinois EPA Great Lakes Program staff will continue to be active on various Great Lakes States work groups and will also participate in the U.S. - Canada Water Quality Board and activities of the International Joint Commission. Active participation will also be pursued in technical workgroups in cooperation with U.S. EPA and the Great Lakes Commission.

GROUNDWATER

Monitoring Objectives

The collection of high-quality chemical data is essential in assessing groundwater programs. The Illinois EPA utilizes routine monitoring data to determine if deterioration (or improvement) in water quality has occurred over time and space. In principle, this information will accurately represent hydrogeologic conditions at a site and enable an understanding of the dynamics of sub-surface aquifer systems. The Illinois EPA has determined that the practical elements of a viable long-term groundwater monitoring program should include:

- Evaluation of hydrogeologic setting and program information needs;
- Evaluation of well-performance and purging strategies; and
- Execution of effective sampling protocols that include the appropriate selection of sampling mechanisms and materials, as well as sample collection, preservation and handling procedures.

The State of Illinois conducts many different water quality monitoring programs, including those designed to detect impairments to groundwater. Groundwater in Illinois is routinely monitored for biological and chemical contaminants and to some degree withdrawal rates.

Groundwater quality monitoring programs consist of fixed station networks and intensive or facility-related surveys of specific pumping centers. The Illinois EPA operates an Ambient Network of Community Water Supply Wells (CWS Network) as well as a Rotating Monitoring Network (Figure 2).

Design & Implementation

CWS Network. The CWS Network is designed to:

- Provide an overview of the groundwater conditions in the CWS Wells in Illinois;
- Provide an overview of the groundwater conditions in the major aquifers in Illinois;
- Establish baselines of water quality within the major aquifers in Illinois;
- Identify trends in groundwater quality in the major aquifers in Illinois; and
- Evaluate the long-term effectiveness of Clean Water and Safe Drinking Water Act program activities in protecting groundwater in Illinois.

From the experience gained from prototype networks, the Illinois EPA designed a long-term ambient groundwater monitoring network for community water supply wells. The design of this network was completed after consultation with the United States Geological Survey (USGS), Illinois State Geological Survey and Illinois State Water Survey. Illinois EPA developed a random stratified network intended to represent contamination levels in all active CWS wells. The CWS well network is stratified by depth, aquifer type and the presence of aquifer material within 50 feet of the surface. Additionally, the network is based on a probability of occurrence that will provide a 95 percent statistical confidence in the data with an associated plus or minus five percent precision and accuracy level. In order to randomize the sampling schedule spatially and temporally, 17 random groups of 21 wells, with alternates, were selected from all the active wells in the State. Each of these 17 random groups is a sample period. To further assure maximum temporal randomization within practical constraints, the samples from each sample period are collected over a three-week period.

Network stations have been sampled within a fixed three-week timeframe bi-annually since 1996 (during 1993 thru 1994 and 1994 thru 1995, samples were obtained within a three week time frame, annually). Water quality parameters include: field pH, field conductivity, field temperature, field specific conductance, field Eh, field pumpage rate, inorganic chemical analysis, and volatile organic/aromatic chemical analysis. All laboratory analytical procedures are documented in the Illinois EPA Laboratories Manual (revised 1987).

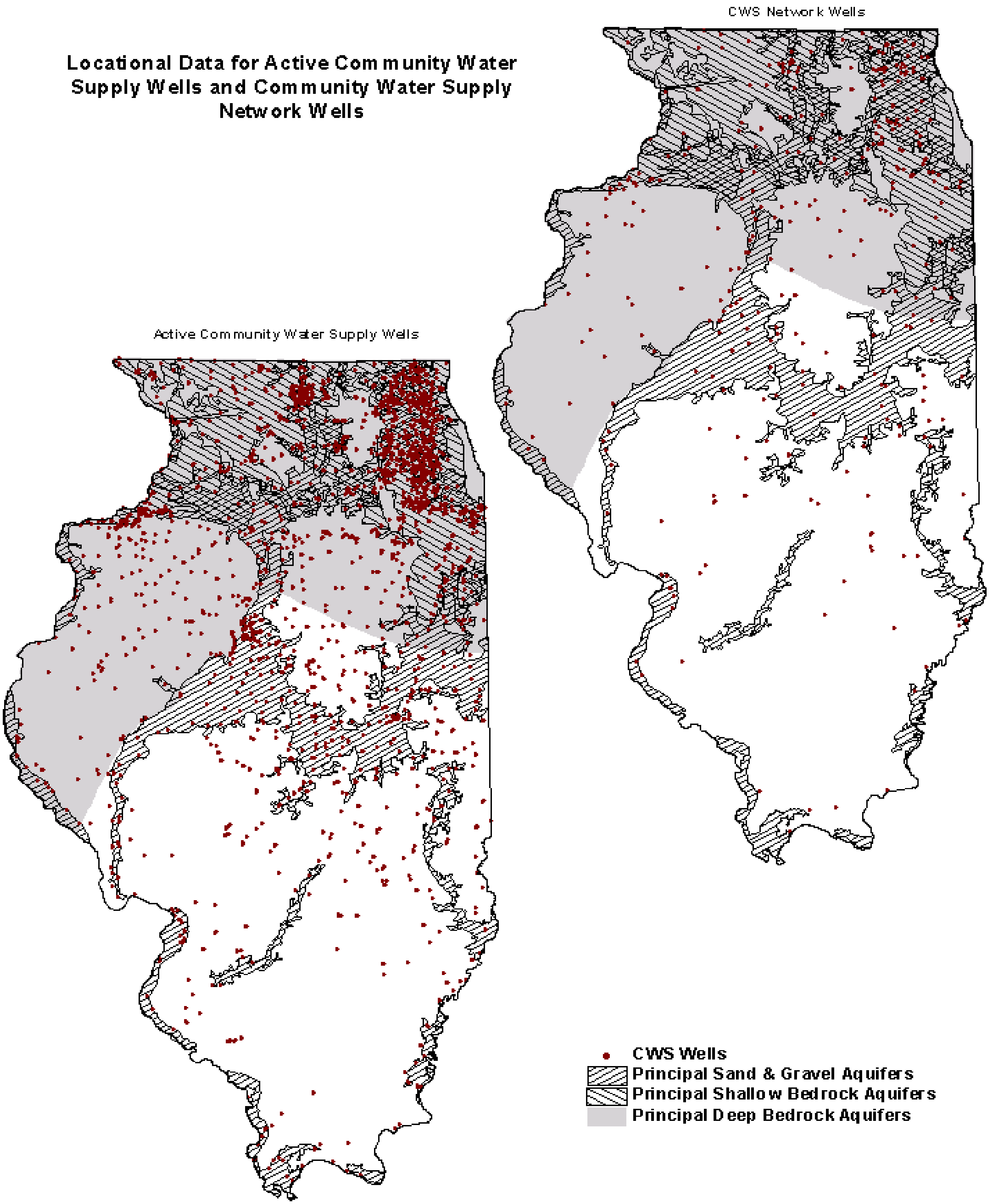

Figure 2. Location of active Community Water Supply wells and Community Water Supply Network wells.

Pesticide Monitoring Subnetwork of the CWS Network. Beginning in 1993, the Illinois EPA has operated a Pesticide Monitoring Subnetwork of the CWS Network. Initially, Illinois EPA tested all wells in the CWS Network for triazine and alachlor using immunoassay-screening methods. However, in the 1998 monitoring cycle Illinois EPA discontinued the use of immunoassay. At this time, the Illinois EPA randomly selected 50 percent of the CWS Network wells that were then analyzed for synthetic organic chemicals (SOCs) using standard laboratory test methods, as documented in the Illinois EPA Laboratories Manual (revised 1987). In the year 2000 monitoring cycle, the remainder of the CWS Network wells were analyzed for SOCs. This rotation will be maintained in the future.

Rotating Monitoring Network. The purpose of this monitoring network is to maximize resources and increase groundwater quality monitoring coverage at CWS wells. During the 1997 monitoring cycle, the Illinois EPA initiated a rotating monitoring network program. Due to funding limitations, the Illinois EPA was forced to evaluate the CWS Network monitoring frequency. Illinois EPA determined that the primary purposes of the CWS Network could still be realized by reducing the monitoring frequency of the CWS Network to a biannual basis.

The Illinois EPA is currently able to concentrate on specialized monitoring at high priority areas during alternate years. In 1997, monitoring was focused on concerns related to highly susceptible CWS wells. These wells were prioritized because of the detections of organic contaminants in treated water samples obtained during routine monitoring required by the Safe Drinking Water Act. During the 1999 monitoring cycle, attention focused on "new" CWS wells with little or no monitoring history. The 2002 monitoring cycle once again focuses on collecting data on new CWS wells and a subset of the CWS Network wells for radon and pesticide metabolite analysis. The Illinois EPA intends to maintain this rationale in the future.

Core Indicators

Chemical data are collected to characterize water quality conditions and statistically evaluate potential impairments to aquifers. Groundwater chemistry is evaluated against Illinois' Groundwater Quality Standards (Title 35 Illinois Administrative Code, Subtitle F, Part 620, Section 620.410 – Groundwater Quality Standards for Class I: Potable Resource Groundwater).

Quality Assurance

Chapter M of the BOW Quality Assurance and Field Methods Manual provides standardized guidelines and quality control procedures for the collection of water quality data generated in conjunction with the Groundwater Monitoring Program.

Data Management

There are three basic types of data to be managed in the groundwater monitoring program:

- Field data;
- Laboratory data; and
- Groundwater site inventory data.

Field Data. Field data includes all data/information prepared or added to the Groundwater Monitoring Field Sheet (Field Sheet), Database coding sheets, well site survey reports, or other risk assessment documents. Normally, the person collecting samples maintains this information. Monitoring at all stations is completed with Hydrolab® samplers to ensure that insitu conditions are reached prior to sample collection. Field and laboratory analysis sheets are filled out completely and accurately. Field parameter data should be collected, as outlined in Section M-2.2.1 of the Quality Assurance and Field Sampling Procedures appendix to the BOW QAPP (Illinois EPA 1994) and accurately recorded on the field sheet. Likewise, all other reported documentation is field verified to ensure that database information, as well as assessment data maintained by the Illinois EPA, is as accurate as possible. These data are then submitted to the appropriate Illinois EPA supervisory staff, such that, updates can be made.

Laboratory Data. Laboratory data are generally obtained through the Illinois EPA laboratories. These data are provided in two basic formats – hard copy and through electronic databases. Hard copies are provided to the Planning and Assessment Unit Manager who then submits the results to the appropriate sample collector and community water supply official. Electronic data are currently compiled on the Laboratory Information Management System (LIMS) where they are reviewed for QA/QC and then stored in the Illinois EPA mainframe system (SAFE) and the Federal monitoring database (STORET). These data can then be downloaded for program use and analysis.

Groundwater Site Inventory Data. Ideally, Groundwater Section staff should sample all wells in the State of Illinois. The initial site selection depends on a number of programmatic constraints as described in Section M-1.0 of the BOW QA Manual. Once a well is selected as a sample site and it is included as part of the monitoring network, basic inventory data should be assimilated. The groundwater site inventory data should consist of the geologic profile of the well, physical attributes of the well, and generally any data describing the well (or well field). These data should be thoroughly researched and verified whenever possible through drillers logs, engineering files, operator interviews, and on site validation. The data should then be reconciled with any Illinois EPA data system.

Data Analysis/Assessment

Groundwater assessments in Illinois have been based primarily upon chemical monitoring analyses. The CWS Network is utilized to predict the likelihood of attaining full use support in the major aquifers in Illinois. An overall use support summary for wells in the CWS Network is provided. The overall use support is based upon compliance with Illinois' Groundwater Quality Standards. The attainment of use support is described as full, susceptible, and poor.

> **Full use support** indicates that no detections occurred in organic chemical monitoring data or evaluated inorganic constituents were at or below the background levels for the groundwater source being utilized.
>
> **Susceptible use support** indicates that detections occurred in organic chemical monitoring data or evaluated inorganic constituents were above the background levels for the groundwater source being utilized.
>
> **Poor** indicates that organic chemical monitoring data detections were greater than the Class I Groundwater Quality Standards or inorganic constituents were above the Class I Groundwater Quality Standard and greater than background concentrations for the groundwater source being utilized.

Reporting

Groundwater quality data is used to develop use support assessments as required by Section 305(b) of the Clean Water Act. These assessments are compiled in a detailed written report and provided biannually to Region 5 of the U.S. EPA. A summary is also provided to annually to U.S. EPA in an Environmental Conditions Report. Furthermore, the Illinois EPA is required by state law to produce a report to the state legislature and governor on the status of Illinois groundwater protection programs.

WHOLE EFFLUENT BIOMONITORING

Monitoring Objectives

A whole effluent biomonitoring program conducted by the Illinois EPA assesses the biological quality of NPDES permitted effluents statewide. Major objectives include the following:

1. Conduct whole effluent toxicity tests (bioassays) on representative aquatic organisms in a variety of wastewater effluents from municipal and industrial sources for purposes of determining which facilities require permit limitations or monitoring conditions.

2. Assess the success of wastewater treatment processes to remove toxic components and thereby meet the directives of whole effluent toxicity-based water quality standards at 35 IAC 302 Subparts B and F.

3. Determine the relative toxicity of these effluents using common end points such as LC_{50}, EC_{50} and No Observable Effect Concentration (NOEC).

4. Determine the nature of receiving waters upstream of effluent discharges regarding toxicity to test organisms.

Design and Implementation

Whole effluent biomonitoring is conducted at contract laboratories under the direction of the Water Quality Standards Section. Effluent samples are collected and shipped to the laboratory by Field Operations Section staff. A goal of the program is to conduct acute and sometime chronic bioassays on all major and some significant minor facilities several months before NPDES permit renewal. Toxicity information will then be available for the water quality standards evaluation conducted on these facilities prior to permit renewal. The interpreted results of the bioassays then allow for permit required monitoring and limitation directives to be placed into the permit. Approximately 40 – 50 facilities are monitored each year.

Core Indicators

Two species of aquatic organisms are routinely used in bioassays. The invertebrate (crustacean) *Ceriodaphnia* represents primary consumers in the aquatic food chain. This is a native organism to Illinois lakes and slow-moving streams. It is a vital link in the food chain because they feed on algae and are consumed by small fish.

The fathead minnow, another native species, is the other extensively used test organism. Fathead minnows feed on organisms like *Ceriodaphnia* and are categorized as secondary consumers. A third type of organism, *Selenastrum*, an algae, is occasionally used to test effluents that may have adverse impacts on primary producers in the aquatic environment. Extensive experience with these bioassays in the past has led us to drop most algae testing because no useful information was being obtained.

Acute tests are conducted with an upstream receiving water control, a laboratory water control, 100% (whole) effluent and four concentrations of effluent diluted with receiving water. If toxicity occurs in the 100% effluent concentration beyond roughly 50% mortality, a LC (lethal concentration, for fathead minnow) or an EC (effect concentration, for *Ceriodaphnia*) 50 values may be calculated. These end points for the acute tests tell what concentration of effluent is lethal to or adversely effects 50% of the organisms exposed to that concentration. Depending on the dilution present in the receiving water and the nature of the toxic component of the effluent, various LC or EC_{50} values could be considered of concern or outright violations of water quality standards once discharge has occurred.

Chronic tests are conducted in a similar manner except the 48-hour exposure for *Ceriodaphnia* and 96 hour exposure for fathead minnows are replaced with seven days of effluent exposure. Chronic toxicity to *Ceriodaphnia* is measured both as reproductive effects and lethality while the fathead minnow test measures both growth and lethality. The NOEC is the end point for chronic tests.

Quality Assurance

Laboratory reports are reviewed by Standards Section staff and checked for mistakes in data reporting, sample holding time and other aspects of the bioassays. The contract laboratory is responsible for adherence to published U.S. EPA methods.

Data Management

All whole effluent biomonitoring results are considered public information and are available upon request. Copies of the laboratory report and Agency Biomonitoring Test Result Summary sheets are stored indefinitely in the Permit Limitation Overview files of the Water Quality Standards Section.

Data Analysis/Assessment

Trained Section staff assess the level of toxicity, if any, present in the effluent sample. Reported lethality in terms of dead or moribund organisms in acute tests and statistically significant reductions in growth or reproduction, as well as lethality, in chronic tests are the primary data evaluated. This information is considered along with the dilution available to the effluent in the receiving stream. Also important is any available information concerning the cause of the toxic effect (e.g., ammonia, pesticides, etc). If a mixing zone has been previously granted for a given parameter, and that parameter is discovered to be a cause of toxicity, toxicity from this cause is not of concern because it has already been evaluated and permitted. A more complete explanation of the facts considered by the evaluator is contained in an Agency guidance document *Effluent Biomonitoring and Toxicity Assessment – Aquatic Life Concerns.* This document is periodically updated and is made available to Agency staff as well as the regulated community.

Reporting

Results from Agency sponsored bioassays, including the Agency Biomonitoring Test Results Summary sheets, are distributed to pertinent Agency staff, usually within a few months of the lab report becoming available. The cover memorandum contains explicit instructions for the Permit Section to incorporate the appropriate monitoring conditions in the renewed permit. The report and summary sheet become part of the permit or Division files after submission to Permit Section. An example of the summary sheet and cover letter are included in Appendix 9.

POINT SOURCE MONITORING

Monitoring of industrial and municipal wastewater treatment facilities in Illinois is the responsibility of the Division of Water Pollution Control (DWPC) Field Operations Section (FOS). The BOW wastewater monitoring programs are conducted out of seven regional offices located throughout the state. They include field offices in: Des Plaines, Rockford, Peoria, Champaign, Springfield, Collinsville, and Marion.

Monitoring Objectives

The Illinois EPA's point source program provides inspections and monitoring of NPDES discharges and other wastewater sources (e.g., livestock and storm water sources) to verify compliance with applicable permit limits and water pollution control laws and regulations.

Design and Implementation

An annual strategy for the DWPC inspection program is prepared and provided to U.S. EPA Region 5 pursuant to the annual Performance Partnership Agreement (Illinois EPA 2001a). The strategy includes a description of the facilities to be monitored and the frequency of sampling. Procedures for routine wastewater effluent monitoring are provided in a Facility Inspection Manual for Reconnaissance Technicians (Illinois EPA 1992) that is being incorporated into the Bureau of Water Quality Management Plan. A new Field Procedures Manual has also been developed to provide program and training guidance to FOS staff (Illinois EPA 2000).

Core Indicators

Total suspended solids, pH, and carbonaceous biological oxygen demand (CBOD) samples are collected at all wastewater treatment facilities monitored by the Illinois EPA. Additional parameters (e.g., ammonia nitrogen) are added to this basic monitoring coverage as applicable to the facility NPDES permit.

Data Management, Analysis and Assessment

Sampling results from wastewater treatment facilities are reviewed by field staff to identify operating problems and target inspections. The data is not currently being entered into STORET; however, a goal is use of STORET or an Illinois EPA data management system to facilitate more effective use of the information.

FISH CONTAMINANT MONITORING

Fish accumulate contaminants and are thus a key indicator for determining water quality. In Illinois, contaminant levels in fish are routinely monitored via a cooperative program with the Illinois EPA, Illinois Department of Natural Resources (IDNR), Illinois Department of Public Health (IDPH), and the Illinois Department of Agriculture (IDOA). In conjunction with this cooperative program referred to as the "Fish Contaminant Monitoring Program (FCMP)," fish samples are collected from rivers and streams, inland lakes, and Lake Michigan. Additional samples may be collected by Illinois EPA SWS staff on a case by case basis to supplement the FCMP or meet other specific Agency program needs.

The FCMP SOP was included as part of Section G (Procedures for Fish Sampling) in the 1994 BOW Quality Assurance and Field Methods Manual appended to the Quality Assurance Project Plan (Illinois EPA 1994). As this guidance document was out of date, a BOW SOP for this program was recently developed and is appended to this monitoring strategy document (see Appendix 10). A Summary of the of Illinois Fish Contaminant Monitoring Program objectives are presented below.

Monitoring Objectives

The objectives of the Illinois Fish Contaminant Monitoring Program are to:

- Investigate and detect the presence and build-up of toxic and potentially hazardous substances in fish, encompassing both fish toxicity and public health implications

- Determine the impact of fish contaminants upon the suitability of aquatic environments for supporting abundant, useful, and diverse communities of fish in streams and impoundments of Illinois.

- Aid in the location of toxic material discharges and evaluate long-term effects of source controls and land use changes.

Design and Implementation

Monitoring Design. The statewide monitoring network consists of the following components:

Lake Michigan. Samples of chinook and/or coho salmon, lake, rainbow, and brown trout, yellow perch, rainbow smelt, bloater chubs, and alewives are collected annually from the open waters of Lake Michigan according to specific size ranges for salmon and trout and as available for other species. In addition, selected harbors and/or tributaries are sampled for representative predators, omnivores, and bottom feeders as needed.

Intensive Basin Surveys. A minimum of one complete sample (i.e., two bottom feeder, one omnivore, and one predator species) is collected from each basin scheduled for an intensive survey each year. Additional samples shall be collected at the discretion of the field sampling team where it is known or anticipated that the public regularly fishs in the water body (e.g., presence of a boat launch, evidence of fishing activity such as discarded bait containers, etc.). Such samples focus on the species and sizes of fish known or anticipated to be sought by anglers. The FCMP may also request the INTB field sampling team obtain samples from specific water bodies within basins scheduled for an intensive survey, or in response to requests from the public or local officials.

Follow-Up Samples. Specific numbers and sizes of one or more species (often 2 sizes of bottom feeders, omnivores, and predators, plus 1 panfish and any other species regularly targeted by anglers) may be requested by the FCMP to follow up on bodies of water where previous samples have indicated one or more species exhibit contaminants above a level of concern — either risk-based or U.S. Food and Drug Administration (U.S. FDA) criteria. Such samples are also requested by the FCMP on a regular basis to evaluate the continued need for an existing advisory on a species or modifications of the existing advisory.

Lower Priority Samples. Bodies of water from which no species have been found with contaminants above a level of concern (either risk-based or U.S. FDA criteria) are assigned a lower priority for sampling frequency. Such bodies shall be re-sampled on a recurring basis (for example, every 5 to 10 years), as permitted by budgetary and laboratory capacity constraints.

Special Samples. As necessitated by special circumstances, such as investigations of spills, fish kills, and toxic chemical cleanup sites, the FCMP may request specific numbers and sizes of selected fish or other aquatic species be collected by field sampling teams or other personnel. Such samples may be designated as high priority for analysis by the Illinois EPA or another designated laboratory. Costs for collection and analysis of such samples shall be paid by the party(ies) responsible for the special circumstance to the extent possible

Core Indicators

Organochlorine Compounds. Including related isomers, a total of 20 pesticide/ polychlorinated biphenyl (PCB) analyses are performed on all composite fillet samples (Appendix 1). The percent lipid or fat content is also determined for each sample. In addition to the pesticide/PCB analyses on fillet samples, a gas chromatography/mass spectrometry "wide scan" analysis may be performed on whole fish samples as needed to aid in the identification of new contaminants of potential concern. The "wide scans" include up to 50 additional parameters, including both volatile and semi-volatile constituents. Based on contaminants identified in such scans, it may be necessary to expand or revise the list of routine parameters analyzed in the future.

Mercury. Analysis for mercury is conducted for all predator species samples and may be performed for other species on a selected or as needed basis. Other heavy metals are not routinely analyzed in fish tissue. Even though metal complexes may be present in fish tissue, metallic ions rarely accumulate in fish tissue to high levels, and are more readily observed and monitored in water and sediment.

Data Management and Quality Assurance

Following a series of data validation procedures by the Division of Laboratories, and BOW Surface Water and Program Management Sections, fish contaminant data are transferred from the LIMS into the U.S. EPA STORET database. The Office of Chemical Safety Toxicity Assessment Unit also maintains a separate fish contaminant database in Access for data management purposes. The FCMP SOP revised in 2002 provides data management and quality assurance procedures for laboratory analysis and the collection of and handling of composite fish fillet samples in the field and tissue bank in more detail (Appendix 10).

Analysis and Assessment

Fish contaminant data is assessed for compliance with either risk-based criteria adopted by the FCMP or action levels set by the U.S. FDA. The risk-based criteria or U.S. FDA action levels regulating commercial fisheries are the criteria adopted at the state level for issuing of sport fish consumption advisories. The list of parameters and the risk-based criteria or U.S. FDA action levels used for this comparison is listed in the FCMP SOP (Appendix 10). Review of data results for purposes of issuing sport fish consumptive advisories is accomplished through the inter-Agency FCMP committee.

Reporting

In the annual publication titled *Guide to Illinois Fishing Regulations*, IDNR provides a list of waterbodies where fish consumption advisories exist. This guide is available at all IDNR offices and commercial facilities where Illinois fishing licenses are available. In addition to posting fish consumption advisories on their web site (http://www.idph.state.il.us/), the IDPH may also publish and distribute additional outreach materials as needed. The fish contaminant data are also used by the Illinois EPA to assess and report impairments to surface waters where fish consumption use is not fully attained due to the issuance of advisories for selected contaminants in fish tissue. This information is updated annually in the Agency 305(b) Report.

SECTION V. QUALITY ASSURANCE (QA)

THE BOW QUALITY SYSTEM

The United States Environmental Protection Agency requires all non-EPA organizations performing work on behalf of U.S. EPA through extramural agreements meet certain minimum quality requirements applicable to the collection, analysis, evaluation, and reporting of environmental data (U.S. EPA 1998a). Collectively, the policies and programmatic management systems developed that pertain to quality are known as a "Quality System". The primary goal of a Quality System is to ensure that environmental programs and decisions are supported by data of the type and quality needed and expected for their intended use (U.S. EPA 1998b). In conjunction with initiating a BOW Quality System, a Quality Assurance Project Plan (QAPP) and Quality Assurance and Field Methods Manual was developed and submitted to U.S. EPA in 1994 (Illinois EPA 1994). U.S. EPA approved these Quality System documents in August 1997.

BOW Quality System Goals and Objectives

The primary objective of the BOW's Quality System is to ensure that environmentally-related data collection and processing activities performed for the Agency will result in the production of data that are of known and documented quality, are suitable for their intended purpose, and can be used with a high degree of certainty by the intended user to support specific decisions or actions. This includes those monitoring and measurement activities supported by the Illinois EPA through the budget process. This goal will be achieved by ensuring that appropriate resources are made available and proper procedures followed throughout the process of planning for, collecting, analyzing and interpreting environmental data.

Specifically, it is the policy of the BOW that:

- The BOW will document its quality assurance activities via a Quality Management Plan (QMP) that is compliant with the U.S. EPA's QMP requirements document.

- The objectives for generating any new environmental data will be determined by the Data Quality Objectives (DQO) process prior to data collection activities, so that appropriate resources and quality assurance and control methods can be applied to ensure a level of data quality commensurate with the intended use(s) of the data.

- Each BOW program or activity that generates or uses environmental data will develop and implement a Quality Assurance Project Plan or QAPP (U.S. EPA 1998c) and/or Standard Operating Procedures (SOPs) which specify the detailed procedures required to assure the production of quality data. QAPPs and/or SOPs shall be prepared by the originating program, reviewed and approved by the appropriate Section Quality Assurance Officer (QAO) or the BOW QAO and by the Section Manager prior to the start of any data collection effort. This QAPP policy also applies to those plans prepared by external parties where a BOW program has oversight responsibilities through a controlling agreement.

- All BOW programs that support externally generated environmental data through contracts, grants or intergovernmental agreements will ensure that acceptable Quality Assurance (QA) requirements are included in the appropriate agreement documents, and that external parties follow acceptable quality assurance management practices as described in the relevant Federal and State regulations, and in requirements issued by the U.S. EPA and/or Illinois EPA. A QAPP approved by the program or project manager, appropriate Section QAO or designee and the Bureau QAO is required prior to the start of any data collection.

- Similarly, BOW programs or activities that accept and use externally generated environmental data shall ensure that the data are of suitable quality for the intended use. A QAPP approved by the program or project manager, appropriate section QAO or designee and the Bureau QAO prior to the start of any data collection will generally be required.

- Secondary data, i.e., data collected for a purpose other than its current use, whether generated within the BOW or external to the BOW, will be reviewed and validated by the project/program manager or designee, and verified by Bureau or Section QAOs before being used in decision-making or incorporated into reports.

- Quality assurance practices and quality control (QC) procedures will be implemented in the most cost effective manner possible without compromising data quality objectives.

- There is an ongoing system of evaluation for BOW QA efforts to ensure that the Quality System is meeting the needs and expectations of data users, and QA requirements set forth by the BOW the Illinois EPA, and the U.S. EPA.

- The BOW will provide sufficient resources to carry out on-going commitments as outlined in the QMP.

Quality Assurance Tools And Practices

Successful implementation of the BOW's QA Program requires a consistent and graded approach for QA practices, commensurate with the intended uses of the data and degree of confidence needed in the results. A variety of tools and procedures are employed for planning, implementing, and evaluating the Quality System. Managers and staff members will be informed of the availability and use of these tools through Agency-wide or BOW-specific training, and through expertise provided by the BOW QAOs.

The BOW has delegated primary responsibility for coordinating the development and enhancement of the BOW Quality System to the Bureau QAO. The Bureau QAO reports directly to the Bureau Chief on quality assurance issues, and serves on the Agency's Quality Systems Coordinating Committee (AQSCC). The AQSCC meets on a monthly basis or as necessary to discuss QA implementation plans, policy and procedures and common QA issues across the Bureau. The Bureau QAO and designated staff serving as section QAOs make up the BOW Quality Assurance Committee (QAC).

Primary QA planning and implementation tools include the QMP, consideration of Data Quality Objectives (DQOs), program or project specific Quality Assurance Project Plans (QAPPs) and Standard Operating Procedures (SOPs). Most of these tools are employed directly by BOW staff with assistance as necessary from the BOW QAOs.

BOW Quality Management Plan

In compliance with U.S. EPA Quality System guidance, the BOW submitted the second revision of the BOW Quality Management Plan (QMP) to U.S. EPA Region 5 quality assurance staff on May 31, 2001. This document is currently under review by Region 5. To effectively implement the QMP, the BOW designated a full-time Quality Assurance Officer (QAO) in September 2000 and responsibilities of this position are detailed in Chapter 1.3 of the BOW QMP (Illinois EPA 2001b). The BOW has also designated part-time QAO's in two sections of the Division of Water Pollution Control: Field Operations Section and the Surface Water Section. A QAO has also been designated in the Division of Public Water Supplies Groundwater Section. A summary of selected elements of the BOW QMP is presented below.

The BOW QMP has been developed to address the quality assurance requirements for states receiving federal financial assistance, as embodied in the July 1998 revised U.S. EPA Order 5360.1 CHG 1 - Policy and Program Requirements (U.S. EPA 1998a) for the Mandatory Agency-Wide Quality System and the October 1998 U.S. EPA QA/R-2 document - EPA Requirements for QMPs (U.S. EPA 1998b). Equally important is the goal of setting up a Quality System and management plan that is effective and efficient and meets the quality assurance needs and expectations of BOW staff and external customers and stakeholders. The QMP reflects the overall QA program framework and management system necessary to ensure that environmental data collected, analyzed and/or compiled by the BOW is of acceptable quality to meet the needs of data users and decision-makers. It also describes the delegation of QA roles and responsibilities within the BOW. The QMP describes the policies, procedures, and systems governing the BOW's QA Program. It serves as the "umbrella" document for all BOW QA operations. The BOW QMP will be reviewed and updated on an annual basis. The BOW QAO will prepare future revisions and updates to the QMP. The BOW QMP has precedence in internal QA policy matters over all other BOW quality-related documents.

The QMP applies to all BOW programs, activities, contracts and intergovernmental agreements or other sources that generate environmental data which are used to make decisions or support actions related to the BOW's defined mission and responsibilities. The QMP establishes the foundation for implementing an effective and comprehensive QA program (i.e., Quality System) within the BOW, covering all BOW activities that involve the generation of environmental data. Environmental data includes information or measurements resulting from any field data collection activity, laboratory analyses, or models involving the assessment of chemical, physical, or biological factors relating to the environment. Further, any BOW programs, activities, etc. that generate such data are required to comply with the requirements found in the QMP.

Quality Assurance Project/Program Plans (QAPPs)*.* The QAPP presents the policies and procedures, organization, objectives, quality assurance requirements, and quality control activities designed to achieve the type and quality of environmental data necessary to support project or program objectives. It is the policy of the BOW that no data collection or analyses will occur without an approved QAPP or equivalent documentation, per the Agency and Bureau QMPs. All in-house and external environmental data collection activities are subject to this requirement. All contracts need to address quality assurance requirements (e.g., data quality and reporting requirements) when those contracts pertain to, or have an impact on, data collection or analysis activities. Additionally, all grants and contracts need to address quality assurance requirements specified in applicable state acquisition or procurement regulations. The BOW's contracts or statement of work for procurement shall comply with these stipulations. Approval and implementation of each QAPP will be the responsibility of the applicable program. The designated Bureau QAO will provide assistance, as necessary, in the development QAPPs for BOW data-generating programs or external contracts**.**

As specified in the BOW QMP, QAPPs will be reviewed by personnel authorized by the originating program. Any BOW personnel conducting reviews must have a working knowledge of the Program and/or Bureau Data Quality Objectives, and training in QAPP review. The BOW QAO or the appropriate Section QAO reviews each QAPP for data quality elements and records the results of his/her review using a standard checklist. QAPPs are not reviewed as stand alone documents. Rather they are reviewed in the context of the broader project objectives for current and future investigations, and may be reviewed by a team of subject area experts who will provide specific project recommendations. This information, used in conjunction with the quality assurance review by the appropriate BOW QAO, allows the program/project Manager or Bureau designee to assign an approval status for the QAPP. The BOW's Quality Assurance Committee is responsible for ensuring that all QAPPs receive a quality assurance review, and are in approved by the appropriate QAO and Program or Project Manager prior to implementation of covered project work.

The BOW Quality Assurance and Field Methods Manual contain QAPPs covering BOW's environmental monitoring programs. QAPPs for BOW programs will be reviewed annually, and updated or revised as necessary. Any revisions to or deviations from an existing QAPP must be reviewed and approved by the appropriate program/project manager and QAO.

Data Quality Objectives. The BOW is committed to "sound science" and thus, the generation, compilation, and analysis of environmental data that are technically and legally defensible, and of adequate quality to support the intended use. The Bureau encourages the use of the Data Quality Objectives (DQO) process in the planning phase of all environmental data collection activities. *Guidance for the Data Quality Objectives Process, U.S. EPA QA/G-4* (U.S. EPA 1994) is used for the development of DQOs. DQOs will be incorporated into QAPPs where appropriate and, in all cases will be communicated to staff responsible for field, laboratory, and data assessment. This requirement is applicable to all parties that generate environmental data for use by the BOW.

Each program (e.g., division or section) is responsible for establishing DQOs for its applicable ongoing and future programs or projects. For many of the BOW's data collection and analysis procedures the various Agency program offices have already established and stipulated the data quality objectives for the testing done under that program via the U.S. EPA approved test methods. The BOW has limited options available to deviate from these pre-established DQOs set by the EPA.

Standard Operating Procedures (SOPs). The use of Standard Operating Procedures (SOPs) promotes consistency within the BOW, reducing work effort and improving data comparability, credibility, and defensibility. SOPs must be clearly written and adequately detailed.

BOW QA and Field Methods Manual . The BOWS Quality Assurance and Field Methods Manual (Illinois EPA 1994) provides standardized guidelines and quality control procedures for the collection of environmental data in conjunction with all water monitoring programs (Table 10). They are maintained in document control format and kept current.

Table 10 . Bureau of Water Quality Assurance and Field Methods Manual SOP's applicable for BOW monitoring programs.

Monitoring Element	QA Manual Section	Section Title
Water Chemistry	B	Ambient Stream Water Quality Monitoring
Macroinvertebrates	C	Macroinvertebrate Monitoring
Intensive Basin and Facility-Related Stream Surveys	D	Special Stream Surveys
Habitat	E	Stream Habitat and Discharge Monitoring
Sediment Chemistry	F	Bottom Sediment Sampling
Fish	G	Fish Sampling, Electrofishing Safety, and Fish Contaminant Monitoring
Lakes	H	Lake Monitoring
Wastewater	L	Wastewater Sampling Procedures
Groundwater	M	Groundwater Sampling Procedures

Applicable SOP's and guidance in the QA manual are routinely reviewed for accuracy and completeness, new monitoring techniques or data management procedures that have the potential to enhance data quality are evaluated and implemented as appropriate. New or revised SOPs must be signed by the author, the approving supervisor and by the Bureau QAO. SOPs must be readily available to all involved personnel and adhered to rigorously. Modifications or deviations from SOPs are documented and have, at a minimum, supervisory and Section or Bureau QAO concurrence.

As BOW monitoring programs evolve with advanced equipment technology, improved field methods, and enhanced environmental indicators (e.g., biological indices), revisions of SOP's are inevitable. Many of the changes anticipated to existing BOW QA and Field Methods Manual SOP's have been discussed in Section IV by program element. Over the next five-year monitoring cycle, several initiatives will be completed which have the potential to enhance the data quality and the overall usefulness of environmental information generated from the Agency water monitoring programs. Some of these initiatives include: new macroinvertebrate sampling procedures, and existing stream water chemistry, habitat assessment and sediment chemistry collection procedures will be evaluated and updated.

Technical Systems Audits (TSA). All Agency programs that employ environmental sample collection and analyses are subject to a TSA. A TSA of the BOW would involve a thorough review of the facilities, equipment, data collection and analysis procedures, documentation, data validation, and management, training procedures and reporting aspects of the technical system for collecting or processing environmental data. On the project level, the frequency and scope of TSAs will be included in the QAPP. The project manager and/or the appropriate Section QAO typically conduct technical systems audits at the project levels**.**

Bureau of Water TSAs may be planned by the Bureau QAO and the Bureau Quality Assurance Committee (QAC), specifically requested by management, or result from other audit or review findings. The BOW QAC is responsible for scheduling the TSA, assembling the audit team, and carrying out the TSA. Results will be reported to the audited organization in the form of a written report. A corrective action period follows the issuance of the written report.

Management System Reviews (MSR). MSR will qualitatively assess the BOW's organization and procedures to determine if the Quality System in place is adequate to ensure the quality of the program's data. The Bureau QAO, Section QAOs and management representatives from outside the organizational area (e.g., Division or Section) being focused on will conduct the MSR using current U.S. EPA MSR guidance. Results of any MSR conducted will be promptly shared with the evaluated BOW Division or Section and with BOW senior management upon completion of the review (but prior to a final written report). Bureau management is responsible for taking necessary corrective action and determining whether additional QA (e.g., audit) activities are required.

QA Annual Report and Workplan*.* During the third quarter of the state fiscal year, the Bureau QAO will prepare, after consulting with the Section QAOs, a QA Annual Report and Workplan. This comprehensive report shall be distributed to BOW senior management for consideration and action. This report shall reflect the implementation status of the BOW's QA Program. The work plan describes major planned QA activities for the next fiscal year, including planned audits and audit responsibilities.

QA Personnel Qualifications and Training. The BOW is committed to ensuring that staff and managers working in the Bureau are properly trained and qualified to fulfill their required QA responsibilities. Maintaining staff proficiency in performing all environmental sampling, testing and data analysis activities within the BOW is the joint responsibility of the individuals filling those positions and the responsible section manager and/or supervisor.

QA related training needs are assessed by first determining the personnel within each BOW section that have QA related responsibilities, what specific types of QA functions they perform, and with what frequency. These findings are conveyed by the Bureau QA Officer to the Agency Quality Assurance Manager (QAM) who works with the Quality Systems Coordinating Committee to develop and deliver commonly needed QA training on an Agency-wide basis. Specific QA training not sponsored at the Agency level, such as field sampling procedures, will be coordinated by the BOW's QA Committee.

The Agency QAM and AQSCC will coordinate in-house, Agency-wide QA training with the BOW's QAO. Additionally, the Agency QAM will make known the schedule and frequency for U.S. EPA courses which may help meet the training needs of Illinois EPA employees with QA responsibilities. Training on the following course topics will be required to meet the general needs of Agency staff with QA responsibilities or supervision thereof:

- Orientation to Quality Systems/Illinois EPA QMP
- Data Quality Objectives
- Preparing Quality Assurance Project Plans
- Reviewing Quality Assurance Project Plans
- Introduction to the Management System Review Process

Section and Bureau QAOs will keep an up-to-date record of all QA training completed by staff and managers within their respective area. This information will be used in preparation of the QA Annual Report and Workplan and in other assessment processes.

SECTION VI. PROGRAMMATIC EVALUATION

As indicated in the Section III Monitoring Program Overview, the Agency has historically operated a variety of comprehensive ambient lake and stream surface water monitoring programs and supplemented this fixed station approach with point source biological surveys and a rotating basin survey program. These more traditional monitoring activities were augmented in recent years by point source biomonitoring (bioassays) and groundwater monitoring programs. The above programs adequately addressed early program goals of characterizing the overall condition of the state's waters. It is clear, however, that the

305(B) ASSESSMENTS

The 305(b) assessment process required by the CWA is the primary mechanism used by the Agency to determine the extent designated uses of the of state's waters are being achieved. While the annual review and refinement of the 305(b) assessment process is an integral element of BOW monitoring programs, areas where additional modifications are anticipated are discussed below:

- **Improving Use Attainment Assessments.** Monitoring conducted in support of 305(b) assessments to determine: 1) the overall quality of the state's waters; 2) how these waters change over time; 3) problem areas and areas needing protection; and 4) the effectiveness of clean water programs are and will remain fundamental BOW monitoring program goals. Integrated with the above goals is the goal to continue to improve the quality of the data used, the assessment tools, and the assessments made. The fundamental challenge of developing use support assessments for the state's waters is to ensure the best suite of environmental indicators and decision matrices are used. Development and used of the new IBI and multimetric macroinvertebrate index will improve future aquatic life use attainment assessments as will the development of new impairment thresholds for these indices.

- **Nondegradation.** Development of new environmental indicators and impairment thresholds will not necessarily ensure a decline of existing high quality waters is adequately addressed using existing 305(b) assessment and 303(d) listing protocols. Over the next reporting cycle, it will be necessary to evaluate and modify existing use attainment assessment procedures so declines in high quality waters (i.e., those full use support waters exhibiting a downward trend) are eligible for both 303(d) listing and improvement via the TMDL process.

- **Cause/source Refinement.** Improvements in development of the 303(d) list and TMDL selection are linked with the improvement of 305(b) assessments. A BOW goal is to improve the process by which causes and sources of water resource impairment are identified. This may require development a combination of new monitoring and assessment approaches for both the field and office.

- **Use of Outside Data.** Water monitoring programs are costly and Agency resources to provide the comprehensive monitoring coverage desirable is not unlimited. To augment the monitoring coverage in the future, the Agency will place greater reliance of the data collected by other agencies or entities that have demonstrated the ability to collect quality data in accordance with recently developed BOW guidance (Illinois EPA 2002). Several QAPP's submitted to the Illinois EPA in recent months by other agencies have been reviewed and approved for such use. Because of manpower restrictions, the Agency has also contracted with the Illinois USGS office to conduct AWQMN sampling at 22 Illinois EPA stations in northern Illinois.

IDENTIFICATION OF IMPAIRED WATERS

Two separate processes are involved in the identification of 1) waters included on the CWA Section 303(d) list and 2) the list of waters targeted for improvement Total Maximum Daily Load (TMDL's). The primary mechanism for the identification and inclusion of impaired waters on the CWA Section 303(d) list is the BOW 305(b) use support assessment process described in the 2002 303(b) report. As this list is dependant upon the 305(b) process, one of the most effective methods to improve the 303(d) list is to improve 305(b) assessments as described above. The procedures used to target 303(d) listed waters for TMDL's are described in the 1998 Clean Water Act Section 303(d) List (Illinois EPA 1998). These methods are currently undergoing revision for inclusion in the Illinois EPA 2002 303(d) List report scheduled for completion on October 1, 2002.

NEW MONITORING INITIATIVES

- **Pre/Post TMDL Monitoring.** The extensive list of 303(d) waters and those scheduled for TMDLs necessitates a review of the adequacy of existing monitoring programs to meet the emerging needs of these program issues. Over the next reporting cycle it is anticipated that the BOW will develop new monitoring approaches to address 303(d) listed waters and those scheduled for TMDLs. In some situations special monitoring may be initiated to update segment assessments where water quality improvements may have occurred and "delisting" may be appropriate. In other situations, post-TMDL monitoring studies will be required to ascertain the success of best management practice (BMP) implementation in a watershed. With limited resources available to implement new monitoring initiatives such as pre and post-TMDL monitoring, contractual assistance may be necessary for this activity.

- **Nutrient Standards.** Development and implementation of nutrient standards for Illinois waters is a complex issue requiring review of existing data and collection of new information for a better understand the relationships among key nutrients (e.g., nitrogen and phosphorus) with the resultant dynamics of primary production and diel oxygen regimes — particularly in streams. To address some of the issues related to nutrient standards development, the BOW has initiated a Continuous Monitoring Pilot Study with the U.S. Geological Survey (USGS) at eight Illinois EPA AWQMN sites located across the state to obtain real time water chemistry data (Appendix 3).

- **Trace Metals.** The adoption of new water quality standards for dissolved metals will ultimately require a review of existing water quality sampling procedures to ensure sampling techniques do not result in sample contamination. Over the next five-year monitoring cycle the BOW will evaluate the feasibility of adopting sampling procedures similar to the USGS "clean hands" techniques to assure that dissolved metal data is of the quality necessary for use in Agency environmental programs.

- **Environmental Contaminant Monitoring.** The development and release of new pesticides and other exotic chemical compounds (e.g., pharmaceutical compounds) into the environment may result in endocrine disruption, or other aquatic life impairments not adequately measured by conventional monitoring approaches. In the future, it may be necessary for the BOW to develop and implement new monitoring approaches that utilize alternative environmental indicators to assess such impairments.

PROGRAM EFFECTIVENESS

Agency water monitoring programs are reviewed annually in conjunction with preparation of the Illinois EPA/U.S. EPA Environmental Performance Partnership Agreement (EnPPA). This agreement, which sets the mutual state/federal agenda for continued environmental progress, also outlines Agency plans to prevent, control, and abate water pollution on a fiscal year basis and the strategy for conducting ongoing surface water programs and new monitoring initiatives. The EnPPA is an evolving public document that allows the general public the opportunity to understand and comment on the Agency surface water-monitoring program.

Evaluation of the effectiveness of surface water monitoring programs to provide suitable and timely data to achieve the program objectives established in this strategy is thus a continual and ongoing process in the BOW. In addition to annual reviews conducted for the Agency Environmental Performance Agreement, preparation of the Illinois Water Quality Report prepared pursuant to Section 305(b) of the CWA, provides the Agency with a mechanism to evaluate the adequacy of surface water monitoring programs and geographic coverage in Illinois. This reporting effort also affords the Agency an opportunity to assess the extent to which appropriate data are available for assessment of environmental impairments, short and long-term trends, and the effectiveness of water pollution control programs. Both processes, the annual Environmental Performance Agreement, and the 305(b) report, continually indicate the Agency is on target in acquiring monitoring information to meet program objectives.

The 305(b) reporting process, for example, historically provided the impetus to review and revise the methodology for assessing and reporting inland lake and stream quality and expanding analysis of groundwater resources. More recently, the 305(b) assessment process has been the catalyst to develop new biological assessment tools that will constitute biological criteria for assessment of aquatic life use attainment. The technical format of the 305(b) report, however, has also proved to be an obstacle to the effective communication and coordination of surface water information to cooperating agencies, volunteer groups, and the general public. In response to the need to disseminate water quality information in a simplified format for selected geographic areas or watersheds, the Agency initiated development of: 1) a simplified eight-page summary document; 2) water quality "Fact Sheets" subsequently followed by; 3) the development of an Agency Web site to provide a summary of surface water quality for significant lakes and streams within designated watersheds or geographic areas.

SUPPORT AND INFRASTRUCTURE

Several key areas pose hurdles to BOW goals to maintain and/or improve BOW monitoring programs over the next five years. Paramount amount among these issues are data management, staff support and continuation of adequate funding for monitoring programs.

Data Management. BOW surface and groundwater monitoring programs result in the generation of tremendous quantities of data that require QA validation, and handling in conjunction with storage and retrieval activities. The lack of single BOW database, recent STORET problems, and adequate full time staff allocated to data management functions is with out question the most significant obstacles to more effective use of monitoring information collected by the BOW. It is anticipated over the next five years the BOW will utilize the expertise of outside consultants for contractual assistance for database system development compatible to BOW needs to achieve desired improvements in water resource assessments and reporting.

BOW Staff Resources. Approximately 240 individuals are employed by the Illinois EPA BOW in the Division of Water Pollution Control. These staff members are distributed among eight BOW sections having water pollution control program responsibilities ranging from compliance to NPDES permitting (Table 11). As of January 2002, a total of 31 positions have been allocated to surface water monitoring activities, representing 13 percent of the division workforce. An additional 16 staff are located in the BOW, Division of Public Water Supply, Groundwater Section.

Table 11. Staff summary for the Bureau of Water, Division of Water Pollution Control, and Public Water Supply, Groundwater Section.

Program Area	Total Staff	% of DWPC	Number of Staff by Program Area
Water Pollution Control			
Surface Water Section	31	13.0	305(b) report; surface water monitoring & assessments; lake grant implementation, 303(d) assistance; technical assistance
Compliance Section	28	11.8	Point source compliance assurance; discharge monitoring reports
Infrastructure Financial Assistance Section	23	9.7	Grants and loans for wastewater treatment facilities, sewers, lift stations, etc.
Watershed Management Section	21	8.8	319 program; 303(d) list development; TMDL implementation; livestock waste; FPAs; Section 401 certifications
Permits Section	29	12.2	Municipal and industrial point source permits; stormwater permits
Field Operations Section	49	20.6	Citizen complaint investigations; treatment plant inspections; fish kills
Administrative Support	36	15.1	Secretarial support; records unit
BOW Management	21	8.8	BOW senior management; budget officer/staff; personnel officer; public information officer; information services
Public Water Supply			
Groundwater Section	16	N/A	Community Water Supply Well and aquifer monitoring; evaluate groundwater trends and effectiveness of Clean Water and Safe Drinking Water Act program

Surface monitoring programs are administered by the SWS, headquartered in Springfield, Illinois. Three regional offices, located in Des Plaines, Springfield, and Marion, are responsible for conducting biological, chemical, and habitat sampling in conjunction with BOW lake and stream monitoring programs as well as providing much of the data management and assessment capabilities. BOW staff in the Des Plaines Regional Office administers the Lake Michigan monitoring program.

Over the past several years it has proven difficult to maintain adequate staffing in the Northern Monitoring Unit located at the Des Plaines Regional Office. Difficulty in the retention and hiring of qualified individuals has seriously hindered surface water monitoring capabilities at this office. With the passage of an Early Retirement Initiative (ERI) in June 2002, and statewide hiring restrictions likely to continue, the short-term prospect of augmenting BOW monitoring staff capabilities for any office is not promising. The hiring of qualified staff to fill other water monitoring program vacancies, particularly for data management activities, will continue to be difficult.

Agency Training. General training for Agency employees in areas such as computers, writing skills, and personal development is a top priority for the Illinois EPA. To enhance training within the Agency, a training coordinators group is responsible for working with vendors to provide relevant training to Agency staff. Because expertise requirements vary widely across the Agency, technical training is accomplished at the bureau level. Bureau of Water staff involved with monitoring programs are encouraged to attend formal technical training courses and workshops offered by U.S. EPA, professional organizations, or private corporations to enhance staff skill levels pertinent to BOW activities and for continued personal professional development. Annually, training courses scheduled and made available to BOW staff for personal computers, word processing, spreadsheet, and data management software. In conjunction with the increased emphasis on quality assurance for water monitoring program activities, the Agency Quality Systems Coordinating Committee and BOW QA staff evaluate QA training needs and schedule QA training for BOW staff with QA responsibilities (see Section V).

Volunteer Monitoring Training and Support. Illinois EPA encourages citizen involvement in efforts to protect, preserve, monitor, and restore the water quality, biodiversity, habitat, and scenic resources of the State of Illinois. Data collected by volunteers in conjunction with the VLMP as well as outside groups will be used for the educational purposes of school age groups and adult volunteer organizations, and to assist Illinois EPA in updating use assessments of future Illinois 305(b) reports. The Agency will continue to provide technical assistance program to lake monitoring volunteers including preparation and distribution of educational materials to facilitate citizen involvement in lake monitoring and implementation of lake management plans.

Information Management Services

Substantial surface water monitoring data and reports are developed annually in conjunction with routine Agency lake and stream monitoring activities such as intensive basin surveys, Facility-Related Stream Surveys, special stream surveys, and Illinois Clean Lakes Program diagnostic studies. All final major monitoring reports developed as a result of such activities are forwarded to the Illinois EPA Library (13 copies), and an additional 40 copies are set Illinois state libraries to enhance public availability. Copies of these documents are also sent to the National Technical Information Services (NTIS) and as appropriate, additional copies are forwarded to the U.S. EPA Region 5 Office.

Over the past several years the Agency has made significant a commitment to enhance data management, assessment, and reporting capabilities through computer and GIS technology.
Considerable resources have been expended for data assessment and reporting capabilities through the purchase of personal computers for all staff. All BOW headquarters and regional offices have installed computer networks (LAN and WAN) that enhance data analysis and management and are linked to the Internet.

Laboratory Resources

The Bureau of Water has a long history of using the services of the Illinois EPA Division of Laboratories (DOL) to provide chemical analyses of water monitoring program samples. The Agency Champaign and Springfield laboratories provide this laboratory support. Agency laboratory methods have been included with the BOW Integrated Water Monitoring Quality Assurance Project Plan (Illinois EPA 1994) and include comprehensive QA/QC procedures, including participation in U.S. EPA, USGS and U.S. FDA quality assurance programs. Quality assurance procedures have been developed and adopted to maintain tight control over sample identities, chain of custody, sample security, sample preservation, and laboratory maintenance.

In April or May of each year, the DOL asks the BOW to complete a workload projection that includes the number of samples or analyses per month that we expect to submit during the next fiscal year. The DOL requests this projection so that it can accommodate our workload by adding or reducing staff and equipment as necessary on a yearly basis. The DOL charges the BOW for analytical work based on the cost per analysis, which varies somewhat from year to year. The analytical capacity of the Illinois EPA laboratories has been sufficient for the projected workload, and the total number of samples submitted has remained stable over the past few years and is not expected to increase significantly over the next five years. The FY2001 laboratory workload shown in Appendix 11 is typical of the number samples analyzed and cost of laboratory analysis expected for future BOW monitoring programs.

The DOL Champaign Inorganic Laboratory and the Springfield Organic Laboratory are both accredited by the National Environmental Laboratory Accreditation Program (NELAP). Both laboratories participate in the NELAP performance-testing (PT) program. In addition, both laboratories have been testing samples under the United States Geological Survey PT program that uses test substances prepared in a river water matrix. The BOW may begin contracting with outside laboratories for some analyses because of an inability of the DOL laboratories to meet required detection and reporting levels for some constituents. For example, the Champaign Inorganic Laboratory is not planning to upgrade to U.S. EPA Method 1631 for mercury analysis. Analysis by Method 1631 is needed to assess whether Illinois ambient waters contain levels of mercury below water quality standards. The BOW is in the process of conducting a study to compare mercury results by Inductively Coupled Plasma (ICP) method (used by the Champaign Inorganic Laboratory) to results obtained when a split sample is sent to a commercial laboratory is experienced with Method 1631.

Additional laboratory support is also provided by the (1) Metropolitan Water Reclamation District of Greater Chicago, (2) City of Chicago, (3) Illinois State Water Survey (Champaign), (4) Indiana Board of Public Health, (5) Illinois Department of Public Health (Chicago and Springfield (6) City of Carbondale, (7) Illinois Department of Agriculture (Centralia), (8) Suburban Laboratories, Inc. (Hillside), and (9) U.S. Food and Drug Administration (Minneapolis, MN). These laboratories also participate in QA/QC activities. For the past five years, bioassays (toxicity tests) have been conducted by a private laboratory under a renewable three-year contract. The laboratory that has been conducting bioassays for the BOW, S-F Analytical, is accredited by the State of Wisconsin. The contract with S-F Analytical expires in 2002. Contracts for services are awarded based on competitive bids, so it is possible that a different laboratory could be used in the future. In conformance with the BOW and Agency QMPs, the requests for bioassay services specify the quality assurance (QA) requirements a laboratory must meet to have its bid considered. The successful bidder is the lowest cost provider selected from those laboratories that meet the specified QA requirements.

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SECTION VIII. APPENDICES

WATER MONITORING STRATEGY

2002 - 2006

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
BUREAU OF WATER

APPENDIX 1

Laboratory and Field Parameters Assessed in Bureau of Water Monitoring Programs

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

BUREAU OF WATER

Appendix Table 1 is best viewed at 150% magnification

Appendix Table 1. Laboratory and field parameters assessed in Bureau of Water Monitoring Programs

STORET # Parameter	BIOSURVEYS Facility-Related	BIOSURVEYS Intensive Basin	FISH TISSUE	AMBIENT WQ STREAMS (AWQMN)	AMBIENT WQ STREAMS Great Rivers(CORE1)	LAKES AND RESERVOIRS ALMP	LAKES AND RESERVOIRS VLMP	LAKES AND RESERVOIRS Clean Lakes	LAKES AND RESERVOIRS Lake Michigan	POINT SOURCE	GROUND-WATER
LABORATORY PARAMETERS											
70508 Acidity, Tot., as CaCO3											
410 Alkalinity, Tot., as CaCO3		X		X*	X	X		X			X
415 Alkalinity, Pheno., as CaCO3						X		X			
1106 Aluminum, Diss.	X	X		X	X						
1105 Aluminum, Tot.	X	X		X	X	X*		X*	X	X	X
1002 Arsenic, Tot.	X*	X*		X*	X			X*	X	X*	X
1005 Barium, Diss.	X	X		X	X	X*					
1007 Barium, Tot.	X	X		X	X	X*		X*	X	X	X
1010 Beryllium, Diss.	X	X		X	X						
1012 Beryllium, Tot.	X	X		X	X	X*		X*	X	X	X
80082 BOD, Carb.	X									X	
310 BOD, Tot.	X									X*	
1020 Boron, Diss.	X	X		X	X	X*		X*			
1022 Boron, Tot.	X	X		X	X	X*			X	X	X
1025 Cadmium, Diss.	X	X		X	X						
1027 Cadmium, Tot.	X	X		X	X	X*		X*	X	X	X
915 Calcium, Diss.	X	X		X	X						
916 Calcium, Tot.	X	X		X	X	X*		X*	X	X	X
940 Chloride, Tot.	X*	X*		X*	X				X	X	X
1030 Chromium, Diss.	X	X		X	X						
1032 Chromium, Hex.										X*	
1034 Chromium, Tot.	X	X		X	X	X*		X*	X	X	X
1035 Cobalt, Diss.	X	X		X	X						
1037 Cobalt, Tot.	X	X		X	X	X*		X*	X	X	X
94 Conductivity, Lab	X*	X*		X*	X*	X		X	X	X	
1040 Copper, Diss.	X	X		X	X						
1042 Copper, Tot.	X	X		X	X	X*		X*	X	X	X
718 Cyanide, Diss.										X*	
720 Cyanide, Tot.	X*	X		X*	X				X		X
31616 Fecal Coliform				X	X				X		
31673 Fecal Streptococci											
951 Fluoride	X*	X*		X*	X				X	X*	X
900 Hardness	X	X		X	X	X*		X*	X	X	
1046 Iron, Diss.	X	X		X	X						
1045 Iron, Tot.	X	X		X	X	X*		X*	X	X	X
1049 Lead, Diss.	X	X		X	X						
1051 Lead, Tot.	X	X		X	X			X*	X	X	X
925 Magnesium, Diss.	X	X		X	X						
927 Magnesium, Tot.	X	X		X	X	X*		X*	X	X	X
1056 Manganese, Diss.	X	X		X	X						
1055 Manganese, Tot.	X	X		X	X	X*		X*	X	X	X
71900 Mercury	X	X		X	X				X	X	X
1065 Nickel, Diss.	X	X		X	X						
1067 Nickel, Tot.	X	X		X	X	X*		X*	X	X	X
610 Nitrogen, Ammonia	X	X		X	X	X	X*	X	X	X	X
625 Nitrogen, Kjeldahl	X*	X		X	X	X		X		X*	
630 Nitrogen, NO3+NO2	X	X		X	X	X	X*	X	X	X	X
556 Oil and Grease	X*									X	
680 Organic Carbon, Tot.	X*	X*		X*	X					X*	
32730 Phenols	X*	X*		X*	X				X	X*	X
666 Phosphorus, Diss.	X	X		X	X	X		X	X		
665 Phosphorus, Tot.	X	X		X	X	X	X*	X	X	X	X
400 pH, Lab	X*	X*		X*	X*	X		X	X	X	
937 Potassium Tot.	X	X		X	X	X*		X*	X	X	X
935 Potassium, Diss.	X	X		X	X						
1147 Selenium					X						X
956 Silica									X		X
1075 Silver, Diss.	X	X		X	X						
1077 Silver, Tot.	X	X		X	X	X*		X*	X	X	X
929 Sodium Tot.	X	X		X	X	X*		X*	X	X	X
930 Sodium, Diss.	X	X		X	X						
70300 Solids, Diss., ROE	X*	X							X	X	X
530 Solids, Tot. Suspended	X	X		X	X	X	X*	X		X	
535 Solids, Volatile Suspended	X*	X		X	X	X	X*	X		X	

1080	Strontium, Diss.	X	X		X	X						
1082	Strontium, Tot.	X	X		X	X	X*		X*	X	X	X
945	Sulfate	X*	X		X*	X			X*	X	X	X
745	Sulfide										X*	
76	Turbidity, NTU	X*	X		X	X	X	X*	X	X	X	
1085	Vanadium, Diss.	X	X		X	X						
1087	Vanadium, Tot.	X	X		X	X	X*		X*	X	X	X
1090	Zinc, Diss.	X	X		X	X						
1092	Zinc, Tot.	X	X		X	X	X*		X*	X	X	X
1097	Antimony											X
900	Hardness						X*					X
1059	Thallium											X

Appendix Table 1. (con't) Laboratory and field parameters assessed in Bureau of Water Monitoring Programs

STORET #	Parameter	BIOSURVEYS Facility-Related	BIOSURVEYS Intensive Basin	FISH TISSUE	AMBIENT WQ STREAMS (AWQMN)	AMBIENT WQ STREAMS Great Rivers(CORE1)	LAKES AND RESERVOIRS ALMP	LAKES AND RESERVOIRS VLMP	LAKES AND RESERVOIRS Clean Lakes	LAKES AND RESERVOIRS Lake Michigan	POINT SOURCE	GROUND-WATER
Water Organics												
00000	4-Methylphenol										X	
00000	4,6-Dinitro-2-methylphenol										X	
00000	2-Methylphenol										X	
00000	4-Chloroaniline										X	
00000	4-Nitroaniline										X	
34200	Acenaphthylene										X	
34205	Acenaphthene										X	
34220	Anthracene										X	
34230	Benzo (B) Fluoranthene										X	
34242	Benzo (K) Fluoranthene										X	
34247	Benzo (A) Pyrene						X*		X*		X	X
34273	Bis (2-Chloroethyl) ether										X	
34278	Bis (2-Chloroethoxy) Methane										X	
34283	Bis (2-Chloroisopropyl)										X	
34292	Butyl Benzyl Phthalate										X	
34320	Chrysene										X	
34336	Diethylphthalate										X	
34341	Dimethylphthalate										X	
34376	Fluoranthene										X	
34381	Fluorene										X	
70017	Hexachlorocyclopentadiene						X*		X*		X	
34391	Hexachlorobutadiene										X	
34396	Hexachloroethane										X	
34403	Ideno (1,2,3-cd) Pyrene										X	
34408	Isophorone										X	
34428	N-Nitroso-di-n-propylamine										X	
34447	Nitrobenzene										X	
34452	4-Chloro-3-Methylphenol										X	
34461	Phenanthrene										X	
34469	Pyrene										X	
34488	Trichlorofluoromethane										X	
34521	Benzo (GHI) Perylene										X	
34526	Benzo(A)Anthracene										X	
34531	1,2-Dichloroethane										X	
34556	Dibenzo (AH) Anthracene										X	
34576	2-Chloroethylvinyl Ether										X	
34581	2-Chloronaphthalene										X	
34586	2-Chlorophenol										X	
34591	2-Nitrophenol										X	
34596	Di-N-Octylphthalate										X	
34601	2,4-Dichlorophenol										X	
34606	2,4-Dimethylphenol										X	
34611	2,4-Dinitrotoluene										X	
34616	2,4-Dinitrophenol										X	
34621	2,4,6-Trichlorophenol										X	
34626	2,6-Dinitrotoluene										X	
34631	3,3'-Dichlorobenzidine										X	
34636	4-Bromophenyl Phenyl Ether										X	
34641	4-Chlorophenyl Phenyl Ether										X	
34646	4-Nitrophenol										X	
34694	Phenols										X	
34696	Naphthalene										X	

39100	Bis(2-Ethylhexyl)Phthalate										X	
39110	Di-N-Butylphthlate										X	
77041	Carbon Disulfide										X	
77057	Vinyl Acetate										X	
77103	2-Hexanone (MSK)										X	
77147	Benzyl Alcohol										X	
77247	Benzoic Acid										X	
77277	Bromochloromethane										X	
77416	2-Methylnaphthalene										X	
77687	2,4,5-Trichlorophenol										X	
78113	Ethylbenzene										X	
78124	Benzene										X	
78131	Toluene										X	
78133	4-Methyl-2-Pentanone(MIBK)										X	
78300	3-Nitroaniline										X	
81302	Dibenzofuran										X	
81552	Acetone										X	
81595	2-Butanone (MEK)										X	
39032	Pentachlorophenol	X*			X		X*		X*	X	X	X
39350	Chlordane Tech & Met	X*			X		X*		X*	X		X
39062	Chlordane cis isomer	X*			X					X		
39065	Chlordane trans isomer	X*			X					X		
39330	Aldrin	X*			X		X*		X*	X		
39337	Alpha BHC	X*			X					X		

Appendix Table 1. (con't) Laboratory and field parameters assessed in Bureau of Water Monitoring Programs

STORET #	Parameter	BIOSURVEYS Facility-Related	BIOSURVEYS Intensive Basin	FISH TISSUE	AMBIENT WQ STREAMS (AWQMN)	AMBIENT WQ STREAMS Great Rivers(CORE1)	LAKES AND RESERVOIRS ALMP	LAKES AND RESERVOIRS VLMP	LAKES AND RESERVOIRS Clean Lakes	LAKES AND RESERVOIRS Lake Michigan	POINT SOURCE	GROUND-WATER
Water Organics (cont)												
39340	Gamma BHC (Lindane)	X*			X		X*		X*	X		X
39700	Hexachlorobenzene	X*			X		X*		X*	X	X	
39370	DDT	X*			X		X*		X*	X		
39300	p,p' DDT				X							
39310	p,p' DDD				X							
39320	p,p' DDE				X							
39380	Dieldrin	X*			X		X*		X*	X		
39390	Endrin				X*		X*		X*			X
39480	Methoxychlor				X*		X*		X*	X		X
39516	PCB's				X*		X*		X*	X	X	X
39400	Toxaphene						X*		X*	X		X
39410	Heptachlor				X*		X*		X*			X
39420	Heptachlor epoxide				X*		X*		X*			X
39348	Alpha-Chlordane				X*							
39810	Gamma-Chlordane				X*							
39730	2,4-D				X*		X*		X*			X
39760	Silvex				X*		X*		X*			X
30200	Dalapon				X*		X*		X*			X
38442	Dicamba				X*		X*		X*			
30191	Dinoseb				X*		X*		X*			X
39720	Picloram				X*		X*		X*			X
79193	Acifluorfen				X*		X*		X*			
30295	Propachlor						X*		X*			X*
39055	Simazine						X*		X*			X
39770	Dacthal						X*		X*			
77860	Butachlor						X*		X*			
77903	Di(2-Ethylhexyl) Adipate						X*		X*			
39107	Di(2-Ethylhexyl) Phthalate						X*		X*			X
49259	Acetochlor				X*		X*		X*			X*
Pesticide Monitoring Network												
39530	Malathion				X*							
39570	Diazinon				X*							
39600	Methyl Parathion				X*							
39630	Atrazine				X*		X*		X*			X
39640	Captan				X*							
39356	Metolachlor (Dual)				X*		X*		X*			X*
46313	Phorate				X*							
77825	Alachlor, Tot. (Lasso)				X*		X*		X*			X

STORET #	Parameter	Facility-Related	Intensive Basin	FISH TISSUE	AMBIENT (AWQMN)	WQ STREAMS Great Rivers(CORE1)	ALMP	VLMP	Clean Lakes	Lake Michigan	POINT SOURCE	GROUND-WATER
81284	Treflan, Trifluralin				X*		X*		X*			
81294	Fonofos (Dyfonate)				X*							
81403	Chloropyrifos (Dursban)				X*							
81408	Metribuzin, Tot.				X*		X*		X*			X*
81410	Butylate, Tot.				X*							
81757	Cyanazine, (Bladex)				X*		X*		X*			X*
82088	Terbufos, Tot.				X*							
39357	Ronnel											
39398	Ethion											
38403	Ametryn											X*
	Dimethenamid											X*
	Flufenacet											X*
76190	Pendimethalin											X*
4037	Prometon											X*
39056	Prometryn											X*
38578	Propazine											X*
38887	Terbutryn											X*
46373	Deethylatrazine											X*
46374	Deisopropylatrazine											X*
	Cyanazine-amide											X*
	Acetochlor ethanesulfonic acid											X*
	Acetochlor oxanilic acid											X*
	Alachlor ethanesulfonic acid											X*
	Dimethenamid ethanesulfonic acid											X*
	Dimethenamid oxanilic acid											X*
	Flufenacet ethanesulfonic acid											X*
	Flufenacet oxanilic acid											X*
	Metolachlor ethanesulfonic acid											X*
	Metolachlor oxanilic acid											X*
Volatile Organics												
34531	1,2 Dichloroethane						X*			X	X	X
34423	Methylene Chloride						X*			X	X	X
34501	1,1-Dichloroethylene						X*			X	X	X
34506	1,1,1-Trichloroethane						X*			X	X	X
77093	Cis-1,2-Dichloroethylene						X*			X	X	X

Appendix Table 1. (con't) Laboratory and field parameters assessed in Bureau of Water Monitoring Programs

STORET		BIOSURVEYS		FISH	AMBIENT	WQ STREAMS	LAKES AND RESERVOIRS				POINT	GROUND-
#	Parameter	Facility-Related	Intensive Basin	TISSUE	(AWQMN)	Great Rivers(CORE1)	ALMP	VLMP	Clean Lakes	Lake Michigan	SOURCE	WATER
Volatile Organics (cont)												
34371	Ethylbenzene						X*			X	X	X
34496	1,1-Dichloroethane									X	X	X
81551	Xylene						X*			X	X	X
78124	Benzene						X*			X	X	X
34301	Chlorobenzene						X*			X	X	X
32104	Bromoform									X	X	
32106	Chloroform									X	X	
34716	Dichlorobenzene									X	X	
39180	Trichloroethylene						X*			X	X	X
32102	Carbon Tetrachloride						X*			X	X	X
34546	Trans - 1,2 Dichloroethylene						X*			X	X	
	Dichlorobromomethane									X	X	
34475	Tetrachloroethylene						X*			X	X	
78131	Toluene						X*			X	X	X
32105	Chlorodibromomethane									X	X	
32101	Bromodichloromethane										X	
34511	1,1,2-Trichloroethane						X*				X	X
34551	1,2,4-Trichlorobenzene						X*				X	X
34536	1,2-Dichlorobenzene						X*				X	X
34571	1,4-Dichlorobenzene						X*				X	X
34541	1,2-Dichloropropane						X*				X	X
77128	Styrene						X*				X	X
34475	Tetrachloroethylene										X	X
34546	Trans-1,2-Dichloroethylene										X	X
39175	Vinyl Chloride						X*				X	X
77562	1,1,1,2-Tetrachloroethane											
34516	1,1,2,2-Tetrachloroethane										X	
77168	1,1-Dichloropropene											

77443	1,2,3-Trichloropropane											
34566	1,3-Dichlorobenzene										X	
77173	1,3-Dichloropropane											
77170	2,2-Dichloropropane											
81555	Bromobenzene											
34413	Bromomethane										X	
34311	Chloroethane										X	
34418	Chloromethane						X*				X	
34704	Cis-1,3-Dichloropropene										X	
81522	Dibromomethane											
77970	Total Chlorotoluenes											
34699	Trans-1,3-Dichloropropene										X	
46491	Methyl Tert-Butyl Ether						X*					X
Fish Tissue												
39105	Lipids (%)		X*	X						X		
71930	Mercury		X*	X*						X		
34680	Aldrin		X*	X						X		
34682	Chlordane		X*	X						X		
34686	Heptachloroepoxide		X*	X						X		
34688	Heptachlorobenzene		X*	X						X		
39074	Alpha BHC		X*	X						X		
39376	DDT		X*	X						X		
39404	Dieldrin		X*	X						X		
39515	PCB's		X*	X						X		
34685	Endrin		X*	X						X		
34687	Heptachlor		X*	X						X		
34691	Toxaphene		X*	X						X		
39785	Gamma BHC (Lindane)		X*	X						X		
81644	Methoxochlor		X*	X						X		
81645	Mirex		X*	X						X		
Sediment Metals and Nutrients												
70322	Volatile Solids (%)		X			X*	X		X	X		
627	Kjeldahl Nitrogen		X			X*	X		X	X		
668	Phosphorus		X			X*	X		X	X		
938	Potassium		X			X*	X		X	X		
1003	Arsenic		X			X*	X		X	X		
1008	Barium		X			X*	X		X	X		
1028	Cadmium		X			X*	X		X	X		
1029	Chromium		X			X*	X		X	X		
1043	Copper		X			X*	X		X	X		
1052	Lead		X			X*	X		X	X		
1053	Manganese		X			X*	X		X	X		
1068	Nickel		X			X*	X		X	X		
1078	Silver		X			X*	X		X	X		
1093	Zinc		X			X*	X		X	X		
1170	Iron		X			X*	X		X	X		
71921	Mercury		X			X*	X		X	X		

Appendix Table 1. (con't) Laboratory and field parameters assessed in Bureau of Water Monitoring Programs

STORET #	Parameter	BIOSURVEYS Facility-Related	Intensive Basin	FISH TISSUE	AMBIENT WQ STREAMS (AWQMN)	Great Rivers(CORE1)	LAKES AND RESERVOIRS ALMP	VLMP	Clean Lakes	Lake Michigan	POINT SOURCE	GROUND-WATER
Sediment Metals and Nutrients (cont)												
46489	TOC, Sediment %						X		X			
70318	Solids, % Wet Sample		X			X*	X		X			
Sediment Organochlorine Compounds (ug/kg)												
39519	PCB's		X			X*	X		X	X		
39333	Aldrin		X			X*	X		X	X		
39383	Dieldrin		X			X*	X		X	X		
39359	DDT		X			X*	X		X	X		
39351	Total Chlordane		X			X*	X		X	X		
39064	Chlordane, cis isomer (Alpha)		X			X*	X		X	X		
39067	Chlordane, trans isomer (Gamma)		X			X*	X		X	X		
39393	Endrin		X			X*	X		X	X		
39481	Methoxochlor		X			X*	X		X	X		
39076	Alpha BHC		X			X*	X		X	X		
39343	Gamma BHC (Lindane)		X			X*	X		X	X		

39701 Hexachlorobenzene		X			X*	X		X	X		
39413 Heptachlor		X			X*	X		X	X		
39423 Heptachlor epoxide		X			X*	X		X	X		
81618 Trifluralin		X			X*	X		X			
39631 Atrazine		X			X*	X		X			
81407 Alachlor		X			X*	X		X			
81409 Metribuzin		X			X*	X		X			
38923 Metolachlor		X			X*	X		X			
82409 Pendimethanlin		X			X*	X		X			
Sediment Organochlorine Compounds (ug/kg) (cont											
49196 Captan		X			X*	X		X			
82543 Cyanazine		X			X*	X		X			
39321 P,P'-DDE		X			X*	X		X			
39311 P,P'-DDD		X			X*	X		X			
39301 P,P'-DDT		X			X*	X		X			
Chlorophyll											
32211 Chlorophyll a (corrected)	X*	X		X*	X*	X	X*	X	X		
32210 Chlorophyll a (uncorrected)	X*	X		X*	X*	X	X*	X	X		
32212 Chlorophyll b	X*	X		X*	X*	X	X*	X	X		
32214 Chlorophyll c	X*	X		X*	X*	X	X*	X	X		
32218 Phaeophytin	X*	X		X*	X*	X	X*	X	X		
Phytoplankton						X		X	X		
FIELD PARAMETERS											
61 Discharge	X	X						X			
20 Temperature, Air (C)	X	X		X	X	X		X	X	X	
10 Temperature, Water (C)	X	X		X	X	X		X	X	X	X
94 Conductivity	X	X		X	X	X		X	X		X
400 pH	X	X		X	X	X		X	X		X
299 Oxygen, Diss.	X	X		X	X	X		X			
410 Alkalinity, Tot., as CaCO3						X		X			
415 Alkalinity, Pheno., as CaCO3						X		X			
31616 Fecal Coliform		X		X	X						
76 Turbidity, NTU	X*	X		X	X	X		X			
90 Redox, Field											X
77 Secchi Transparency						X	X	X	X		
Fish Tissue											
81614 # of Fish		X	X			X*		X*	X		
23 Weight of Fish		X	X			X*		X*	X		
24 Length of Fish		X	X			X*		X*	X		
74990 Fish Species (Numeric)		X	X								
84005 Fish Species (Alpha)		X	X								
74995 Anatomy (Numeric)		X	X								

X Collected on a Routine basis

X* Not a Routine parameter, but site specific

APPENDIX 2

ILLINOIS EPA
AMBIENT STREAM WATER QUALITY
MONITORING NETWORK
2002

Prepared by
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State of Illinois
Illinois Environmental Protection Agency
Bureau of Water
Division of Water Pollution Control
Surface Water Section
Springfield Monitoring Unit

This report is an overview and update of the Illinois Environmental Protection Agency's (Illinois EPA) ambient stream water quality monitoring network (AWQMN). Minor changes have occurred over the past year including the addition of 2 parameters to the universal group, the relocation of three stations and the collection of pesticides from 6 stations as part of the routine sampling protocol. In addition, seven ambient stations were incorporated into a pilot study with the United State Geological Survey (USGS) to evaluate the use of continuous field monitor probes.

Purpose of the Network:

In general, the goals of Illinois EPA surface water monitoring programs are to identify causes of pollution (toxics, nutrients, sedimentation) and their sources (point or nonpoint) of surface water impairments, determine the overall effectiveness of pollution control programs and identify long term resource quality trends. The AWQMN specifically is utilized by the Illinois EPA to provide baseline water quality information, to characterize and define trends in the physical, chemical and biological conditions of the state's waters, identify new or existing water quality problems and to act as a triggering mechanism for special studies or other appropriate actions. Additional uses of the data collected by the Illinois EPA through the AWQMN program includes the establishment of water quality based effluent limits for NPDES permits. The AWQMN is integrated with other Illinois EPA stream sampling programs, both chemical and biological, which are more localized geographically (specific watershed or point source receiving stream) and cover a shorter span of time (e.g., one year) to evaluate compliance with water quality standards and to determine designated use supports as required in Section 305(b) of the Clean Water Act.

Station Information:

The Illinois EPA began operating the AWQMN in October 1977. Through September 1996, it consisted of 209 stations. The AWMQN was preceded by a 538 station network operated by the Illinois EPA between water years 1972 and 1977 (note water years run from October 1 through September 30). Of the 538 original stations, 108 were incorporated into the AWQMN. The change in stations in October 1977 reflected in part, the adoption of USGS sampling methodologies. The network currently consists of 213 active stations: 202 interior stations and 11 stations on the Mississippi River (Figure 1). In addition, there are 15 inactive stations for a grand total of 228 (Table 1).

Table 1. List of inactive IEPA ambient stream stations.

IEPA Code	Stream Name	Period of Record
A 06	Ohio River	1972-91
B 07	Wabash River	1974-87
DT 46	Fox River	1978-98 replaced by DT 01
*E 28	Sangamon River	1978-01 replaced by E 18
*EO 01	South Fork Sangamon	1979-01 replaced by EO 03
GI 01	Sanitary & Ship Canal	1987-92
*GB 10	Du Page River	1968-01 replaced by GB 16
J 05	Mississippi River	1989-95 replace by J 98
J 83	Mississippi River	1975-89 replaced by J 05
K 04	Mississippi River	1972-99 replaced by K 22
M 04	Mississippi River	1967-99 replaced by M 12
N 10	Big Muddy River	1977-99 replaced by N 06
NB 01	Kincaid Creek	1979-97
ND 02	Crab Orchard Creek	1972-97
OI 09	Shoal Creek	1982-99 replaced by OI 07

* changed for 2002 water year

Although the Illinois EPA does not sample the Mississippi River at Thebes (I-84) it is considered part of the "active" network because the Missouri USGS collects extra bottles for us which are analyzed by the Illinois EPA labs. The USGS and Ohio River Valley Water Sanitation Commission (ORSANCO) sample other sites on the Mississippi River, Ohio River and Wabash River that overlap Illinois EPA AWQMN stations: A-06, B-07, M-04 and J-05. Since the data from these four stations are not collected by, for, or analyzed by the Illinois EPA, these stations are classified as "inactive." In addition, many of the AWQMN stations are located at USGS gaging stations, resulting in an overlap with the USGS National Water Quality Assessment Program (NAWQA) at several sites within the Upper Illinois River and Lower Illinois River NAWQA units. The results from these stations are generally limited to dissolved parameters and are therefore not directly comparable to state standards which are based on total concentrations. However, although the data itself is not considered part of the AWQMN, the Illinois EPA can use quality assured data for assessment purposes.

The single largest change to the AWQMN station list came during the 2000 water year when the number and location of stations monitored on the Mississippi River were altered. For the 2002 cycle, sampling locations were changed at three stations: E-28, EO-01 and GB-10. On the Sangamon River E-28 was located at the bridge in Allerton Park and was moved 4 miles upstream to correspond with the USGS gage west of Monticello. On the South Fork Sangamon River, EO-01 was moved from Illinois Route 29 for safety reasons upstream 1.3 miles to a county road west of Rochester. On the Du Page River, GB-10 was moved due to safety concerns and the proximity of new wastewater treatment plant discharges, from the Plainfield-Naperville road bridge downstream 2.2 miles to 119th Street bridge west of Naperville.

Station location information including the Illinois EPA stream code, corresponding USGS stream code, the stream name, county, drainage area, latitude and longitude are presented in Appendix Table A-1. Active main stem sites in the AWQMN include nine stations on the Sangamon and Kaskaskia Rivers, eight stations on the Illinois River, seven stations on the Des Plaines River, six stations on the Fox River, five stations each on the Little Wabash and Rock Rivers, and four stations each on the Embarras River, Spoon River, and Big Muddy River. There are two stations each on the Kankakee River, La Moine River, Vermilion River (Illinois), Mackinaw River, Green River and Macoupin Creek. The Illinois EPA AWQMN program includes eight different streams named Sugar Creek and two different Indian Creeks, Vermilion Rivers, Salt Creeks and Little Vermilion Rivers.

The Illinois EPA utilizes an alpha-numeric stream coding system consisting of one to four alphabetic characters, which indicate the stream being sampled, and two numeric characters which represent the station number on the stream. The state is divided into 14 major basins (Figure 2):

A	Ohio River	I	Mississippi River (South)
B,C	Wabash River	J	Mississippi River (South Central)
D	Illinois River	K,L	Mississippi River (North Central)
DT	Fox River	M	Mississippi River (North)
E	Sangamon River	N	Big Muddy River
F	Kankakee River	O	Kaskaskia River
G,H	Des Plaines River	P	Rock River

The few streams which drain directly into Lake Michigan utilize the letter "Q" as a basin identifier. However, there are no AWQMN stations in this basin. Letter designations are generally added alphabetically to major tributaries as one moves upstream from the mouth. For minor tributaries, the second letter is usually "Z". Therefore the letter furthest to the right designates the stream within a watershed being sampled. Station numbers reflect the stations establishment over time (i.e. the oldest stations are generally "01") and are not related to upstream downstream position within the watershed drainage. For example station DJBZ18:

D - Illinois River
J - Spoon River
B - Big Creek
Z - Slug Run
18 - station number 18 on Slug Run

Station codes may appear in reports with a dash separating the stream code from the station number for ease of reading (i.e. E 18 as E-18).

Sample collection and analysis:

The Illinois EPA collects water quality samples from AWQMN stations using methods developed by the USGS (Edwards and Glysson, 1988). Stations are sampled nine times per water year (note: water years run from October 1 to September 30), on an approximately six week cycle. Mississippi River stations are sampled quarterly. In general, water quality samples are collected utilizing the equal width increment, equal transit rate method. This method requires equal spacing of intervals across the stream cross section which vary with stream width, and an equal transit rate or constant speed of lowering and raising the sampler. The sampler utilized is dependent on water velocity and stream depth (Illinois EPA, 1994). Samples are composited in a churn splitter before being transferred to the appropriate collection bottles. Dissolved parameters are collected by filtering through a 0.45 µm filter. The samples are analyzed by Illinois EPA Division of Laboratories. Measurements of air and water temperature, dissolved oxygen, conductivity, pH and turbidity are done in the field. A summary of laboratory methods is provided in Table 2.

The universal parameter group, ASN01, which is collected from all stations in the network, includes the following (STORET code) parameters: (20) air temperature, (10) water temperature, (299) field dissolved oxygen, (400) field pH, (94) field conductivity, (535) volatile and (530) total suspended solids, (610) total ammonia-N, (630) total nitrate +nitrite-N, (76) turbidity, (665) total and (666) dissolved phosphorus, (31616) fecal coliform bacteria, (900) hardness (calc.), and total and dissolved ICAP Metals:

Total	Metal	Dissolved	Total	Metal	Dissolved
1105	Aluminum	1106	1051	Lead	1049
1007	Barium	1005	927	Magnesium	925
1022	Boron	1020	1055	Manganese	1056
1012	Beryllium	1010	1067	Nickel	1065
1027	Cadmium	1025	937	Potassium	935
916	Calcium	915	1077	Silver	1075
1034	Chromium	1030	929	Sodium	930
1042	Copper	1040	1082	Strontium	1080
1037	Cobalt	1035	1087	Vanadium	1085
1045	Iron	1046	1092	Zinc	1090

Two parameters were added to the universal parameter group for the 2002 water year: total Kjeldahl nitrogen or TKN (625) and total mercury (71900). A field test for turbidity (82078) was added during the 2001 water year. Additional parameters collected at selected stations include (680) total organic carbon, (940) total chloride, (945) total sulfate, (1002) total arsenic, (32730) phenol, (951) total fluoride, (720) total cyanide, (410) total alkalinity and (70508) total acidity. Chemical oxygen demand, COD (335) was dropped from the network in 1990. Total and dissolved phosphorus were added to all stations in 1984, although some stations contain older data. Descriptions of additional parameter groups are listed in Table 3.

Subnetworks for the monitoring of pesticides, industrial solvents and chlorophyll were established in 1985, 1988 and 2000 respectively. The pesticide subnetwork consists of approximately 30 stations per year. It was modified in 1994 from a specific fixed station network to allow sampling to correspond with the 5 year intensive basin surveys rotation. Sample frequency was also reduced from 5x to 3x per year to correspond with pre-application, application and post-application periods. In 2001, 6 stations (Lusk Creek AK-02, Little Wabash River C-19, Illinois River D-30, Sangamon River E-18, Des Plaines River G-15 and Bear Creek KI-02) were selected for pesticide sampling on the same frequency as the routine sampling (9x/year). The industrial solvents subnetwork consisted of 32 stations but was dropped in 1999. The largest concentration of industrial solvents stations were in the Des Plaines River basin (N=13). The chlorophyll subnetwork, consisting of 32 stations, was initiated in October of 2000 in response to requirements by U.S. EPA to develop nutrient criteria.

The continuous monitoring project consists of a total of eight stations. The stations were co-located with USGS gages and utilize seven existing ambient stations (AK-02, BPK-07, BPG-09, GL-09, D-32, DV-04 and NK-01) along with a station on the Vermilion River at Danville. The current ambient station on the Vermilion River BP-01 is located downstream from the Danville Sanitary District discharge but the gage and the continuous monitoring site (BP-08) are located upstream from the outfall. A list of the parameter group for each station plus whether it was a pesticide, industrial solvent, chlorophyll or continuous monitoring project station is presented in Appendix Table A-2.

Data Results

The Illinois EPA stored water quality data through December 1998 in a U.S. EPA database known as STORET. The AWQMN data is divided into two files: 21ILAMB and 21ILL. The 21ILAMB file contains data from the universal parameter groups for all stations beginning in October 1977 (or later depending on when the station was established) through December 1998. Pesticides and industrial solvents data is stored in the 21ILL file. Additional data which may be available from these stations include surficial sediments, stored in 21ILSED, and fish tissue, stored in 21ILFISH. Evaluation of the older data was presented in a series of reports prepared by the Illinois Water Information System Group, headed by Ronald Flemal and Donovan Wilkin (Peckham, 1980). Older stream water quality data, (i.e., from 1945 through 1971), have also been collected by the Illinois State Water Survey and the Illinois Department of Public Health at many of these stations and was compiled in a USGS report (Winget, 1976). Water quality data collected by the Illinois EPA during the 1978 through 1992 water years has been published in a series of reports by the USGS entitled "Water Resources Data: Illinois, Volume 1 and 2." Since the network was operated in cooperation with the USGS for water years 1985 through 1991 a report comparing the results of concurrent and split samples was also prepared (Melching and Coupe, 1995). This historical data is also available through the internet at www.epa.gov/storet. Data collected since January 1999 is not available in an electronic format at this time.

Table 2. Summary of Illinois EPA laboratory methods for parameters in the ASN* list.

Parameter	Sample Container	Field Preservative	Method of Analysis	Units of Measure	Min. Reporting Value	General Use Standard *
Fecal Coliform	4 oz PE	0.15 m-l0% thiosulfate at 4 °C	Membrane filtration-24 hr incubation at 44.5 °C± 0.2 °C	no./100ml		200/100 ml geometric mean
Total Suspended Solids	500 ml PE	cooled at 4 °C	filtration on glass fiber filter determination of increase in weight upon drying at 103-05 °C	mg/l	1 mg/l	None
Total Nitrate+Nitrite-N (NO3+NO2-N)	4 oz. PE	10 ml 20% H2SO4/l at 4 °C	Cadmium reduction method with flow Injection Analysis	mg/l	low at 0.02 mg/l high at 2 mg/l	None
Ammonia-N (NH3+NH4-N)	4 oz. PE	10 ml 20% H2SO4/l at 4°C	Phenate method on Continuous Flow Analyzer	mg/l	low at 0.01 mg/l high at 0.05 mg/l	15.0 mg/l maximum
Un-ionized Ammonia-N			Calculated based on total ammonia-N, field pH, and temperature.		0.001 mg/l	Apr-Oct as/cs 0.33/0.057 Nov-Mar as/cs 0.14/0.025 mg/l
Total Kjeldahl Nitrogen (TKN)	4 oz. PE	10 ml 20% H2SO4/l at 4°C	Block Digestion, Automated Phenate method for ammonia	mg/l	0.1 mg/l	None
Total Phosphorus	4 oz. PE	10 ml 20% H2SO4/l at 4°C	Digestion to orthophosphate, followed by absorbic acid reduction method using Continuous Flow Analyzer	mg/l	low at 0.001 mg/l mid at 0.01 mg/l high at 0.1 mg/l	0.05 mg/L for lakes
Total ICP: (Pb, Cu, Fe, Mn, Cd, Cr, Mg, Zn, K, Ba, Be, Co, Ni, Sr, Ca, Na, Al, B, Ag, V, Se)	8 oz. PE	cooled at 4°C	Inductively Coupled Plasma (ICP) Atomic Emission Spectrometric method	µg/l	1 µg/l Be, 3 µg/l Ag, Cd, 5 µg/l Ba,Cr, Pb,V, 10 µg/l B,Co,Cu, 15 µg/l Mn, 25 µg/l Ni, 50 µg/l Fe, 100 µg/l Al,Zn	5.0 mg/l: Ba 1.0 mg/l: B, Mn, Ni, Se, Fe (diss), Zn; 5.0 µg/l Ag; H: Cd,Cr,Cu,Pb
Sulfate (SO4)	500 ml PE	cooled at 4°C	Automated Methylthymol Blue method Continuous Flow Analyzer	mg/l	10 mg/l	500 mg/l
Total Dissolved Solids (TDS)	500 ml PE	cooled at 4°C	Residue on evaporation (ROE) Filterable residue, gravimetric at 180 °C micro method	mg/l	3 mg/l	1000 mg/l
Cyanide	4 oz PE	5 ml 5N NaOH	Automated Pyridine-Barbituric Acid method using Continuous Flow Analyzer	mg/l	5 µg/l	a 22 µg/l c 5.2 µg/L
Chloride	500 ml PE	Cooled at 4°C	Automated Ferricyanide method using Continuous Flow Analyzer	mg/l	1 mg/l	500 mg/l
Total Alkalinity	500 ml PE	Cooled at 4°C	Automated methyl orange method using Continuous Flow Analyzer	mg/l	10 mg/l	none
Total Mercury	40 ml glass	cooled at 4°C	Automated cold vapor technique with atomic absorption	µg/l	0.01 µg/l	a 0.5 µg/l
Total Hardness	500 ml PE	cooled at 4°C	Automated Calmagite method using Continuous Flow Analyzer	mg/l	5 mg/l	None
Arsenic	8 oz PE	20 ml 50% HNO3/l cooled at 4°C	Manual digestion/oxidation Automated Hydride generation, Atomic Absorption Spectroscopy	mg/l	0.001 mg/l	a 360 µg/l c 190 µg/l
Fluoride	500 ml PE	cooled at 4°C	Ion selective electrode using Continuous Flow Analyzer	mg/l	0.05 mg/l	1.4 mg/l
Phenol	8 oz glass	10 ml CuS4+H3PO4/l at 4°C	Automated 4-Aminoantipyrine method using manual distillation and Continuous Flow Analyzer	µg/l	10 µg/l	0.1 mg/l

Note Dissolved metals and phosphorus are filtered through a 0.45 µm nitrocellulose membrane filter.

*General Use Water Quality Standards based on Section 302(subpart B) of Title 35: Subtitle C: Chapter I, Illinois Pollution Control Board. June 1998. H = hardness dependent acute and chronic standards. a = acute, c = chronic Note that sample containers have changed somewhat over time. For example the quart polyethylene bottle was replace by a 500 ml bottle because the smaller bottle contained enough material for analysis and was less expensive to ship to the laboratory.

Table 3. Illinois EPA AWQMN Parameters and Code Numbers, mercury and TKN are part of ANS01 as of October 2001.

ASN01 Universal Ambient Stream Network: 20 air temperature, 10 water temperature, 299 field dissolved oxygen, 400 field pH, 94 field conductivity, 82078 field turbidity, 535 volatile and 530 total suspended solids, 610 total ammonia-N, 630 total nitrate +nitrite-N, 76 turbidity, 665 total and 666 dissolved phosphorus, 31616 fecal coliform, 900 hardness calc., and total and dissolved ICAP Metals. For 2002 630 TKN and 71900 Mercury were added.
ASN02 UASN + 71900 Mercury (Illinois - Mississippi River Basins)
ASN03 UASN + 625 Total Kjeldahl N (Fox River and Lake Watersheds)
ASN04 UASN + 940 Chloride, 720 Cyanide and 71900 Mercury (Ohio River Basin)
ASN05 UASN + 940 Chloride and 71900 Mercury (Wabash River Basin)
ASN06 UASN + 720 Cyanide (Des Plaines - Lake Michigan Basin)
ASN07 UASN + 71900 Mercury, 940 Chloride, and 945 Sulfate (Illinois, Mississippi and Wabash Basins - Urban)
ASN09 UASN + 625 Total Kjeldahl N, 940 Chloride, and 945 Sulfate (Fox River and Lake Watersheds - Urban)
ASN10 UASN + 720 Cyanide, 940 Chloride, and 945 Sulfate (Des Plaines - Lake Michigan Basin - Urban)
ASN12 UASN + 940 Chloride, 945 Sulfate (Urban)
ASN13 UASN + 410 Alkalinity, 70508 Total Acidity, 945 Sulfate and 71900 Mercury (Mining)
ASN14 UASN + 940 Chloride, 720 Cyanide, 410 Alkalinity, 70508 Total Acidity, 945 Sulfate and 71900 Mercury (Ohio River Basin - Mining)
ASN15 UASN + 625 Total Kjeldahl N, 410 Alkalinity, 70508 Total Acidity, 945 Sulfate, 71900 Mercury (Lake Watersheds - Mining)
ASN16 UASN + 940 Chloride, 410 Alkalinity, 70508 Total Acidity, 945 Sulfate, 71900 Mercury (Wabash River Basin - Mining)
ASN17 UASN + 940 Chloride, 945 Sulfate, 410 Alkalinity, 70508 Total Acidity and 71900 Mercury (Mining - Urban)
ASN18 UASN + 625 Total Kjeldahl N, 410 Alkalinity, 70508 Total Acidity, 940 Chloride, 945 Sulfate, 71900 Mercury (Wabash River Basin - Lake Watershed - Mining)
ASN20 UASN + 625 Total Kjeldahl N, 71900 Mercury (Lake Watershed - Illinois and Mississippi Basins)
ASN21 UASN + 940 Chloride, 945 Sulfate, 410 Alkalinity, 70508 Total Acidity, 71900 Mercury, 625 Total Kjeldahl N
ASN22 UASN + 410 Alkalinity, 70508 Total Acidity, 71900 Mercury, 945 Sulfate and 625 Total Kjeldahl N (Mining - Lake Watershed)
ASN23 UASN + 940 Chloride, 71900 Mercury, 625 Total Kjeldahl N, (Wabash Basin - Lake Watershed)

CORE1 CORE Ambient - UASN + 720 Cyanide, 1002 Arsenic, 32730 Phenol, 951 Fluoride, 71900 Mercury, 940 Chloride, 945 Sulfate, 70508 Total Acidity, 410 Alkalinity, 625 Total Kjeldahl N.

CORE2 Water Organics - 39516 PCBs, 39330 Aldrin, 39380 Dieldrin, 39370 Total DDT, 39320 P,P' DDE, 39310 P,P' DDD, 39300 P,P' DDT, 39350 Total Chlordane, 39348 Alpha Chlordane, 39810 Gamma Chlordane, 39390 Endrin, 39410 Heptachlor, 39420 Heptachlor Epoxide, 39480 Methoxychlor, 39337 Hexachlorocyclohexane, 39337 Alpha BHC, 39340 gamma BHC-Lindane, 39700 Hexachlorobenzene, 39032 Pentachlorophenol,

PEST1 Pesticide Subnetwork – 39730 2,4-D, 39760 2,4,5-TP (silvex), 49259 Acetochlor, 79193 Acifluorfen, 77825 Alachlor, 39630 Atrazine, 81410 Butylate, 39640 Captan, 81403 Chloropyrifos, 81757 Cyanazine, 30200 Dalapon, 39570 Diazinon, 38442 Dicamba, 30191 Dinoseb, 81894 EPTC, 81294 Fonofos, 39530 Malathion, 39600 Methyl Parathion, 39356 Metolachlor, 81408 Metribuzin, 79190 Pendimethalin, 46313 Phorate, 39720 Picloram, 82088 Terbufos, 81284 Trifluralin + CORE2.

IND01 Industrial Subnetwork - 32106 Chloroform, 32101 Dichlorobromomethane, 32105 Chlorodibromomethane, 32104 Bromoform, 34423 Methylene Chloride, 34501 1,1-

Dichloroethylene, 34496 1,1-Dichloroethane, 34546 Trans-1,2-Dichloroethylene, 34531 1,2-Dichloroethane, 34506 1,1,1-Trichloroethane, 32102 Carbon Tetrachloride, 39180 Trichloroethylene, 34475 Tetrachloroethylene, 34301 Chlorobenzene, 34716 Dichlorobenzene (total), 78124 Benzene, 78131 Toluene, 78113 Ethylbenzene, 81551 Xylenes, 77093 CIS-1,2-Dichloroethylene.

LAKE2 Chlorophyll - F11FO Depth, volume filtered, 32210 Chlorophyll-a uncorrected, 32211 Chlorophyll-a corrected, 32212 Chlorophyll-b, 32214 Chlorophyll-c, 32218 Pheophytin-a

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Figure 1. Location of Illinois EPA AWQMN stations for the 2002 water year.

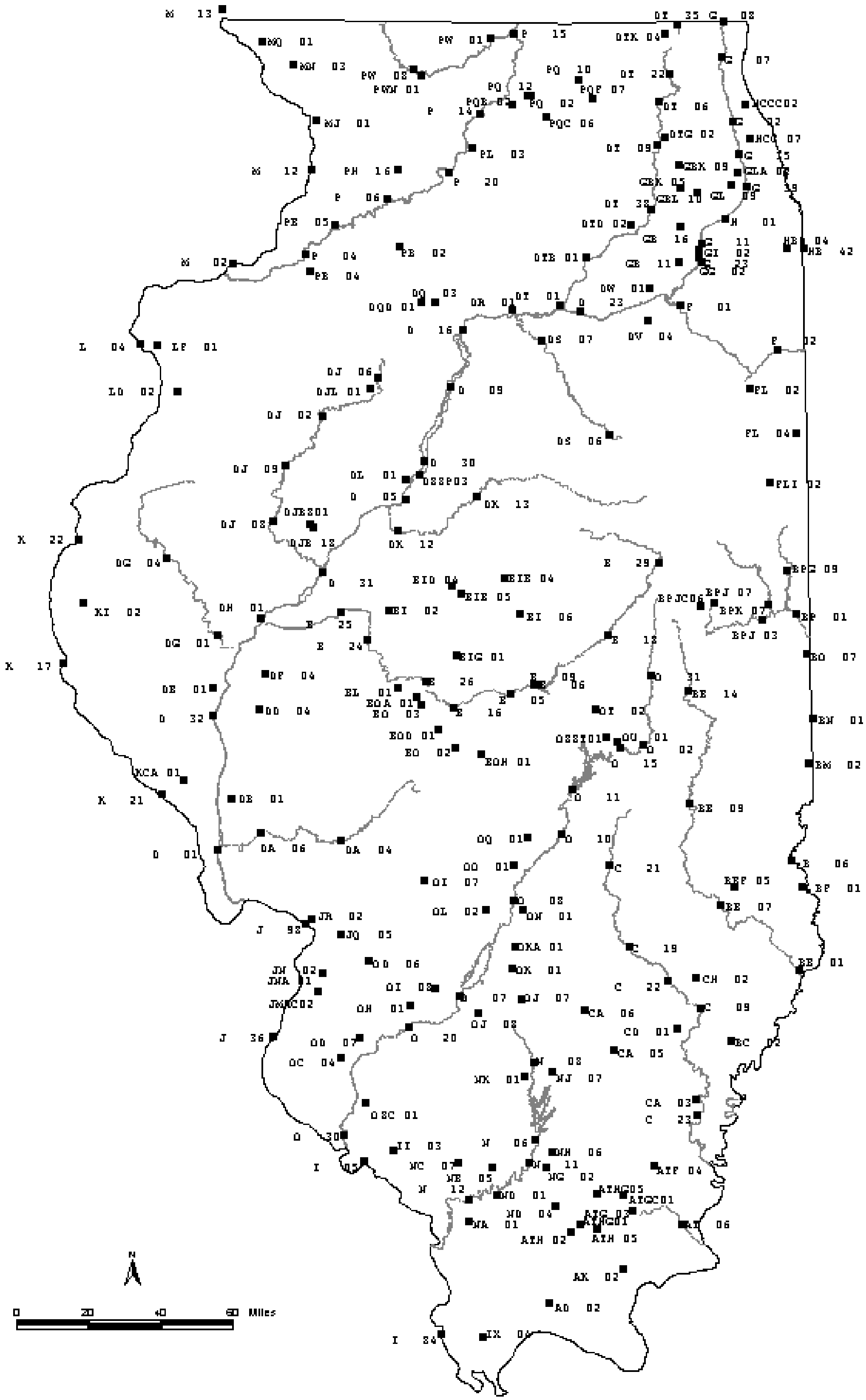
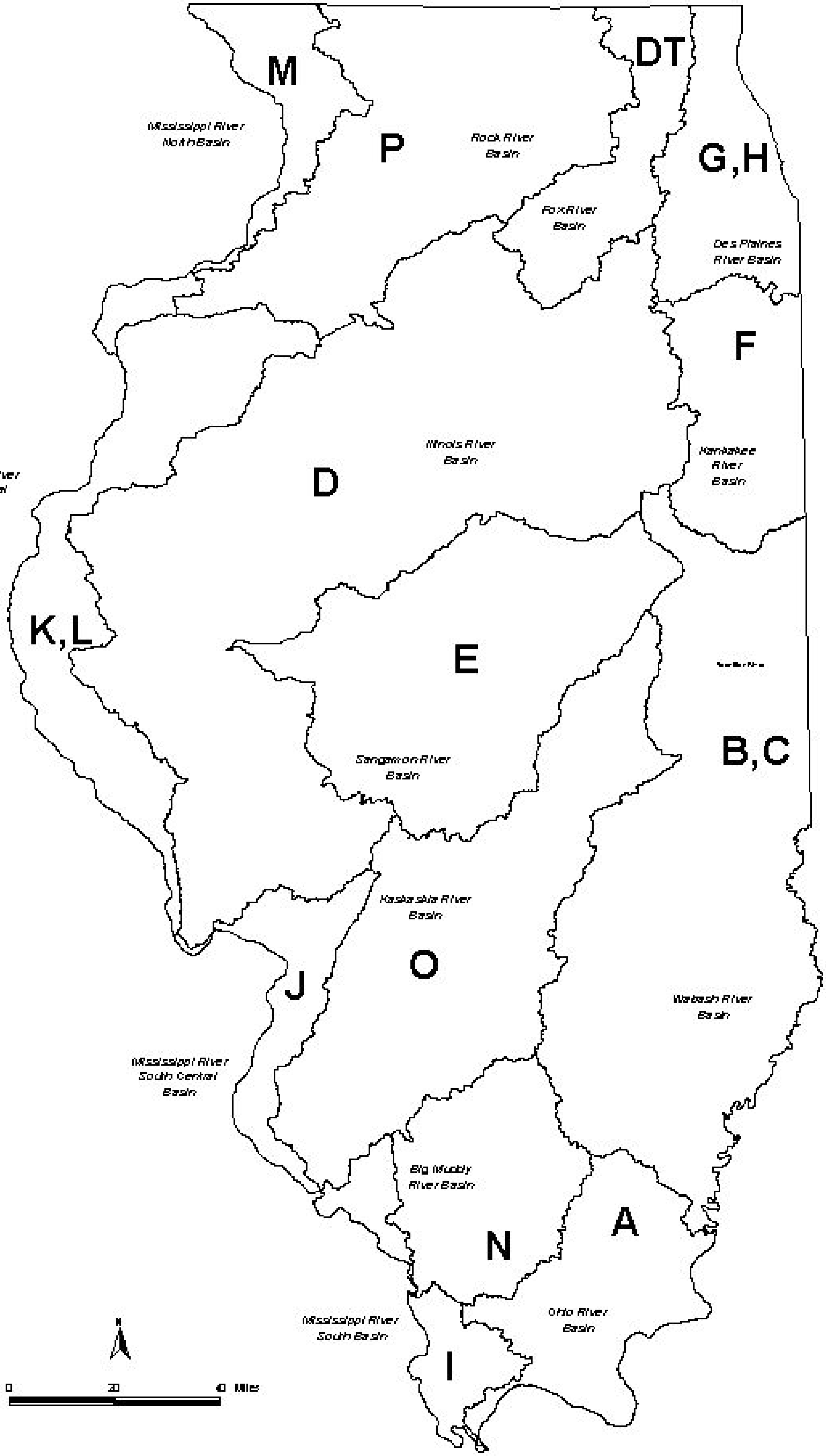


Figure 2. Illinois EPA major basin codes.



Appendix Table A-1. Illinois EPA AWQMN station location information, 2002 water year.

IEPA STATION CODE	USGS STATION NUMBER	STREAM NAME	DESCRIPTION	COUNTY	LATITUDE	LONGITUDE
Ohio River Basin (A)						
[1] A 06	03612500	OHIO RIVER	NORTH END OF DAM 53, E OF OLMSTED	PULASKI	37.203615	89.040838
AD 02	03612000	CACHE RIVER	CO. RD. BR., 1 MI NE OF BELKNAP	JOHNSON	37.336393	88.923892
AK 02	03384450	LUSK CREEK	CO. RD. BR., 2.8 MI SE OF EDDYVILLE	POPE	37.472226	88.547226
AT 06	03382530	SALINE RIVER	PEABODY BR., 1.3 MI E OF GIBSONIA	GALLATIN	37.648059	88.241670
ATF 04	03382325	NORTH FORK SALINE RIVER	RT. 45 BR., 5.1 MI NE OF ELDORADO	SALINE	37.888337	88.385004
ATG 03	03382205	MIDDLE FORK SALINE RIVER	CO. RD. BR., 2.7 MI SE OF HARRISBURG	SALINE	37.707781	88.491948
ATGC01	03382185	BANKSTON CREEK	RT. 34 BR., 2.5 MI N OF HARRISBURG	SALINE	37.768059	88.540282
ATH 02	03382055	SOUTH FORK SALINE RIVER	CO. RD. BR., 3.4 MI S OF CRAB ORCHARD	WILLIAMSON	37.622920	88.812087
ATH 05	03382100	SOUTH FORK SALINE RIVER	RT. 45 BR., 3.8 MI SW OF CARRIER MILLS	SALINE	37.637782	88.677782
ATHG01	03382090	SUGAR CREEK	CO. RD. BR., 5.1 MI NE OF CREAL SPRINGS	WILLIAMSON	37.655281	88.763338
ATHG05		SUGAR CREEK	CO. RD. BR., UPS PALZO AREA, CREAL SPRINGS	WILLIAMSON	37.652226	88.791115
Wabash River Basin (B,C)						
B 06	03341920	WABASH RIVER	IN. RT. 154 BR. AT HUTSONVILLE	CRAWFORD	39.110282	87.655004
[1] B 07	03378500	WABASH RIVER	RT. 14 BR. NEAR NEW HARMONY, IN.	WHITE	38.131948	87.940281
BC 02	03378000	BONPAS CREEK	RT. 15 BR., 0.6 MI NE OF BROWNS	EDWARDS- WABASH	38.386392	87.975560
BE 01	03346550	EMBARRAS RIVER	CO. RD. BR., 1.3 MI E OF BILLET	LAWRENCE	38.665004	87.626392
BE 07	03345500	EMBARRAS RIVER	CO. RD. BR. AT N EDGE OF STE. MARIE	JASPER	38.936115	88.019448
BE 09	03344000	EMBARRAS RIVER	RYAN BR., CO. RD., 9 MI S OF CHARLESTON	CUMBERLAND	39.344448	88.170837
BE 14	03343395	EMBARRAS RIVER	CO. RD. BR. W EDGE OF CARMARGO	DOUGLAS	39.799726	88.170281
BEF 05	03346000	NORTH FORK EMBARRAS RIVER	CO. RD. BR., 2.8 MI W OF OBLONG	CRAWFORD	39.010281	87.946393
BF 01	03342050	SUGAR CREEK	TWP. RD. BR., NE OF PALESTINE NEAR ICRR	CRAWFORD	39.004449	87.597226
BM 02	03341540	SUGAR CREEK	CO RD. BR. 1 MI FROM THE INDIANA LINE	EDGAR	39.498059	87.553059
BN 01	03341414	BROUILETTS CREEK	IN. RT. 71 BR., 0.5 MI N OF BLANFORD, IN.	VERMILLION, IN	39.681392	87.521115
BO 07	03339147	LITTLE VERMILION RIVER	CO. RD. BR. 4 MI SE OF GEORGETOWN	VERMILION	39.941393	87.551393
BP 01	03339000	VERMILION RIVER	GRAPE CREEK ROAD 3.5 MI SE OF DANVILLE	VERMILION	40.100837	87.597781
BPG 09	03338780	NORTH FORK VERMILION RIVER	2 MI W OF BISMARK ON CO. RD.	VERMILION	40.270281	87.642782
BPJ 03	03338097	SALT FORK VERMILION RIVER	CO. RD. BR. 3.0 MI S OF OAKWOOD	VERMILION	40.082226	87.781393
BPJ 07	03336900	SALT FORK VERMILION RIVER	CO. RD. BR. 2.5 MI N OF ST. JOSEPH	CHAMPAIGN	40.148615	88.033338
BPJC06	03337700	SALINE BRANCH	CO. RD. BR. 1.0 MI N OF MAYVIEW	CHAMPAIGN	40.133059	88.104171
BPK 07	03336645	MIDDLE FORK VERMILION RIVER	KICKAPOO ST. PARK BR. UPSTREAM OF I-74 BR.	VERMILION	40.136670	87.745837
C 09	03379600	LITTLE WABASH RIVER	W. SALEM-MT. ERIE RD. BR., SW EDGE OF BLOOD	EDWARDS	38.518892	88.131948
C 19	03378900	LITTLE WABASH RIVER	CO. RD. BR., NE EDGE OF LOUISVILLE	CLAY	38.773059	88.497226
C 21	03378635	LITTLE WABASH RIVER	US 40 BR., 2.2 MI SW OF EFFINGHAM	EFFINGHAM	39.103615	88.592504
C 22	03379500	LITTLE WABASH RIVER	CO. RD. BR., 5 MI SE OF CLAY CITY	CLAY	38.634726	88.297226
C 23	03381495	LITTLE WABASH RIVER	MAIN ST. BR. IN CARMI	WHITE	38.092227	88.156116
CA 03	03381400	SKILLET FORK	WINTERS BR., CO. RD., 4 MI N OF CARMI	WHITE	38.153338	88.165282
CA 05	03380500	SKILLET FORK	RT. 15 BR., 1 MI N OF WAYNE CITY	WAYNE	38.356948	88.583338
CA 06	03380350	SKILLET FORK	CO. RD. BR., 7.5 MI SE OF IUKA	MARION	38.519448	88.727505
CD 01	03379950	ELM CREEK	PRICE BR., CO. RD., 6 MI NE OF FAIRFIELD	WAYNE	38.441115	88.258060
CH 02	03379560	FOX RIVER	5 MI W OF CALHOUN	RICHLAND	38.641670	88.155004
Illinois River Basin (D)						
D 01	05587060	ILLINOIS RIVER	RT. 100 BR. AT HARDIN	CALHOUN- GREENE	39.160281	90.615282
D 05	05563800	ILLINOIS RIVER	RT. 9 BR. AT PEKIN	PEORIA	40.573059	89.654727
D 09	05558995	ILLINOIS RIVER	RT. 17 BR. AT LACON	MARSHALL	41.025004	89.417227
D 16	05556200	ILLINOIS RIVER	RT. 26 BR. AT HENNEPIN	PUTNAM	41.257503	89.346948
D 23	05543500	ILLINOIS RIVER	MARSEILLES, DOWNSTREAM FROM NABISCO BLDG.	LA SALLE	41.327781	88.719449
D 30	05559900	ILLINOIS RIVER	PEORIA PWS INTAKE	PEORIA	40.725004	89.549448
D 31	05570520	ILLINOIS RIVER	ILLINOIS POWER INTAKE NEAR HAVANA	MASON	40.280281	90.081392
D 32	05586100	ILLINOIS RIVER	NORFOLK SOUTHERN RR BR., 0.5 MI E OF VALLEY CITY	SCOTT	39.702781	90.644448
DA 04	05586690	MACOUPIN CREEK	MACOUPIN STATION - PLAINVIEW RD. BR.	MACOUPIN	39.201115	89.979171
DA 06	05587000	MACOUPIN CREEK	RT. 267 BR., 3.5 MI NW OF KANE	GREENE	39.234170	90.394448
DB 01	05586600	APPLE CREEK	CO. RD. BR., 6 MI N OF ELDRED	GREENE	39.369727	90.546116
DD 04	05586040	MAUVAISE TERRE CREEK	CO. RD. BR., 1.5 MI NE OF MERRITT	SCOTT	39.731392	90.407226
DE 01	05585830	MCKEE CREEK	RT. 104 BR. AT CHAMBERSBURG	PIKE	39.817782	90.652505
DF 04	05585275	INDIAN CREEK	CO. RD. BR., SW EDGE OF ARENZVILLE	CASS	39.877781	90.377227
DG 01	05585000	LA MOINE RIVER	US RT. 24 BR. AT RIPLEY	BROWN- SCHUYLER	40.025281	90.631948
DG 04	05584500	LA MOINE RIVER	RT. 61 BR. AT COLMAR	MCDONOUGH	40.329170	90.898616
DH 01	05583915	SUGAR CREEK	RT. 100 BR., 2.0 MI NE OF FREDERICK	SCHUYLER	40.096948	90.404448
DJ 02	05568915	SPOON RIVER	US 150 BR., 1 MI S AND 4 MI W OF WILLIAMSFIELD	KNOX	40.907504	90.086670
DJ 06	05568775	SPOON RIVER	RT. 17 BR., 2.0 MI W OF WYOMING	STARK	41.062505	89.795281
DJ 08	05570000	SPOON RIVER	RT. 95 BR., 0.4 MI NE OF SEVILLE	FULTON	40.486115	90.342781
DJ 09	05569500	SPOON RIVER	CO. RD. BR. AT N EDGE OF LONDON MILLS	FULTON	40.714170	90.266670
DJB 18	05570370	BIG CREEK	CO. RD. BR. 2.0 MI SW OF BRYANT	FULTON	40.458892	90.133337
DJBZ01	05570380	SLUG RUN	PRIVATE RD. 2.5 MI NW OF BRYANT	FULTON	40.473337	90.143616
DJL 01	05568800	INDIAN CREEK	CO. RD. BR. 3 MI S; 3 MI W OF WYOMING	STARK	41.018337	89.835281
DK 12	05568005	MACKINAW RIVER	CO. RD. BR. 4 MI SSW OF SOUTH PEKIN	TAZEWELL	40.447504	89.691116
DK 13	05567510	MACKINAW RIVER	CO. RD. BR. 4 MI SE OF DEER CREEK	TAZEWELL	40.586670	89.278338
DL 01	05563525	KICKAPOO CREEK	US 24 BR. N OF BARTONVILLE	PEORIA	40.655004	89.647781
DQ 03	05556500	BIG BUREAU CREEK	RT. 6 BR. NEAR W EDGE OF PRINCETON	BUREAU	41.365281	89.498615

Appendix Table A-1. Illinois EPA AWQMN station location information, 2002 water year.

IEPA STATION CODE	USGS STATION NUMBER	STREAM NAME	DESCRIPTION	COUNTY	LATITUDE	LONGITUDE
DQD 01	05557000	WEST BUREAU CREEK	US 6/34 BR. AT E EDGE OF WYANET	BUREAU	41.365003	89.568892
DR 01	05555950	LITTLE VERMILION RIVER	US 6 BR. IN LASALLE	LA SALLE	41.333338	89.080837
DS 06	05554490	VERMILION RIVER	CO. RD. BR. 0.5 MI E OF MCDOWELL	LIVINGSTON	40.830559	88.574726
DS 07	05555300	VERMILION RIVER	CO. RD. BR. 3 MI NE OF LEONORE	LA SALLE	41.208338	88.930838
DV 04	05542000	MAZON RIVER	RT. 113 BR. 4 MI W OF COAL CITY	GRUNDY	41.286115	88.359726
DW 01	05541710	AUX SABLE CREEK	US 6 BR. 6 MI NE OF MORRIS	GRUNDY	41.417226	88.347504
DZZP03	05562010	FARM CREEK	CAMP ST. BR. N OF E. PEORIA, GAGE #05562000 MAIN ST.	TAZEWELL	40.671116	89.580003
Fox River Basin (DT)						
DT 06	05550000	FOX RIVER	RT. 62, ALGONQUIN RD. BR.	MCHENRY	42.166392	88.290282
DT 09	05551000	FOX RIVER	STATE ST. BR. IN SOUTH ELGIN	KANE	41.994448	88.294448
DT 22	05549600	FOX RIVER	RT. 176 BR. 5 MI. ENE OF CRYSTAL LAKE	MCHENRY	42.279587	88.227087
DT 35	05546700	FOX RIVER	RT. 173 BR. NEAR WISCONSIN LINE	LAKE	42.479170	88.178337
DT 38	05551540	FOX RIVER	MILL ST. BR. IN MONTOGOMERY	KANE	41.733892	88.333892
DT 01		FOX RIVER	RT. 6 BR. IN NE OTTAWA	LASALLE	41.355559	88.825005
[1] DT 46	05552500	FOX RIVER	CO. HWY. 18 BR. AT DAYTON	LA SALLE	41.387226	88.789170
DTB 01	05551995	SOMONAUK CREEK	E-W TWP. RD. BR. 1 MI N OF SHERIDAN	LA SALLE	41.543615	88.686671
DTD 02	05551700	BLACKBERRY CREEK	US RT. 47 BR. N OF YORKVILLE	KENDALL	41.671670	88.441393
DTG 02	05550500	POPLAR CREEK	US RT. 20 BR., VILLA ST. IN ELGIN	COOK	42.026392	88.255559
DTK 04	05548280	NIPPERSINK CREEK	WINN RD. BR. 0.6 MI W OF SPRING GROVE	MCHENRY	42.443615	88.247505
Sangamon River Basin (E)						
E 05	05573650	SANGAMON RIVER	LINCOLN TRAIL BR 5 MI. SE OF NIANTIC	MACON	39.796670	89.104171
E 06	05573504	SANGAMON RIVER (L. Decatur)	CITY OF DECATUR PUBLIC WATER SUPPLY INTAKE NEAR DAM	MACON	39.828892	88.959727
E 09	05573540	SANGAMON RIVER	RT. 48 BR. AT DECATUR	MACON	39.831116	88.976392
E 16	05573800	SANGAMON RIVER	CO. RD. BR., 4.5 MI. S MECHANICSBURG	CHRISTIAN- SANGAMON	39.742226	89.399170
E 18	05572000	SANGAMON RIVER	CO. RD. BR., 0.5 MI W MONTICELLO	PIATT	40.045281	88.577781
E 24	05578000	SANGAMON RIVER	RT. 123 BR., E OF PETERSBURG	MENARD	40.010281	89.845003
E 25	05583000	SANGAMON RIVER	RT. 97 BR. NEAR OAKFORD	MENARD- MASON	40.123615	89.984726
E 26	05576500	SANGAMON RIVER	OLD RT. 36, W OF RIVERTON	SANGAMON	39.842781	89.547782
[1] E 28	05572125	SANGAMON RIVER	CO. RD. BR. (ALLERTON PARK) 4.5 MI. SW OF MONTICELLO	PIATT	40.002227	88.635281
E 29	05570910	SANGAMON RIVER	RT. 136 BR. 0.75 MI. E OF FISHER	CHAMPAIGN	40.311115	88.322226
EI 02	05582000	SALT CREEK	RT. 29 BR., 4 MI. N OF GREENVIEW	MASON	40.133615	89.735559
EI 06	05578500	SALT CREEK	CO. RD. BR., 2 MI. NE OF KENNEY	DE WITT	40.115003	89.049171
EID 04	05581500	SUGAR CREEK	TWP. RD., 2.6 MI. SE OF HARTSBURG	LOGAN	40.222226	89.403338
EIE 04	05580000	KICKAPOO CREEK	CO. RD. BRIDGE, 0.75 MI. N OF WAYNESVILLE	DE WITT	40.255559	89.127781
EIE 05	05580500	KICKAPOO CREEK	CO. RD. BR., 1.75 MI. N OF LINCOLN	LOGAN	40.191670	89.361115
EIG 01	05579500	LAKE FORK	RT. 54 BR., 2 MI. NE OF CORNLAND	LOGAN	39.950004	89.386116
EL 01	05577505	SPRING CREEK	BRUNS LANE BR. NW EDGE OF SPRINGFIELD, GAGE # 05577500, RT 97	SANGAMON	39.821115	89.687781
[1] EO 01	05576022	SOUTH FORK SANGAMON RIVER	RT. 29 BR., 1.5 MI. NW OF ROCHESTER	SANGAMON	39.763892	89.561948
EO 02	05575500	SOUTH FORK SANGAMON RIVER	RT. 104 BR., 1 MI. E OF KINCAID	CHRISTIAN	39.578892	89.391949
EO 03		SOUTH FORK SANGAMON RIVER	CO. RD. BR., 1.5 MI W ROCHESTER	SANGAMON	39.753615	89.565837
EOA 01	05576250	SUGAR CREEK	RT. 29 BR., 1 MI SE OF SPRINGFIELD	SANGAMON	39.780004	89.588892
EOD 01	05575570	CLEAR CREEK (L. Sangchris)	NEW CITY RD. LAKE SANGCHRIS AT DAM	CHRISTIAN	39.650004	89.477782
EOH 01	05574500	FLAT BRANCH	OLD RT. 29 BR., 1 MI E OF TAYLORVILLE	CHRISTIAN	39.553892	89.253337
Kankakee River Basin (F)						
F 01	05527500	KANKAKEE RIVER	I-55 BR.; 3 MI. NW OF WILMINGTON	WILL	41.350003	88.194448
F 02	05520500	KANKAKEE RIVER	HWY. 1 BRIDGE AT MOMENCE	KANKAKEE	41.160003	87.663060
FL 02	05526000	IROQUOIS RIVER	CO. RD. BR.; 5 MI. W OF ST. ANNE	KANKAKEE	41.008892	87.824170
FL 04	05525000	IROQUOIS RIVER	US 52 BRIDGE AT IROQUOIS	IROQUOIS	40.823616	87.581948
FLI 02	05525500	SUGAR CREEK	CO. RD. BRIDGE 1 MI. W OF MILFORD	IROQUOIS	40.630559	87.723615
Des Plaines River - Lake Michigan Basin (G,H)						
G 07	05528000	DES PLAINES RIVER	RT. 120, BELVIDERE RD. BR., E OF GRAYSLAKE	LAKE	42.344170	87.938337
G 08	05527800	DES PLAINES RIVER	RUSSELL RD. BR., 1 MI DNS OF WI STATE LINE	LAKE	42.489448	87.925560
G 11	05534050	DES PLAINES RIVER	DIVISION ST. BR. AT LOCKPORT	WILL	41.596392	88.068615
G 15	05530590	DES PLAINES RIVER	IRVING PARK RD. BR. AT SCHILLER PARK	COOK	41.953059	87.854171
G 22	05529000	DES PLAINES RIVER	CENTRAL AVE. BR. AT DES PLAINES	COOK	42.081948	87.890281
G 23	05537980	DES PLAINES RIVER	RT. 53 (RUBY ST. BR.) IN JOLIET	WILL	41.536670	88.082503
G 39	05532500	DES PLAINES RIVER	BARRY POINT RD. AT RIVERSIDE	COOK	41.822226	87.820837
[1] GB 10	05540290	DU PAGE RIVER	PLAINFIELD-NAPERVILLE RD. BRIDGE	WILL	41.690003	88.166115
GB 11	05540500	DU PAGE RIVER	AT RT. 52 AT SHOREWOOD	WILL	41.522226	88.193059
GB 16		DU PAGE RIVER	119TH (FURGUSON ROAD) WEST OF NAPERVILLE	WILL		
GBK 05	05540095	WEST BR. DU PAGE RIVER	RT. 56 BUTTERFIELD RD. BR. NEAR WARRENVILLE	DU PAGE	41.822781	88.173059
GBK 09	05539900	WEST BR. DU PAGE RIVER	RT. 64/ST. CHARLES RD. BR. N OF WEST CHICAGO	DU PAGE	41.910837	88.178892
GBL 10	05540210	EAST BR. DU PAGE RIVER	RT. 34 BR. NEAR LISLE	DU PAGE	41.800559	88.081392
GG 02	05539000	HICKORY CREEK	WASHINGTON ST. BR. AT JOLIET	WILL	41.519448	88.069448
[1] GI 01	05536995	SANITARY & SHIP CANAL	135TH ST. BR. AT ROMEOVILLE	WILL	41.640837	88.060005
GI 02	05537000	SANITARY & SHIP CANAL	DIVISION ST. BR. AT LOCKPORT	WILL	41.569726	88.078337
GL 09	05531500	SALT CREEK	WOLF ROAD BR.	COOK	41.826392	87.900004
GLA 02	05532000	ADDISON CREEK	WASHINGTON BOULEVARD BR. IN BELLWOOD	COOK	41.880004	87.868615

Appendix Table A-1. Illinois EPA AWQMN station location information, 2002 water year.

IEPA STATION CODE	USGS STATION NUMBER	STREAM NAME	DESCRIPTION	COUNTY	LATITUDE	LONGITUDE
H 01	05536700	CALUMET SAG CHANNEL	RT. 83 BR., 3 MI NE OF LEMONT	COOK	41.695837	87.936392
HB 42	05536195	LITTLE CALUMET RIVER	HOLMAN AVE. BR. AT IN STATE LINE, N OF MUNSTER, IN	LAKE	41.568615	87.521671
HBD 04	05536275	THORN CREEK	THORNTON-LANSING RD. BR. IN THORNTON	COOK	41.568059	87.608337
HCC 07	05536000	NORTH BR. CHICAGO RIVER	TOUHY AVE. BR. IN NILES	COOK	42.012226	87.795837
HCCC02	05534500	NORTH BR. CHICAGO RIVER	LAKE-COOK CO. LINE RD. BRIDGE	LAKE-COOK	42.152781	87.818615
Mississippi River South Basin (I)						
I 05		MISSISSIPPI RIVER	RM 111 NEAR CHESTER, IL, 1MI UPST HIGHWAY BRIDGE	RANDOLPH	37.912500	89.851944
I 84	07022000	MISSISSIPPI RIVER	AT THEBES, ILL.	ALEXANDER- PULASKI	37.216670	89.463892
II 03	05595540	MARYS RIVER	CO. RD. BR., 0.3 MI. E OF WELGE	RANDOLPH	37.956116	89.706116
IX 04	05600150	CACHE RIVER	CO. RD. BR., 0.7 MI. E OF SANDUSKY	ALEXANDER- PULASKI	37.203337	89.258060
Mississippi River South Central Basin (J)						
[1] J 05	05587555	MISSISSIPPI RIVER	RM 214.6 NEAR ELSAH (HISTORICALLY J83)	JERSEY	38.951948	90.370004
[1] J 83	05587550	MISSISSIPPI RIVER	CORPS OF ENGS. LOCK AND DAM 26	MADISON	38.861392	90.137503
J 98		MISSISSIPPI RIVER	LOCK AND DAM 26 AT RM 200.8, 1 MI S OF ALTON, IL	MADISON	38.871389	90.153611
J 36		MISSISSIPPI RIVER	RM 162.2 UPSTREAM OF MERAMEC R CONFLUENCE	MONROE	38.400833	90.323333
JMAC02	05589785	HARDING DITCH (CAHOKIA CANAL #1)	LAKE DRIVE AT FRANK HOLTEN STATE PARK	ST CLAIR	38.595003	90.088337
JN 02	05589490	CAHOKIA CANAL	SAND PRAIRIE LN. BR. SE OF HORSESHOE LAKE	MADISON	38.666948	90.065560
JNA 01	05589510	CANTEEN CREEK	SAND PRAIRIE LN. BR. SE OF HORSESHOE LAKE	MADISON	38.666115	90.065560
JQ 05	05587900	CAHOKIA CREEK	RT. 143 BR. NW OF EDWARDSVILLE	MADISON	38.824449	89.974727
JR 02	05587700	WOOD RIVER	RT. 3 BR. AT MILTON RD. JUNCTION IN ALTON	MADISON	38.884170	90.122226
Mississippi River North Central Basin (K,L)						
[1] K 04	05474500	MISSISSIPPI RIVER	AT KEOKUK, IOWA	LEE	40.393616	91.374171
K 22		MISSISSIPPI RIVER	LOCK AND DAM 19 AT RM 364, E EDGE OF KEOKUK, IA	LEE	40.392222	91.376667
K 17		MISSISSIPPI RIVER	LOCK AND DAM 21 AT RM 325, 0.75 MI SW QUINCY, IL	ADAMS	39.904444	91.428611
K 21		MISSISSIPPI RIVER	LOCK AND DAM 24 AT RM 273.5, CLARKSVILLE, MO	PIKE	39.373611	90.905833
L 04		MISSISSIPPI RIVER	LOCK AND DAM 17 RM 437, 2MI NW OF NEW BOSTON,IL	MERCER	41.192222	91.058333
KCA 01	05513000	BAY CREEK	TWP. ROAD BR. AT W EDGE OF NEBO	PIKE	39.443059	90.795837
KI 02	05495500	BEAR CREEK	CO. RD. BR., 2.2 MI. NE OF MARCELLINE	ADAMS	40.142781	91.337226
LD 02	05469000	HENDERSON CREEK	RT. 94 BR., 1 MI. S OF BALD BLUFF	HENDERSON	41.001392	90.854171
LF 01	05466500	EDWARDS RIVER	RT. 17 BR., 2 MI. NE OF NEW BOSTON	MERCER	41.187505	90.968060
Mississippi River North Basin (M)						
[1] M 04	05420500	MISSISSIPPI RIVER	RT. 136 BR. AT FULTON	WHITESIDE	41.781393	90.251115
M 12		MISSISSIPPI RIVER	LOCK AND DAM 13 AT RM522.5, 1.5MI NE OF FULTON, IL	WHITESIDE	41.898611	90.155000
M 13		MISSISSIPPI RIVER	LOCK AND DAM 11 AT RM 583, 2MI NE DUBUQUE, IA	DUBUQUE	42.540833	90.645000
M 02		MISSISSIPPI RIVER	LOCK AND DAM 15 AT RM 482.9, ARSENAL ISLAND	ROCK ISLAND	41.518333	90.566111
MJ 01	05420100	PLUM RIVER	US 52 BR. AT E EDGE OF SAVANNA	CARROLL	42.097226	90.127227
MN 03	05418950	APPLE RIVER	US 20 BR., 2 MI. W OF ELIZABETH	JO DAVIESS	42.318615	90.255003
MQ 01	05416000	GALENA RIVER	US 20 BR. AT GALENA	JO DAVIESS	42.413892	90.427782
Big Muddy River Basin (N)						
N 06	05596000	BIG MUDDY RIVER	RT. 14 BR, 3.0 MI W OF BENTON	FRANKLIN	37.994171	88.983337
N 08	05595700	BIG MUDDY RIVER	RT. 15 BR., 3.0 MI. W OF MT.VERNON	JEFFERSON	38.310004	88.988337
[1] N 10	05595950	BIG MUDDY RIVER	DAM ACCESS RD. BR., 2.5 MI. NW OF BENTON	FRANKLIN	38.041670	88.958338
N 11	05597000	BIG MUDDY RIVER	RT. 149 BR., 0.7 MI. W OF PLUMFIELD	FRANKLIN	37.901392	89.013892
N 12	05599500	BIG MUDDY RIVER	RT. 127 BR. S OF MURPHYSBORO	JACKSON	37.758337	89.327227
NA 01	05599565	CEDAR CREEK (Cedar L.)	RT. 127 BR., 6 MI. NNE OF ALTO PASS	JACKSON	37.670837	89.322226
[1] NB 01	05599540	KINKAID CREEK (Kinkaid L.)	9.5 MILES W. OF MURPHYSBORO	JACKSON	37.777226	89.453893
NC 07	05599200	BEAUCOUP CREEK	CO. RD. BR., 2.0 MI. W OF VERGENNES	JACKSON	37.903338	89.376670
ND 01	05598245	CRAB ORCHARD CREEK	DILLINGER RD. BR. 3.2 MI. NE OF CARBONDALE	JACKSON	37.771671	89.180281
[1] ND 02	05598050	CRAB ORCHARD CREEK	CRAB ORCHARD LAKE 150 YRDS DNS FROM DAM	WILLIAMSON	37.714170	89.151115
ND 04	05597500	CRAB ORCHARD CREEK	RT. 13 BR., 1.3 MI. E OF MARION	WILLIAMSON	37.731115	88.889171
NE 05	05597280	LITTLE MUDDY RIVER	CO. RD. BR., 1.3 MI. E OF ELKVILLE	JACKSON	37.883615	89.208615
NG 02	05597040	POND CREEK	RT. 37 BR., 0.5 MI. S OF W. FRANKFORT	FRANKLIN	37.885004	88.931671
NH 06	05596400	MIDDLE FORK BIG MUDDY RIVER	CO. RD. BR.; 2.7 MI. SSE OF BENTON	FRANKLIN	37.949449	88.900004
NJ 07	05595830	CASEY FORK	RT. 37 BR., 3 MI. S OF MT. VERNON	JEFFERSON	38.269448	88.898616
NK 01	05595730	RAYSE CREEK	TWP. RD. BR., 2.4 MI. N OF WALTONVILLE	JEFFERSON	38.253893	89.039726
Kaskaskia River Basin (O)						
O 02	05591200	KASKASKIA RIVER	LOCAL RD. BR. IN COOKS MILLS	COLES	39.583615	88.413892
O 07	05593010	KASKASKIA RIVER	RT. 127 BR., 2.3 MI. S OF CARLYLE	CLINTON	38.574449	89.369171
O 08	05592500	KASKASKIA RIVER	US RT. 51 BR. AT SE EDGE OF VANDALIA	FAYETTE	38.959726	89.088892
O 10	05592100	KASKASKIA RIVER	RT. 128 BR., 2 MI. SE OF COWDEN	SHELBY	39.230559	88.842504
O 11	05592000	KASKASKIA RIVER	RT. 16 BR. AT SHELBYVILLE NEAR DAM	SHELBY	39.405837	88.783615
O 15	05591300	KASKASKIA RIVER	RT. 121 BR., 1 MI. N OF ALLENVILLE	MOULTRIE	39.572781	88.532226
O 20	05594100	KASKASKIA RIVER	RT. 160-177 BR., 4.3 MI. NW OF OKAWVILLE	WASHINGTON	38.450559	89.627503
O 30	05595400	KASKASKIA RIVER	CO. RD. BR., 2.7 MI. W OF ELLIS GROVE	RANDOLPH	38.016115	89.953893
O 31	05590420	KASKASKIA RIVER	CO. RD. 6 BR. 4 MI. W OF HAYES	DOUGLAS	39.864726	88.364449
OC 04	05595200	Richland CREEK	RT. 156 BR., 1.6 MI. NE OF HECKER	ST. CLAIR	38.323892	89.970838

Appendix Table A-1. Illinois EPA AWQMN station location information, 2002 water year.

IEPA STATION CODE	USGS STATION NUMBER	STREAM NAME	DESCRIPTION	COUNTY	LATITUDE	LONGITUDE
OD 06	05594450	SILVER CREEK	RT. 40 BR., 2.7 MI. SE OF TROY	MADISON	38.716670	89.829170
OD 07	05594800	SILVER CREEK	RT. 460 BR., 2.2 MI. SE OF FREEBURG	ST. CLAIR	38.406115	89.873892
OH 01	05594090	SUGAR CREEK	RT. 161 BR., 0.5 MI. W OF ALBERS	CLINTON	38.541392	89.626670
OI 08	05594000	SHOAL CREEK	RT. 50 BR., 1.4 MI. E OF BREESE	CLINTON	38.609726	89.494448
[1] OI 09	05593785	SHOAL CREEK	CO. RD. BR. 3 MILES NW OF PANAMA	MONTGOMERY	39.063337	89.545281
OI 07	05593800	SHOAL CREEK	CO. RD. BR. 2 MILES NW OF PANAMA	MONTGOMERY	39.041115	89.551393
OJ 07	05593505	CROOKED CREEK	CO. RD. BR., 3.1 MI. S OF ODIN	MARION	38.563892	89.050281
OJ 08	05593520	CROOKED CREEK	HOYLETON RD. BR., 2.2 MI SW OF HOFFMAN	WASHINGTON	38.506948	89.273337
OK 01	05592900	EAST FORK KASKASKIA RIVER	RT. 51 BR., 5.2 MI. N OF SANDOVAL	MARION	38.688892	89.098615
OKA 01	05592930	NORTH FORK KASKASKIA RIVER	OLD PATOKA RD. BRIDGE	MARION	38.773615	89.086116
OL 02	05592800	HURRICANE CREEK	RT. 140 BR., 1.0 MI E OF MULBERRY GROVE	FAYETTE	38.922504	89.237227
ON 01	05592600	HICKORY CREEK	CO. RD. BR., 2.7 MI. S OF BLUFF CITY	FAYETTE	38.925004	89.038892
OO 01	05592400	RAMSEY CREEK	RT 51, 3 MI S OF RAMSEY	FAYETTE	39.101670	89.088892
OQ 01	05592195	BECK CREEK	CO. LINE RD. BR., 2 MI W OF HERRICK	FAYETTE	39.216392	89.020559
OT 02	05591700	WEST OKAW RIVER	RT. 32 BR., NW OF LOVINGTON	MOULTRIE	39.721670	88.662781
OU 01	05591400	JONATHAN CREEK	RT. 121 BR., 2.5 MI. E OF SULLIVAN	MOULTRIE	39.601116	88.546116
OZC 01	05595280	PLUM CREEK	CO. RD. BR., 2.5 MI S OF BALDWIN	RANDOLPH	38.146671	89.843060
OZZT01	05591500	ASA CREEK	CO. RD. BR., 0.8 MI. N OF SULLIVAN	MOULTRIE	39.619727	88.604727
Rock River Basin (P)						
P 04	05446500	ROCK RIVER	RT. 92 BR., 2 MI. E OF JOSLIN	ROCK ISLAND	41.559726	90.181948
P 06	05443500	ROCK RIVER	US RT. 30 BR., 2 MI. W OF ROCK FALLS	WHITESIDE	41.783337	89.749448
P 14	05440700	ROCK RIVER	RT. 72 BR. AT BYRON	OGLE	42.123337	89.255559
P 15	05437500	ROCK RIVER	RT. 75 BR. AT ROCKTON	WINNEBAGO	42.448616	89.069727
P 20	05442200	ROCK RIVER	RT. 2 BR., NEAR GRAND DETOUR; COUNTY LINE	OGLE	41.889726	89.419448
PB 02	05447100	GREEN RIVER	RT. 88 BR., 1 MI. S OF DEER GROVE	WHITESIDE	41.593893	89.689448
PB 04	05447500	GREEN RIVER	RT. 82 BR., N OF GENESEO	HENRY	41.488892	90.158338
PE 05	05446100	ROCK CREEK	RT 2 BR. 3 MI NE OF ERIE	WHITESIDE	41.679726	90.026115
PH 16	05444000	ELKHORN CREEK	2 MI NW OF PENROSE CO. RD. BR.	WHITESIDE	41.902781	89.694448
PL 03	05442020	KYTE RIVER	HONEY CR. RD. BR. 1 MI E. OF DAYSVILLE	OGLE	41.986115	89.294726
PQ 02	05438600	KISHWAUKEE RIVER	PERRYVILLE RD. BR., NEAR S. BRANCH	WINNEBAGO	42.201671	88.978615
PQ 10	05438201	KISHWAUKEE RIVER	CO. RD. BR., 0.5 MI. N OF GARDEN PRAIRIE	BOONE	42.261116	88.716670
PQ 12	05440000	KISHWAUKEE RIVER	BLACKHAWK RD. BR.	WINNEBAGO	42.195837	88.998615
PQB 02	05440520	KILLBUCK CREEK	US 251 BR., 4 MI S. OF ROCKFORD	WINNEBAGO	42.160003	89.075559
PQC 06	05439500	SOUTH BR. KISHWAUKEE RIVER	CO. RD. BR., 0.5 MI. N OF RT 72; 2 MI. W OF KIRKLAND	DE KALB	42.111115	88.900004
PQF 07	05438250	COON CREEK	RILEY-HARMON RD. 0.8 MI SW OF RILEY	MCHENRY	42.182781	88.641115
PW 01	05435800	PECATONICA RIVER	RT. 75 BR. AT HARRISON	WINNEBAGO	42.427503	89.195560
PW 08	05435500	PECATONICA RIVER	RT. 75 BR., WEST-BOUND AT FREEPORT	STEPHENSON	42.303615	89.615837
PWN 01	05435680	YELLOW CREEK	HOLLYWOOD ROAD AT SE EDGE OF FREEPORT	STEPHENSON	42.279170	89.573337

ACTIVE STATIONS = 213

[1] INACTIVE STATIONS (n=15)

Appendix Table A-2. Illinois EPA AWQMN parameter information, 2002 water year.

IEPA STATION CODE	STREAM NAME	YEARS OF RECORD TO 2002	PARAMETER GROUP (POST 1977)	CHLOROPHYL (2000-)	PESTICIDE SUBNETWORK (1985-)	IND. SOLVENTS (1988-2000)	CONTINUOUS MONITORING PROJECT (2000 01)
Ohio River Basin (A)							
A 06	OHIO RIVER	1972-91	CORE1		A		
AD 02	CACHE RIVER	1972-	ASN04		A		
AK 02	LUSK CREEK	1961,64,68-	CORE1	C	B	I	CMP
AT 06	SALINE RIVER	1978-	ASN14	C			
ATF 04	NORTH FORK SALINE RIVER	1972-	CORE1		A		
ATG 03	MIDDLE FORK SALINE RIVER	1972-	CORE1	C	A		
ATGC01	BANKSTON CREEK	1972-77,79-	ASN14				
ATH 02	SOUTH FORK SALINE RIVER	1982-	ASN16		A		
ATH 05	SOUTH FORK SALINE RIVER	1963-	CORE1		A		
ATHG01	SUGAR CREEK	1968-	ASN14				
ATHG05	SUGAR CREEK	1999-	ASN14				
Wabash River Basin (B,C)							
B 06	WABASH RIVER	1969-	ASN05	C			
B 07	WABASH RIVER	1974-97	CORE1				
BC 02	BONPAS CREEK	1978-	ASN05		A		
BE 01	EMBARRAS RIVER	1958-59,61-	ASN05		A		
BE 07	EMBARRAS RIVER	1972-	ASN05		B		
BE 09	EMBARRAS RIVER	1971-	ASN23		A		
BE 14	EMBARRAS RIVER	1978-	ASN16		A		
BEF 05	NORTH FORK EMBARRAS RIVER	1978-	ASN05		A		
BF 01	SUGAR CREEK	1972-77,79-	ASN17			I	
BM 02	SUGAR CREEK	1978-	ASN05				
BN 01	BROUILETTS CREEK	1972-	ASN16		A		
BO 07	LITTLE VERMILION RIVER	1978-	ASN16		A		
BP 01	VERMILION RIVER	1958-	CORE1		A	I	*CMP
BPG 09	NORTH FORK VERMILION RIVER	1978-	ASN23		A		CMP
BPJ 03	SALT FORK VERMILION RIVER	1958-	ASN16		A		
BPJ 07	SALT FORK VERMILION RIVER	1959-62,77-	ASN16		B		
BPJC06	SALINE BRANCH	1977-	ASN07				
BPK 07	MIDDLE FORK VERMILION RIVER	1977-	ASN18	C	A		CMP
C 09	LITTLE WABASH RIVER	1972-	ASN05		A		
C 19	LITTLE WABASH RIVER	1971-	ASN05		B		
C 21	LITTLE WABASH RIVER	1979-	ASN07		A		
C 22	LITTLE WABASH RIVER	1979-	ASN05		A		
C 23	LITTLE WABASH RIVER	1982-	CORE1	C	A		
CA 03	SKILLET FORK	1958-59, 61-	ASN05		A		
CA 05	SKILLET FORK	1978-	ASN05	C	A		
CA 06	SKILLET FORK	1979-	ASN05		A		
CD 01	ELM CREEK	1972-77, 79-	ASN05		A		
CH 02	FOX RIVER	1997-	ASN07		A		
Illinois River Basin (D)							
D 01	ILLINOIS RIVER	1959-	ASN02		A		
D 05	ILLINOIS RIVER	1959-	CORE1	C		I	
D 09	ILLINOIS RIVER	1959-61,63-	ASN02	C			
D 16	ILLINOIS RIVER	1967-69,72-	ASN02			I	
D 23	ILLINOIS RIVER	1968-70,75-	CORE1	C	B	I	
D 30	ILLINOIS RIVER	1970-72,77-	CORE1	C	A	I	
D 31	ILLINOIS RIVER	1978-	ASN02				
D 32	ILLINOIS RIVER	1975-	CORE1	C	A		CMP
DA 04	MACOUPIN CREEK	1972-77,79-	ASN13		A		
DA 06	MACOUPIN CREEK	1978-	ASN13		B		
DB 01	APPLE CREEK	1959,61-	ASN02		A		
DD 04	MAUVAISE TERRE CREEK	1978-	ASN02		A		
DE 01	MCKEE CREEK	1959,62-77,78-	ASN02		A		
DF 04	INDIAN CREEK	1978-	ASN02		A		
DG 01	LA MOINE RIVER	1959,62,64-	CORE1		B		
DG 04	LA MOINE RIVER	1975-	ASN22		B		
DH 01	SUGAR CREEK	1959,71-77,78-	ASN13				
DJ 02	SPOON RIVER	1959-62,64-77,79-	ASN13		A		
DJ 06	SPOON RIVER	1972-77,79-	ASN13		A		
DJ 08	SPOON RIVER	1977-	ASN13		B		
DJ 09	SPOON RIVER	1979-	ASN13	C	A		
DJB 18	BIG CREEK	1972-	ASN13		A		
DJBZ01	SLUG RUN	1975-	ASN13		A		

Appendix Table A-2. Illinois EPA AWQMN parameter information, 2002 water year.

IEPA STATION CODE	STREAM NAME	YEARS OF RECORD TO 2002	PARAMETER GROUP (POST 1977)	CHLOROPHYL (2000-)	PESTICIDE SUBNETWORK (1985-)	IND. SOLVENTS (1988-2000)	CONTINUOUS MONITORING PROJECT (2000 01)
DJL 01	INDIAN CREEK	1977-	ASN13		A		
DK 12	MACKINAW RIVER	1978-	ASN13		A		
DK 13	MACKINAW RIVER	1978-	ASN13		B		
DL 01	KICKAPOO CREEK	1959-62,64-77,79-	ASN13				
DQ 03	BIG BUREAU CREEK	1977-	ASN13		B		
DQD 01	WEST BUREAU CREEK	1972-77,79-	ASN13		A		
DR 01	LITTLE VERMILION RIVER	1971-77,78	ASN07		A		
DS 06	VERMILION RIVER	1978-	ASN13		A		
DS 07	VERMILION RIVER	1977-	ASN13		B		
DV 04	MAZON RIVER	1978-	ASN13		A		CMP
DW 01	AUX SABLE CREEK	1968,72-77,79-	ASN13		A		
DZZP03	FARM CREEK	1979-	ASN07		A		
Fox River Basin (DT)							
DT 06	FOX RIVER	1959-	ASN09		A		
DT 09	FOX RIVER	1960,63-67,69-	ASN09			I	
DT 22	FOX RIVER	1964,67,69-71,79-	ASN09		A		
DT 35	FOX RIVER	1971-	CORE1	C	A		
DT 38	FOX RIVER	1964,71-	CORE1			I	
DT 01	FOX RIVER	1958,72-77,1998-	CORE1	C	A		
DT 46	FOX RIVER	1978-98	CORE1				
DTB 01	SOMONAUK CREEK	1968,69,71-77,79-	ASN03		A		
DTD 02	BLACKBERRY CREEK	1977-	ASN03				
DTG 02	POPLAR CREEK	1977-	ASN09				
DTK 04	NIPPERSINK CREEK	1976-	ASN03		A		
Sangamon River Basin (E)							
E 05	SANGAMON RIVER	1958-	ASN17				
E 06	SANGAMON RIVER (L. Decatur)	1958,60-77,79-	ASN09				
E 09	SANGAMON RIVER	1964-65,67-68, 71-	ASN12			I	
E 16	SANGAMON RIVER	1965,67-68, 71,78-	ASN17				
E 18	SANGAMON RIVER	1972-77,2002	CORE1				
E 24	SANGAMON RIVER	1978-	ASN17			I	
E 25	SANGAMON RIVER	1976-	CORE1	C	B		
E 26	SANGAMON RIVER	1977-	CORE1	C	A		
E 28	SANGAMON RIVER	1978-	CORE1		B		
E 29	SANGAMON RIVER	1979-	ASN03				
EI 02	SALT CREEK	1958-	ASN01		B		
EI 06	SALT CREEK	1978-	ASN01				
EID 04	SUGAR CREEK	1978-	ASN12		A		
EIE 04	KICKAPOO CREEK	1978-	ASN01				
EIE 05	KICKAPOO CREEK	1978-	ASN13		A		
EIG 01	Lake FORK	1972-	ASN01				
EL 01	SPRING CREEK	1979-	ASN12		A		
EO 01	SOUTH FORK SANGAMON RIVER	1972-	ASN13				
EO 02	SOUTH FORK SANGAMON RIVER	1972-	ASN21		A		
EO 03	SOUTH FORK SANGAMON RIVER	2002-	ASN13				
EOA 01	SUGAR CREEK	1972-77, 79-	ASN09				
EOD 01	CLEAR CREEK (L. Sangchris)	1972-77, 79-	ASN03				
EOH 01	FLAT BRANCH	1972-77, 79-	ASN13				
Kankakee River Basin (F)							
F 01	KANKAKEE RIVER	1959-	CORE1	C	B		
F 02	KANKAKEE RIVER	1959-71, 75-	CORE1		A		
FL 02	IROQUOIS RIVER	1959-	ASN01		A		
FL 04	IROQUOIS RIVER	1972-	ASN01		A		
FLI 02	SUGAR CREEK	1978-	ASN01		A		
Des Plaines River - Lake Michigan Basin (G,H)							
G 07	DES PLAINES RIVER	1959-61, 72-	ASN10			I	
G 08	DES PLAINES RIVER	1959-60, 64-	ASN06	C			
G 11	DES PLAINES RIVER	1964,66-	ASN10	C		I	
G 15	DES PLAINES RIVER	1967-	CORE1		A	I	
G 22	DES PLAINES RIVER	1977-	ASN10				
G 23	DES PLAINES RIVER	1982-	CORE1			I	
G 39	DES PLAINES RIVER	1987-	ASN10				
GB 10	DU PAGE RIVER	1968-2000	ASN06			I	

Appendix Table A-2. Illinois EPA AWQMN parameter information, 2002 water year.

IEPA STATION CODE	STREAM NAME	YEARS OF RECORD TO 2002	PARAMETER GROUP (POST 1977)	CHLOROPHYL (2000-)	PESTICIDE SUBNETWORK (1985-)	IND. SOLVENTS (1988-2000)	CONTINUOUS MONITORING PROJECT (2000 01)
GB 11	DU PAGE RIVER	1964-76,78-	ASN10			I	
GB 16	DU PAGE RIVER	2000-	ASN06				
GBK 05	WEST BR. DU PAGE RIVER	1964-	ASN10				
GBK 09	WEST BR. DU PAGE RIVER	1964-77,79-	ASN10			I	
GBL 10	EAST BR. DU PAGE RIVER	1977-	ASN10				
GG 02	HICKORY CREEK	1967-77,79-	ASN10				
GI 01	SANITARY & SHIP CANAL	1987-92	NWQA1				
GI 02	SANITARY & SHIP CANAL	1964-	CORE1	C		I	
GL 09	SALT CREEK	1977-	CORE1			I	CMP
GLA 02	ADDISON CREEK	1979-	ASN10		A		
H 01	CALUMET SAG CHANNEL	1965-	CORE1			I	
HB 42	LITTLE CALUMET RIVER	1977-	CORE1			I	
HBD 04	THORN CREEK	1972-77,79-	ASN10		A	I	
HCC 07	NORTH BR. CHICAGO RIVER	1972-	CORE1		A	I	
HCCC02	NORTH BR. CHICAGO RIVER	1964-	ASN10		A	I	
Mississippi River South Basin (I)							
I 05	MISSISSIPPI RIVER	1999-	CORE1	C			
I 84	MISSISSIPPI RIVER	1983-95,99-	(USGS)		A		
II 03	MARYS RIVER	1972-	ASN13		A		
IX 04	CACHE RIVER	1978-	ASN13		A		
Mississippi River South Central Basin (J)							
J 05	MISSISSIPPI RIVER	1989-95	CORE1		A		
J 83	MISSISSIPPI RIVER	1975-89	CORE1				
J 98	MISSISSIPPI RIVER	1999-	CORE1	C	A		
J 36	MISSISSIPPI RIVER	1999-	CORE1				
JMAC02	HARDING DITCH	1978-	ASN07		A	I	
JN 02	CAHOKIA CANAL	1972-	ASN07		A		
JNA 01	CANTEEN CREEK	1972-	ASN07			I	
JQ 05	CAHOKIA CREEK	1978-	ASN13		A		
JR 02	WOOD RIVER	1972-	ASN07		A	I	
Mississippi River North Central Basin (K,L)							
K 04	MISSISSIPPI RIVER	1972-99	CORE1		A		
K 22	MISSISSIPPI RIVER	1999-	CORE1	C			
K 17	MISSISSIPPI RIVER	1999-	CORE1				
K 21	MISSISSIPPI RIVER	1999-	CORE1	C			
L 04	MISSISSIPPI RIVER	1999-	CORE1				
KCA 01	BAY CREEK	1972-	ASN02		B		
KI 02	BEAR CREEK	1978-	ASN02		B		
LD 02	HENDERSON CREEK	1972-	ASN13		B		
LF 01	EDWARDS RIVER	1959,71-	ASN02		B		
Mississippi River North Basin (M)							
M 04	MISSISSIPPI RIVER	1967-99	CORE1		A		
M 12	MISSISSIPPI RIVER	1999-	CORE1	C			
M 13	MISSISSIPPI RIVER	1999-	CORE1	C			
M 02	MISSISSIPPI RIVER	1999-	CORE1				
MJ 01	PLUM RIVER	1972-	ASN02		A		
MN 03	APPLE RIVER	1972-	ASN02		B		
MQ 01	GALENA RIVER	1972-77,79-	ASN13		A		
Big Muddy River Basin (N)							
N 06	BIG MUDDY RIVER	2000-	ASN15				
N 08	BIG MUDDY RIVER	1972-	ASN15		A		
N 10	BIG MUDDY RIVER	1977-99	ASN15				
N 11	BIG MUDDY RIVER	1978-	ASN13		B		
N 12	BIG MUDDY RIVER	1975-	CORE1	C	A		
NA 01	CEDAR CREEK (Cedar L.)	1979-	ASN15				
NB 01	KINKAID CREEK (Kinkaid L.)	1973-77,79-97	ASN15				
NC 07	BEAUCOUP CREEK	1978-	ASN13		A		
ND 01	CRAB ORCHARD CREEK	1972-	ASN21		A	I	
ND 02	CRAB ORCHARD CREEK	1972-97	ASN15				
ND 04	CRAB ORCHARD CREEK	1972-	ASN13		A		
NE 05	LITTLE MUDDY RIVER	1978-	ASN13		A		
NG 02	POND CREEK	1968-	ASN13		A		

Appendix Table A-2. Illinois EPA AWQMN parameter information, 2002 water year.

IEPA STATION CODE	STREAM NAME	YEARS OF RECORD TO 2002	PARAMETER GROUP (POST 1977)	CHLOROPHYL (2000-)	PESTICIDE SUBNETWORK (1985-)	IND. SOLVENTS (1988-2000)	CONTINUOUS MONITORING PROJECT (2000 01)
NH 06	MIDDLE FORK BIG MUDDY RIVER	1978-	ASN13		A		
NJ 07	CASEY FORK	1958,62-	CORE1		A	I	
NK 01	RAYSE CREEK	1972-	ASN15		A		CMP
Kaskaskia River Basin (O)							
O 02	KASKASKIA RIVER	1961-68,70-71,77-	CORE1	C	A		
O 07	KASKASKIA RIVER	1958-60,62-	ASN20				
O 08	KASKASKIA RIVER	1958-62,64,71-	CORE1		B		
O 10	KASKASKIA RIVER	1958,60-61,71-	ASN03				
O 11	KASKASKIA RIVER	1959-68,70-	ASN03	C	A		
O 15	KASKASKIA RIVER	1974-	ASN20		A		
O 20	KASKASKIA RIVER	1972-	CORE1	C	A		
O 30	KASKASKIA RIVER	1978-	CORE1		A		
O 31	KASKASKIA RIVER	1979-	ASN03		A		
OC 04	Richland CREEK	1978-	ASN17				
OD 06	SILVER CREEK	1972-	ASN17		A		
OD 07	SILVER CREEK	1978-	ASN17		B		
OH 01	SUGAR CREEK	1972-	ASN13		A		
OI 08	SHOAL CREEK	1978-	ASN13		A		
OI 09	SHOAL CREEK	1982-2000	ASN13		A		
OI 07	SHOAL CREEK	1972-77, 2000-	ASN13				
OJ 07	CROOKED CREEK	1972-	ASN17		A		
OJ 08	CROOKED CREEK	1979-	ASN17				
OK 01	EAST FORK KASKASKIA RIVER	1972-	ASN22		A		
OKA 01	NORTH FORK KASKASKIA RIVER	1977-	ASN22		A		
OL 02	HURRICANE CREEK	1978-	ASN20		A		
ON 01	HICKORY CREEK	1977-	ASN22		A		
OO 01	RAMSEY CREEK	1997-	ASN20				
OQ 01	BECK CREEK	1958,60-62,64,71-	ASN12				
OT 02	WEST OKAW RIVER	1977-	ASN20		A		
OU 01	JONATHAN CREEK	1977-	ASN20		A		
OZC 01	PLUM CREEK	1972-77, 79-	ASN13				
OZZT01	ASA CREEK	1978-	ASN03		A		
Rock River Basin (P)							
P 04	ROCK RIVER	1959,61-	CORE1		A		
P 06	ROCK RIVER	1959,61-	ASN09				
P 14	ROCK RIVER	1964,71-	ASN09			I	
P 15	ROCK RIVER	1972-	CORE1				
P 20	ROCK RIVER	1977-	ASN09	C	A	I	
PB 02	GREEN RIVER	1959,61-62,64,72-	ASN01		A		
PB 04	GREEN RIVER	1977-	CORE1		B		
PE 05	ROCK CREEK	1964-77,79-	ASN01				
PH 16	ELKHORN CREEK	1979-	ASN01		B		
PL 03	KYTE RIVER	1979-	ASN01		A		
PQ 02	KISHWAUKEE RIVER	1964,71-	ASN12				
PQ 10	KISHWAUKEE RIVER	1972-	ASN12		A		
PQ 12	KISHWAUKEE RIVER	1978-	ASN12		A		
PQB 02	KILLBUCK CREEK	1958-77,79-	ASN01		A		
PQC 06	SOUTH BR. KISHWAUKEE RIVER	1977-	ASN01		A		
PQF 07	COON CREEK	1979-	ASN01		A		
PW 01	PECATONICA RIVER	1958-	ASN01		B		
PW 08	PECATONICA RIVER	1977-	ASN12		B		
PWN 01	YELLOW CREEK	1972-77,79-	ASN01		B		
		TOTAL STATIONS		32	146	32	8
	"A" LESS THAN 10 YEARS OF DATA				117		
	"B" GREATER THAN 10 YEARS OF DATA				29		

APPENDIX 3

Continuous Real-Time Monitoring Of
Selected Water Quality Characteristics in Illinois

BACKGROUND

The Illinois Environmental Protection Agency (IEPA), the primary regulatory agency responsible for safeguarding the water resources of Illinois, operates an Ambient Water Quality Monitoring Network (AWQMN) composed of over 210 fixed stations to support surface-water chemistry data needs. Water samples are collected at 6-week intervals and analyzed for a minimum of 55 water-quality characteristics including field pH, temperature, specific conductance, dissolved oxygen, suspended solids, nutrients, fecal coliform bacteria, and total and dissolved heavy metals. Other chemical constituents are analyzed in samples from specific stations, watersheds, and/or subnetworks within the AWQMN. These subnetworks include a pesticide monitoring subnetwork, an industrial solvents subnetwork, and a mining subnetwork. As of June 2001, over 100 AWQMN stations are either located at a U.S. Geological Survey (USGS) continuous streamflow gaging station or located very near a USGS station (typically at the next upstream or downstream bridge).

Budgetary and logistical constraints necessarily limit the number and frequency of water-quality samples collected as part of a water-quality monitoring program. Laboratory chemical analyses are relatively expensive, and field personnel are not always able to collect data during critical conditions or events (for example, during extreme high- or low-flow conditions, spills, or during weekends and/or late-night hours). These constraints can limit the ability of environmental monitoring programs such as the IEPA AWQMN to document important water-quality conditions. However, advances in technology provide a means to continuously monitor selected water-quality characteristics with reduced field personnel time. In addition, the water-quality data can be transmitted to Web servers in near real-time for viewing and dissemination.

Multi-parameter water-quality probes can continuously monitor a variety of stream characteristics, including temperature, specific conductance, dissolved oxygen, pH, turbidity, chlorophyll, and nitrate. Such monitoring can continuously measure the changes in stream chemistry across a broad range of hydrologic conditions. These probes can be installed at current USGS streamflow-gaging stations and transmit water-quality data to centrally located computer systems using the power, data loggers, and telemetry already installed as part of the streamgaging operation. The water-quality data then can be made available in near real-time through USGS

Web servers. Real-time continuous water-quality monitoring technology provides a mechanism to immediately alert water-resources planners and regulators of appreciable short-term changes in water chemistry. Furthermore, this technology establishes a highly-detailed long-term record of daily, seasonal, and annual water-quality conditions that can then be used to document trends in water quality, to support numerical modeling, and to provide information on the effects of regulatory decisions and conservation programs on water-quality conditions.

PROBLEM

The U.S. Environmental Protection Agency (USEPA) has determined the regional stream nutrient criteria for total phosphorus, total nitrogen, chlorophyll-a, and turbidity (USEPA, 2000). These criteria are based on the concept of nutrient ecoregions (Omernik, 2000). The Nation is divided into 14 such ecoregions. However, specific States may reject these nutrient criteria and have considerable latitude to develop nutrient water-quality standards, based on other data. Also, States have the option to establish local water-quality criteria. Further, the current dissolved oxygen water-quality standards promulgated in Illinois Pollution Control Board regulations date from the early 1970s and are in need of review and updating. The present minimum dissolved oxygen concentration standard may be overly restrictive with respect to both natural daily variation and within certain regions of the State (particularly in southern Illinois). To some extent, diurnal fluctuations of dissolved oxygen are natural. However, the present standard does not readily accommodate this normal fluctuation. The present standard also may be inappropriate for parts of Southern Illinois, where many streams are warmer and have sluggish flow characteristics as compared to streams in the northern part of the State. Continuous monitoring would document dissolved oxygen concentrations under all conditions, in both unimpaired and impaired streams. This monitoring would provide some of the information necessary to determine an appropriate water-quality standard for the protection of aquatic life.

OBJECTIVES

The objectives of this study are:

1. Acquire and validate a continuous-monitoring record of water temperature, specific conductance, pH, dissolved oxygen, and turbidity, at eight USGS streamflow gaging-stations that are co-located with IEPA AWQMN stations throughout Illinois. The selected stations are listed in table 1 and depicted graphically in figure 1. In addition, a continuous record of chlorophyll will be acquired at a subset of four stations and nitrate will be acquired at one station.

2. Develop and implement an interface to display and distribute the continuous water-quality data in near real-time through the World Wide Web.
3. Acquire a record of stream chemistry conditions including selected chlorophyll and nutrient concentrations at the eight stations through a supplemental program of traditional water-quality sampling and laboratory analyses.
4. Document the performance, data quality, and operational issues of the water-quality monitoring system.
5. Evaluate and interpret the real-time water-quality monitoring data and supplemental water-quality sampling results in the context of (a) dissolved oxygen occurrence and variability; (b) the relation of chlorophyll production to oxygen depletion and nutrient concentration; and (c) the estimation of constituent loads.

RELEVANCE AND BENEFITS

A major part of the USGS mission is to provide impartial scientific information to effectively manage the natural resources of the Nation. This project has the strong potential to benefit both State and national interests. Real-time monitoring of water-quality characteristics can improve the effectiveness of current water-quality monitoring programs by providing data during periods and hydrologic conditions not represented by the AWQMN program. Real-time monitoring can quickly identify undesirable water-quality conditions and can document the effectiveness of conservation programs and related land-resource management practices on water-quality status and trends. Important daily, seasonal, and annual changes in water chemistry can be determined and documented for use in a wide variety of water-resource management applications and could augment both IEPA and USGS water-quality databases. The continuous water-quality data will assist the State of Illinois in determining whether and how water-quality standards should account for the natural fluctuation of dissolved oxygen and other characteristics in streams. Thus, the study will provide a framework to evaluate and adjust the dissolved oxygen standard to accommodate both diurnal fluctuation and stream location, if necessary. The relation of algal community primary production (as estimated by chlorophyll) to oxygen depletion is important in understanding the effects of nutrients in streams. Thus, studying the effect of primary algal production on dissolved oxygen concentrations is central to understanding the effects of nutrient concentrations on Illinois streams and therefore provides valuable information on the setting of standards. Finally, the increased implementation of total maximum daily loads (TMDLs) as a water-quality monitoring tool can be supplemented by a continuous record of water quality. TMDLs may be based upon surrogate relations, making a continuous record useful in constituent load computation of selected water-quality characteristics.

APPROACH

The project will proceed in close cooperation with IEPA Bureau of Water technical staff and managers. IEPA staff will be kept informed of project activities through periodic meetings and reviews, telephone contact, surface mail, e-mail, and Web-based data display. The project will include the following major elements: (1) water-quality equipment installation, operation and maintenance, and data distribution; (2) supplemental water-quality sampling and laboratory analysis; and (3) interpretive analyses and reporting of results. These elements are described in greater detail below. The workplan also is attached.

1. Water-quality equipment installation, operation and maintenance, and data distribution: Water-quality sensor systems with continuous monitoring capabilities will be installed at eight USGS streamflow-gaging stations, which are located at selected IEPA AWQMN stations (fig 1). At eight stations the water-quality monitoring system will include sensors for water temperature, specific conductance, pH, dissolved oxygen, and turbidity. At a subset of four stations the water-quality monitoring system will include all the previous sensors plus a sensor for chlorophyll. At a single station the water-quality monitoring system will also include a sensor for ISE (ion selective electrode) nitrate. The instrumentation will be programmed to communicate with the streamflow gaging-station telemetry and the water-quality monitoring data will be transmitted to USGS computer systems. An interface will be created to provide the water-quality data in both tabular and graphical format in near real-time from a public USGS Web server. The water-quality data will be made available from the public USGS web server after an initial period of evaluation and documentation of system performance, in consultation with the IEPA. The water-quality sensory equipment will be serviced and maintained on a routine basis approximately 24 times per year. Equipment servicing visits will average every 2-3 weeks, but will be adjusted as field conditions and instrument performance dictate. It is anticipated that servicing visits will be more frequent during the months of April through October, and less frequent during the remaining months. Water-quality equipment installation, operation, servicing, quality assurance, and data reporting will be done according to guidelines published in Wagner and others (2000).

2. Supplemental water-quality sampling and laboratory analysis: A grab sample will be acquired concurrent with each servicing visit from April through October and once monthly otherwise in 2002 and 2003. The target analytes include selected nutrients and chlorophyll and are shown in table 2. The USGS will collect and process the samples using methods approved by IEPA and USGS. The samples will be preserved and shipped in an appropriate condition as soon as feasible to the IEPA Champaign, Illinois laboratory. The IEPA will supply sample bottles, processing filters, and perform all supplemental sampling laboratory analyses. Appropriate IEPA and USGS protocols and quality assurance/quality control methods will be used at each step of sample acquisition and processing. It will be a secondary goal of the supplemental water-quality sampling program to acquire samples during extreme hydrologic conditions, defined as periods of very high- and low-flow. Other water-quality samples and/or continuous concurrent field parameter monitoring might be performed to document instrument performance and stream chemistry variability through the diurnal cycle.

3. Interpretive analyses and reporting of results: The interpretive activity will consist of two distinct phases. First, the performance of the real-time water-quality monitoring system will documented. Operational issues relating to instrument reliability, servicing frequency, and sensitivity to field conditions will be summarized and reported after the first year of data collection. Second, after 2 years of data collection, statistical analyses will be performed to document the overall quality of the data record and investigate the relation of the real-time water-quality data record to the AWQMN laboratory results obtained through the concurrent water-quality sampling program. The relative distribution and variability of dissolved oxygen will be interpreted and summarized. The relation of chlorophyll concentration to oxygen depletion and nutrient concentration will be investigated and summarized. Regression techniques and other statistical analyses will be used to establish a surrogate relation between the real-time data and the AWQMN data, where appropriate. For example, at some large river locations in Kansas, Christensen and others (2000) found significant relations among the surrogates specific conductance with dissolved solids; turbidity with total suspended solids; specific conductance and discharge with chloride; and specific conductance with sulfate.

PRODUCTS

The products of this study are: (1) Real-time continuous water-quality data made available through USGS Web servers for temperature, specific conductance, pH, dissolved oxygen, turbidity, chlorophyll, and nitrate; (2) A short letter report describing the quality of the data collected and the performance of the real-time water-quality data system (after first year of operation); and (3) An interpretive report documenting the data analysis and investigation and which summarizes all project activity (after second year of operation). It is anticipated that the interpretive report will be published as a USGS Water-Resources Investigation Report.

PERSONNEL

The project chief will be a GS-11 hydrologist with professional experience, training, and interest in the areas of water-quality instrumentation, water-quality sampling, telemetry, environmental statistics, automated hydrologic-data retrieval, and Web-based data distribution. Technical support staff available in the Illinois District Office can provide assistance with equipment installation, field maintenance, and water-quality sampling, as needed. Professional and technical support staff available in the Illinois District Office can provide assistance with telemetry, Web-programming, and exploratory data analysis, as needed.

COSTS

Project costs are primarily for salary, equipment, vehicle, and travel. The project costs are given through federal fiscal year 2003 (ending September 30, 2003), although the final interpretive report may not be published until at least December 2003. The workplan is attached.

ITEM	FY2001	FY2002	FY2003	TOTAL
Salary	$65,100	$80,330	$80,330	$225,760
Equipment	116,790	14,880	14,880	$146,550
Vehicle	14,500	22,000	22,000	$58,500
Travel	12,500	17,300	17,300	$47,100
Publication	0	8,900	26,710	$35,610
TOTAL	$208,890	$143,410	$161,220	$513,520
USGS Coop Share	66,420	71,705	80,610	$218,735
IEPA Coop Share	142,470	71,705	80,610	$294,785

REFERENCES

Christensen, V.G., Xiaodong, J., and Ziegler, A.C., 2000, Regression Analysis and Real-Time Water-Quality Monitoring to Estimate Constituent Concentrations, Loads, and Yields in the Little Arkansas River, South-Central Kansas, 1995-99: U.S. Geological Survey Water-Resources Investigation Report 00-4126, 36 p.

Omernik, J.A., 2000. Draft Aggregations of Level III Ecoregions for the National Nutrient Strategy. [http://www.epa.gov/ost/standards/ecomap.html].

U.S. Environmental Protection Agency, 2000, Nutrient Criteria Technical Guidance Manual-Rivers and Streams, EPA-822-B-00-002.
[http://www.epa.gov/ost/criteria/nutrient/guidance/rivers/frontcover.pdf]

Wagner, R.J., Mattraw, H.C., Ritz, G.F., and Smith, B.A., 2000, Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Site Selection, Field Operation, Calibration, Record Computation, and Reporting: U.S. Geological Survey Water-Resources Investigation Report 00-4252, 53 p.

Table 1

Site name and number (USGS/IPEA)	Site type
Salt Creek at Western Springs (5531500/GL-09)	Disturbed Northern
Mazon River near Coal City (5542000/DV-04)	Undisturbed Northern
Illinois River at Valley City (5586100/D-32)	Disturbed Central
Middle Fork Vermilion River above Oakwood (3336645/BPK-07)	Undisturbed Central
North Fork Vermilion River near Bismark (3338780/BPG-09)	Undisturbed Central
Vermilion River near Danville (3339000/BP-01)	Slightly disturbed Central
Rayse Creek near Waltonville (5595730/NK-01)	Disturbed Southern
Lusk Creek near Eddyville (3384450/AK-02)	Undisturbed Southern

Table 2

Parameter Name	Code
Total alkalinity	00410
Total suspended solids	00530
Volatile suspended solids	00535
Total ammonia nitrogen	00610
Total nitrate+nitrite-N	00630
Total Kjeldahl nitrogen	00625
Total phosphorus	00665
Dissolved phosphorus	00666
Total organic carbon	00680
Chloride	00940
Sulfate	00945
Chlorophyll-a uncorrected	32210
Chlorophyll-a corrected	32211
Chlorophyll-b	32212
Chlorophyll-c	32214
Pheophytin-a	32218
Chlorophyll filtered	A14200

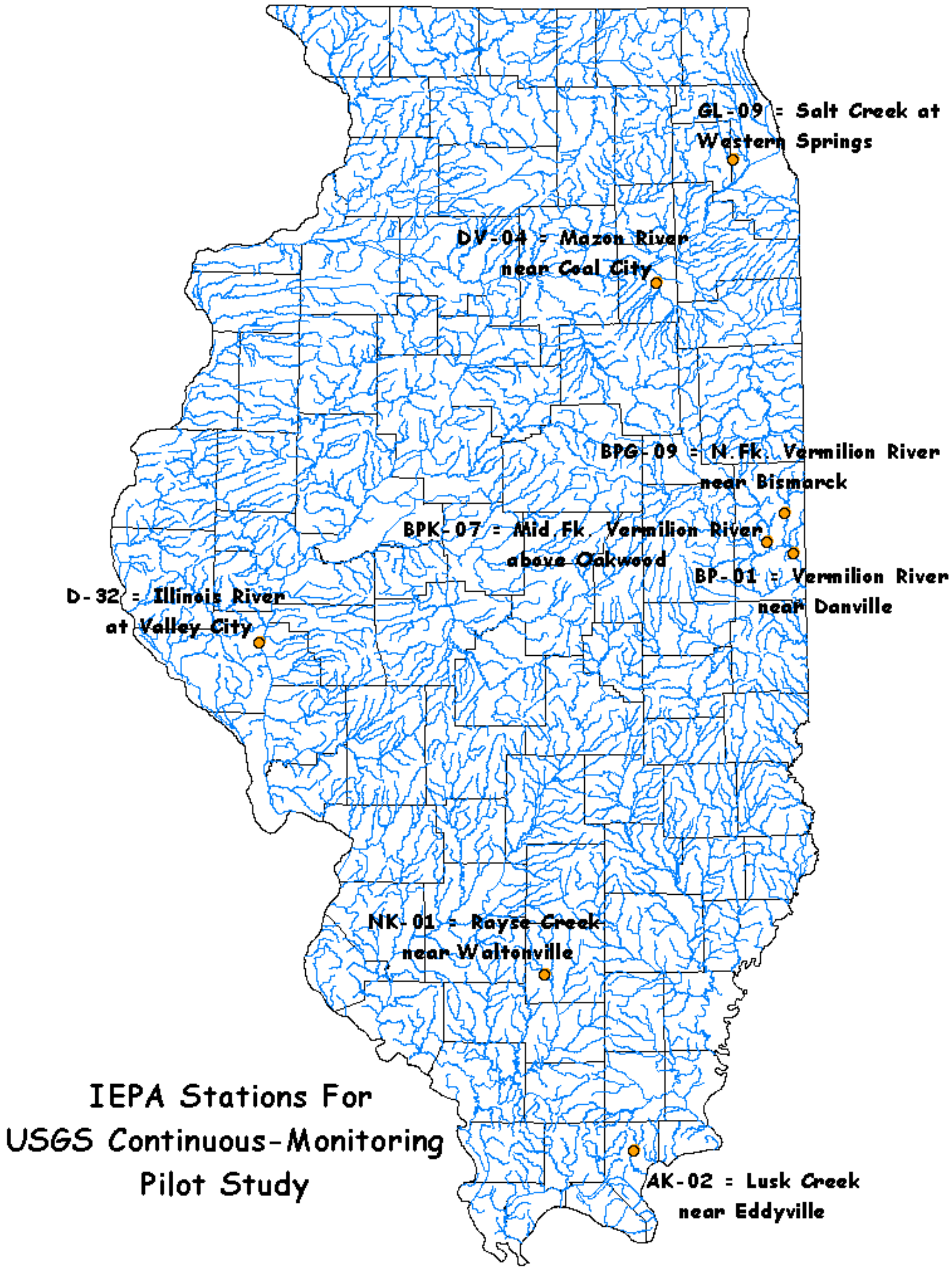

GL-09 = Salt Creek at
Western Springs
DV-04 = Mazon River
near Coal City
BPG-09 = N. Fk. Vermilion River
near Bismarck
BPK-07 = Mid Fk. Vermilion River
above Oakwood
BP-01 = Vermilion River
near Danville
D-32 = Illinois River
at Valley City
NK-01 = Rayse Creek
near Waltonville
IEPA Stations For
USGS Continuous-Monitoring
Pilot Study
AK-02 = Lusk Creek
near Eddyville

Figure 1

Workplan for Continuous Real-Time Monitoring of Selected Water Quality Characteristics in Illinois

	FY2001 FY2002 FY2003
	AMJJAS ONDJFMAMJJAS ONDJFMAMJJAS
Reconnaissance and Equipment ordering	XX
Equipment Installation	XXX
Operations and Maintenance	XX XXXXXXXXXXXX XXXXXXXXXXXX
Supplemental Sampling	XXXXXXXX XXXXXXXXXXXX
Status Report Writing	X XX
Status Report Delivery	X
Interpretive Report Writing	XXX XXXXX XX

APPENDIX 4

Fish Indexes of Biotic Integrity (IBIs)
for
Assessing the Ecological Health of Illinois Streams

Overview of IBI Revision and Reevaluation

Since 1997, Illinois EPA has been supporting and coordinating the reevaluation and revision of fish IBIs for Illinois streams. As of January 1, 2002, the IBI-reevaluation project has completed the following tasks:

- Identification of physical and chemical measures of anthropogenic disturbance, reflected at both watershed and stream-site spatial scales, to rate fish samples for degree of human impact;

- Determination of the response, of each of several potential IBI metrics, along a gradient from least- to most-disturbed conditions. Selection for inclusion in Illinois fish IBIs, the subset of metrics that most meaningfully reflect human effects on Illinois stream-fish communities (Table 1);

- For least-disturbed conditions, examine variation in IBI metrics among alternative regional groupings throughout Illinois. Define a set of IBI regions (Figure 1) that best stratify natural variation in IBI metrics and then examine within-region variation (in metrics) with stream size and map slope. From these analyses, devise criteria that allow one to assign standardized scores to each metric in each IBI region; and

- Develop a draft manual that explains how to calculate metric scores and IBI scores for Illinois streams.

Table 1. Ten metrics selected for inclusion in revised Illinois IBIs. Metrics in bold type are new to Illinois IBIs; four others are slight variants of previous metrics.

Species-richness metrics	
NFSH	Number of native fish species
NSUC	Number of native sucker species (i.e., in family Catostomidae)
NSUN	Number of native sunfish species (i.e., in family Centrarchidae)
INTOL	Number of native intolerant species
NMIN	**Number of native minnow species (i.e., in family Cyprinidae)**
NBINV	**Number of native benthic invertivore species**
Trophic- or reproductive-structure metrics	
SBI	**Proportion of individuals of species that are specialist benthic invertivores**
GEN	**Proportion of individuals of species that are generalist feeders**
LIT0T	**Proportion of individuals of species that are obligate coarse-mineral-substrate spawners and not "tolerant" (i.e., excludes creek chub and white sucker)**
Tolerance metric	
PRTOL	**Proportion of tolerant species**

A final version of the IBI manual is scheduled for completion in 2002. Also, a separate project has been started (September 2001) to create a computer program that will calculate IBI metric values, metric scores, and overall IBI scores, as well as provide useful output at key steps in this process. A test version of this computer program is expected by July 2002.

Purpose and Structure of an Index of Biotic Integrity

An Index of Biotic Integrity (IBI) provides biologists with a simple and easily communicated measure of biological health. Combined with other environmental information such as physical-habitat or water-chemistry conditions, an IBI-based assessment provides an essential component of judging the overall environmental quality of an area.

In Illinois and around the world, researchers have developed IBIs that address various animal and plant groups (e.g., fish, invertebrates, algae) living in various habitats (e.g., streams, lakes, estuaries). IBIs based on fish living in streams are the most commonly used probably because the original IBI approach applied to stream fish. In Illinois, biologists use IBIs based on fish to help assess the environmental quality of streams.

An IBI score is a single number that represents several, especially relevant attributes of the group of fish species (i.e., fish assemblage) that inhabit a site (i.e., a section of stream). The fish-assemblage attributes selected for inclusion in an IBI (i.e., metrics) are those that are expected to provide a clear signal of how stream fish respond to the impacts of humans on watersheds and streams. Even for cases in which human disturbances remain unspecified, unmeasured, or cannot be completely discerned, one can use a biological metric (e.g., number of native fish species present) as a direct warning that a stream is being degraded by human impacts or, conversely, as an indication of recovery from such impacts (e.g., improved land-management practices, decreased input of toxic substances, revegetated riparian areas, reduced sediment runoff to stream channels).

Because streams, watersheds, and their biological structure and function can be complex, a single attribute of the fish assemblage (e.g., number of native fish species) is unlikely to provide an accurate signal of disturbance or improvement in all situations. However, if one examines multiple signals simultaneously–each a different attribute of the fish assemblage--then a more-accurate and robust picture emerges. An IBI can be thought of as a super-signal of the level of biological integrity possessed by a stream because it combines the information from several individual signals of fish-assemblage response to human impacts. The multiple signals selected to constitute an IBI are called metrics, thus IBIs and similar indexes are often collectively called “multimetric indexes”. Typically, an IBI incorporates the information of 5 to 15 metrics; for Illinois, the most recently revised IBIs each comprise ten metrics.

To obtain estimates of each metric, biologists capture, identify, and count the fish that occur at a site on a single date. They then use this information to determine values of each IBI metric. For example, the proportion (based on total number of individuals in the sample) of fish that feed primarily on bottom-dwelling invertebrates (e.g., insects) constitutes the metric, “proportion of specialist, benthic invertivores”. For each metric, the value obtained directly from the fish sample is replaced with a standardized value (i.e., “metric score”) that allows combining the information of each metric into a single, comprehensive, and more-easily understood IBI score--which is simply the sum of metric scores.

How An IBI Works

Assigning scores to each metric requires a keen understanding of how fish assemblages respond to disturbance or improvement, how these responses can vary among sites, and what types of fish assemblages can be expected at sites representing a wide range of human influences. The IBI process requires expert judgment and knowledge and is valid only if performed by biologists who know the identity, habits, and ecological requirements of stream fishes in the types of streams and in the geographic areas being addressed. Operationally, an IBI score measures the degree to which values of metrics at a “test” site (i.e., one with unknown integrity) deviate from predefined metric values that serve as standards of reference or benchmarks (often called “reference conditions”) of high biological integrity. To assign scores to each metric, the metric value is compared with predefined ranges of values that signal high to low biological integrity. These predefined ranges are called “metric-scoring criteria”. For example, if a metric value determined from the fish sample deviates very little from a predefined range of values that represent a high-integrity condition, then the metric is assigned the highest possible metric score. The more the metric value deviates from this "reference condition", the lower the score it receives--down to a minimum metric score that represents maximal deviation from the reference condition. For example, if high-integrity sites typically harbor 29 (or so) native fish species (i.e., the reference condition for this metric), then one can set a minimum metric-scoring criterion value of 29 species for assigning the highest metric score to the metric. After each metric receives a metric score based on comparisons with the metric-scoring criteria, the metric scores are summed across all metrics to yield the IBI score. A high IBI score indicates high biological integrity and relative lack of disturbance, suggesting the need for continued protection or conservation. A low IBI score indicates disturbance, suggesting a need for remediation.

Prior IBIs in Illinois have used twelve metrics, each receiving a possible metric score of 1, 3, or 5. Thus, the IBI score ranged from 12 to 60. However, for the most recently revised IBIs (each comprising ten metrics), metric scores range from 0 to 6; therefore, total IBI scores can range from 0 to 60.

Interpreting IBI scores

Perhaps the most important use of IBI scores is to communicate a simple measure of environmental quality to all interested persons. For example, a 1986 publication by IBI originator, James Karr (and others), provides the following guidance for translating IBI scores (Table 2) into biological-integrity classes:

Table 2. Description of Index of Biotic Integrity scoring range and fish community attributes.

IBI Score	Integrity Class	Attributes
58 - 60	Excellent	Comparable to the best situations without human disturbance; all regionally expected species for the habitat and stream size, including the most intolerant forms, are present with a full array of age (size) classes; balanced trophic structure
48 - 52	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant forms; some species are present with less than optimal abundances or size distributions; trophic structure shows some signs of stress
40 - 44	Fair	Signs of additional deterioration include loss of intolerant forms, fewer species, and highly skewed trophic structure; older age classes of top predators may be rare.
28 - 34	Poor	Dominated by omnivores, tolerant forms, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; hybrids and diseased fish often present.
12 - 22	Very Poor	Few fish present, mostly introduced or tolerant forms; hybrids common; disease, parasites, fin damage, and other anomalies regular.

Although these classes and their description refer to particular metrics or situations that may no longer be directly applicable to the most recently revised IBIs, the classification does provide a useful example of the need to define integrity classes that can be communicated directly and in simple words that describe the health of the aquatic resource (e.g., fish in streams).

For the most recent Illinois fish IBIs, a new classification and description will be necessary, but neither has been established yet. In 2002, Illinois EPA biologists and a workgroup comprising representatives of non-Illinois EPA groups interested in biological assessment will discuss ways to interpret the new IBI scores. Based on these discussions, Illinois EPA intends to define and describe new integrity classes and IBI scoring ranges.

Figure 1. Revised Index of Biotic Integrity regions for Illinois.

APPENDIX 5

Development of a multimetric macroinvertebrate index for Illinois.

The use of aquatic macroinvertebrates as indicators of stream pollution has been well documented (Cairns and Pratt, 1993). Macroinvertebrates are particularly well suited to bioassessment strategies because: 1) they are sedentary which makes them well suited for assessing site specific impacts, 2) they have life spans which range from several months to several years allowing them to indicate past environmental conditions, 3) aquatic macroinvertebrates are common and can be found in almost every stream, 4) aquatic insects are relatively easy and inexpensive to collect, and 5) their sensitivity to habitat and water quality impacts make them effective indicators of stream impairment (MacDonald et al., 1991). In Illinois, the use of aquatic insects was pioneered in the early 1950's by Illinois EPA biologists Bob Schiffman and Bill Tucker. Their work focused on species tolerance to dissolved oxygen and the development of a stream classification system.

Since 1983, Illinois EPA 's macroinvertebrate assessments have used the Macroinvertebrate Biotic Index or MBI which is based primarily on the work of Hilsenhoff (1982) from Wisconsin. This index was developed to provide a rapid stream quality assessment. Most macroinvertebrate taxa known to occur in Illinois have been assigned a pollution tolerance rating, ranging from 0 to 11 based on references and field studies. A zero was assigned to taxa found only in streams of high water quality, and an 11 was assigned to taxa known to occur in severely polluted or disturbed streams. Intermediate ratings were assigned to taxa that occur in streams with moderate degrees of pollution or disturbance. The MBI is an average of tolerance ratings weighted by organism abundance, and is calculated from the formula:

$$MBI = \Sigma(n_i t_i)/N$$

where n_i is the number of individuals in each taxon, t_i is the tolerance rating assigned to that taxon and N is the total number of individuals in the sample.

The MBI which is a single metric index is still in use by the Illinois EPA and works well for point source related studies. However, it is based primarily on a community response to deoxygenating waste. With the increased emphasis on the watershed approach, Illinois EPA believes an index that looks at more than one aspect of the aquatic environment will enable the Agency to more accurately define the subtle changes in macroinvertebrate community structure caused by nonpoint as well as point sources.

According to Barbour et al. (1992):

> "The use of multiple community metrics to evaluate instream biological impairment has become a popular assessment approach. The approach was first developed by Karr in 1981 for fish communities in Illinois and later refined for wider application. This approach consists of analyzing different components of the structure and function of stream and river fish communities in an integrated assessment, using various attributes of ecological systems. Information obtained for the different community components is evaluated as metrics. Each metric is expected to contribute relevant and necessary ecological information on the integrity of the community under study. Recent applications of this metric approach to benthic macroinvertebrate communities include... the Ohio EPA (1987), Shackelford (1988) in Arkansas , Plafkin et al. (1989)" for the USEPA and Kerans et al. (1992) for the Tennessee Valley Authority.

In 1997 Tetra Tech, Inc., the world leader in multimetric macroinvertebrate index development, was contracted to assist Illinois EPA in developing a macroinvertebrate index for Illinois. Tetra Tech transferred Illinois EPA's biological data to its Ecological Data Application System (EDAS) for management and analysis, evaluated various regionalization schemes to develop the most appropriate stream classification system for macroinvertebrate communities in Illinois, and made recommendations for filling data gaps and supplementing the current qualitative macroinvertebrate sampling procedures with a semi-quantitative multi-habitat sampling method. Preliminary analysis of Illinois' macroinvertebrate data suggest a north to south regionalization pattern. However, Tetra Tech's analysis needed additional data to confirm this preliminary determination.

In April, 2001 Illinois EPA and Tetra Tech entered into a new contract to continue the development of a multimetric macroinvertebrate index for Illinois. Beginning with the 2001 sampling season, Illinois EPA biologists began collecting proportional multi-habitat macroinvertebrate samples in addition to the usual qualitative macroinvertebrate data at all intensive river basin stations. Analyses on these data will be conducted by Tetra Tech to determine performance characteristics of both sampling methods (qualitative and semi-quantitative). Performance characteristics to be assessed include measures of method precision, bias, effectiveness over a prescribed range of conditions and sensitivity (detection limit). Examining performance will allow Illinois EPA to define a level of confidence in its biological data. Additional issues to be addressed include identifying regional patterns in macroinvertebrate distribution and suggesting possible reasons for these patterns.

Following guidance of U.S. EPA's Rapid Bioassessment Protocols (Barbour et al. 1999) and using Illinois EPA's biological data, Tetra Tech will develop a multimetric index for assessing biological integrity in Illinois' streams. This task will involve the selection of 10-12 metrics via an analysis of a data subset extracted from Illinois EPA's biological monitoring stations. Collectively, the selected metrics should provide a measure that reflects ecological health over a wide range of anthropogenic disturbance, *i.e.*, the index should be sensitive to the effects of nonpoint as well as point-source pollution. Tetra Tech will determine metric scoring criteria and then develop a way to aggregate metric scores into a single index by doing the following:

1. Using the methods outlined in Karr et al. (1986), Barbour et al. 1999, or other appropriate methods, Tetra Tech will develop scoring criteria for each of the selected metrics.

2. Determine and justify whether metrics require differential weighting.

3. Determine integrity classes based on intervals defined by ranges in the index score.

4. Based on precision estimates of the refined methods determined earlier, develop a strategy for interpreting scores that occur near the endpoints of their integrity classes.

5. Develop a strategy for verifying the accuracy of the multimetric macroinvertebrate index after it is developed.

Illinois EPA's existing sampling protocol may also support the River Invertebrate Prediction and Classification Scheme (RIVPACS) multivariate bioassessment protocol without the need for additional semi-quantitative data. Illinois EPA and Tetra Tech, as a logical next step, agreed upon an evaluation of this approach. It was hoped this evaluation could be conducted with the remaining funds in the 1997 contract with Tetra Tech. However, before the analysis could move forward, digital elevation models to delineate the catchments of the 600+ sites were necessary. This effort exhausted the 1997 USEPA contract. Under the 2001 Illinois EPA contract, Tetra Tech will develop a model that uses the biological data to classify sites into homogenous groupings and to develop an expected biological assemblage for each group. Characteristics of the site, such as elevation, catchment area, distance [of the site] from its source, certain chemical data, etc., will be used to help delineate the classes.

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APPENDIX 6

Overview of a Project to Develop: (a) Stream-fish Sampling Guidelines for IBI-based Biological Assessment of Illinois Streams, and (b) an Ecologically Based Stream-Classification System

(a) Developing Stream-fish Sampling Guidelines

In Illinois, recent emphases on watershed management, conservation, and the development of regulatory criteria that address biological conditions (i.e., biocriteria) have highlighted the need for accurate and reliable biological-assessment tools. One such tool, the index of biotic integrity (IBI) continues to be a major component of resource-quality assessment and regulation in Illinois. Currently in Illinois, the Illinois Department of Natural Resources and the Illinois Environmental Protection Agency rely heavily on IBI-based biological assessments to evaluate effects of watershed-management practices, to characterize the ecological health of streams, to guide the setting of management and conservation priorities, to meet federal requirements for water-quality reporting, and to define criteria for regulating the "uses" of stream resources. This continued reliance on the IBI demands that developers and users of the index provide formal justification for the accuracy and reliability of IBI-based assessments and regulatory criteria.

Because an IBI score is determined from a sample of the fish community at a stream site, the accuracy of an IBI-based assessment depends directly on how well the fish sample represents the true biological conditions at the site. Unfortunately, for Illinois streams, little formal documentation exists to assess how accurately or precisely each fish-community sample represents the true conditions. Consequently, IBI scores and IBI-based assessments are subject to potentially large uncertainties. This project proposes to extensively sample a selected set of Illinois stream sites and then analyze the collected fish-community information to provide sampling guidelines to best ensure acceptable levels of accuracy and precision in IBI metrics and total IBI scores. The project will try to answer the following three questions to help provide guidelines for sampling wadable streams in Illinois:

1. How many passes with an electric seine in a given length of stream are needed to yield acceptably accurate estimates of IBI metrics at a wadable site?

2. How much sampling effort (i.e., length of stream) with an electric seine is needed to yield acceptably accurate and precise estimates of IBI metrics at a wadable site?

3. What magnitude of difference in any two IBI scores represents a true difference in biotic integrity, i.e., how precise is an IBI score?

(b) Developing an Ecologically Based Stream-Classification System

Assessing the resource quality of a stream of unknown quality is enhanced by comparing the biological stream conditions to a standard (i.e., reference condition) that represents known high quality. Such comparisons are useful only if reference conditions account for natural variability in biota among streams that differ in location or type. A system, for classifying streams, based on ecologically relevant attributes can help one define meaningful reference conditions that, in turn, help to ensure accurate determinations of stream-resource quality. This project follows the steps below to develop a system to identify segments of Illinois streams and to classify each segment into each of several ecologically relevant types.

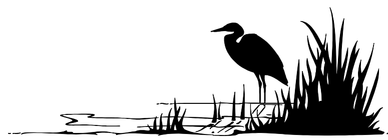
1. Use existing GIS coverages (e.g., ReachFile 3, National Hydrography Database) to identify stream reaches.

2. Create a GIS-based database in which physical, map-based attributes (e.g., drainage area, stream order, geological and hydrological setting) are assigned to each stream reach.

3. Use the system to classify and to aggregate stream reaches into ecologically relevant types of stream segments, based on biological, physical, and perhaps chemical relationships.

APPENDIX 7

Illinois Ambient Lake Monitoring Program (ALMP)



In Illinois there are 3,041 lakes over six acres in size. Including ponds, there are over 87,000 bodies of water. These bodies of water serve many purposes including municipal, industrial and agricultural water supplies, cooling water sources, flood control structures and recreational uses such as swimming, boating, skiing, fishing and hunting.

The Illinois Ambient Lake Monitoring Program (ALMP) was established in 1977 by the Illinois Environmental Protection Agency (Illinois EPA) to gather fundamental information on the quality of Illinois inland lakes. Approximately 50 lakes are monitored annually under the Illinois Clean Lake Program and Conservation 2000 initiatives.

Objectives of the ALMP

* Characterize and define trends in the condition of significant lakes;
* Diagnose lake problems, determine causes/sources of problems, and provide a basis for identifying alternative solutions;
* Evaluate progress success of pollution control/restoration programs;
* Judge effectiveness of applied protection/management measures and determine applicability/transferability to other lakes;
* Revise and update the Illinois lake classification system; and
* Meet the requirements of the Illinois Clean Lakes Program regulations and/or grant agreements.

The Basic Program

ALMP lakes include a wide range in size, origin, morphometry, and quality, ranging from glacial lakes in northern Illinois, small municipal public water supply lakes in southern Illinois, to major reservoirs several thousand acres in size. Each lake that is monitored, is sampled five times: once during the spring runoff/turnover period (April or May), three times during the summer (June, July and August), and once during the fall overturn (September or October). The larger or more significant lakes, or "Core Lakes", are sampled every three years (see list below). Other lakes are monitored on a less frequent basis.

Illinois EPA Ambient Lake Monitoring Program List of "Core Lakes"

Northern Illinois		Central Illinois		Southern Illinois	
Lake Name	**County**	**Lake Name**	**County**	**Lake Name**	**County**
Bluff	Lake	Argyle	McDonough	Cedar	Jackson
Busse Woods	Cook	Bloomington	McLean	Centralia	Marion
Carlton	Whiteside	Charleston SCR	Coles	Crab Orchard	Williamson
Catherine	Lake	Clinton	DeWitt	Devils Kitchen	Williamson
Channel	Lake	Decatur	Macon	Forbes	Marion
DePue	Bureau	Eureka	Woodford	Frank Holten # 1	St. Clair
Fox	Lake	Evergreen	McLean	Frank Holten # 2	St. Clair
Frentress	JoDaviess	Glen Shoals	Montgomery	Frank Holten # 3	St. Clair
George	Rock Island	Homer	Champaign	Glen O. Jones	Saline
Grass	Lake	Jacksonville	Morgan	Glendale	Pope
Johnson Sauk	Henry	Lou Yaeger	Montgomery	Governor Bond	Bond
Le-Aqua-Na	Stephenson	Mattoon	Shelby	Highland Silver	Madison
Long	Lake	Mauvaisse Terre	Morgan	Horseshoe	Alexander
Marie	Lake	Mill Creek	Clark	Horseshoe	Madison
Nippersink	Lake	Otter	Montgomery	Kinkaid	Jackson
Petite	Lake	Paris East	Edgar	Lake of Egypt	Williamson
Pierce	Winnebago	Paris West	Edgar	Little Grassy	Williamson
Pistakee	Lake	Pittsfield	Pike	Murphysboro	Jackson
Powderhorn	Cook	Sangchris	Christian	Newton	Jasper
Round	Lake	Sara	Effingham	Olney E. Fork	Richland
Senachwine	Putnam	Siloam Springs	Adams	Pinckneyville	Perry
Shabbona	DeKalb	Spring North	Tazewell	Raccoon	Marion
Wolf	Cook	Spring South	Tazewell	Sam Dale	Wayne
		Springfield	Sangamon	Vandalia	Fayette
		Taylorville	Christian	Washington County	Washington
		Vermillion	Vermillion		
		Weldon Springs	DeWitt		

Illinois lakes are monitored for a variety of chemical and biological parameters indicative of resource quality and trophic status. Each lake is typically sampled at three locations: site 1 is located near the dam or deepest area of the lake; site 2 is established at mid-lake; and the third station, site 3, is normally positioned in upper end of the lake or arm where the largest tributary enters. Routine monitoring coverage includes field measurements of water quality for pH, conductivity, temperature/dissolved oxygen profiles, Secchi transparency, and alkalinity. Analysis samples for chlorophyll a, nutrients such as nitrogen and phosphorus, and sediment chemistry is conducted at one of the Agency laboratories. For some lakes, phytoplankton (algae) samples may be identified to evaluate community structure and lake trophic status. Special investigations of shoreline erosion problems and lake macrophytes (aquatic plants) are also routinely conducted assess lake quality and impairments of designated uses.

The Expanded Program

Historically, approximately 20 to 30 lakes were sampled annually in conjunction with the ALMP. On June 29, 1995, a major natural resource protection bill titled Conservation 2000, was signed into law by Governor Jim Edgar. This bill provided funding to the Illinois EPA to expand Clean Lake Program activities. A portion of this funding was used to expand the Ambient Lake Monitoring Program. Starting in 1996, Illinois EPA biologists now about monitor 50 lakes annually pursuant to enhanced ALMP goals. This is an increase of 67%from the number of lakes previously monitored. Some of the ALMP lakes are “core lakes” or lakes that are monitored on a three year cycle while the other lakes are monitored on a five year cycle. With the expanded program Illinois EPA has also expanded its number of “core lakes”.

Importance of Monitoring Illinois Inland Lakes

As previously stated the Illinois EPA Ambient Lake Monitoring Program has many objectives such as long term lake quality trends, diagnosing problems within the lake and correcting problems within the lake to name just a few. With this valuable monitoring data Illinois EPA can help attain these objectives and help protect and restore these valuable natural resources for future generations to enjoy and use.

Analyzed data are stored in a national database called STORET. Data is used for many important program activities such as, 305(b) Water Quality Report which drives the 303(d) listings and the TMDL process, Clean Lakes Program Grant and Priority Lake and Watershed Implementation Grant activities to name a few.

Glossary of lake terms

The Illinois EPA ALMP provides in-depth studies and analyses of Illinois inland lakes. There are several water quality parameters that the Illinois EPA analyzes for under the ALMP to help assess the water quality of lakes, including;

Trophic status: Refers to the productivity of a lake as measured by the nutrient content, particularly phosphorus, and generally includes three major categories: Oligotrophic (low productivity, low concentrations of plant nutrients), Mesotrophic (moderate productivity, moderate concentrations of plant nutrients), and Eutrophic (high productivity, high concentrations of plant nutrients).

Eutrophication: The aging of a lake through nutrient enrichment and sedimentation. Natural eutrophication refers to the process in which a lake slowly becomes enriched with nutrients and gradually fills in with organic matter or sediment. Cultural eutrophication is the acceleration of the lake aging process attributable to the activities of man including agriculture, mining, urbanization and construction.

Fall Overturn: Mixing of the water column due to declining air temperatures and winds in the fall. The air temperature cools the surface of the waters so that its temperature and density get closer and closer to that of the bottom waters. Eventually they will be similar enough so that a strong wind will penetrate the thermocline (region of greatest change in temperature and density) and mixing will occur all the way to the bottom. Complete mixing soon results in uniform temperatures, dissolved oxygen levels and densities from top to bottom.

Spring Overturn: Before the ice cover melts in the spring, the temperature at the interface of the water and ice is 0* C (32* F). The water temperature at the bottom of the lake is 4* C (39.2* F), because water at this temperature is denser than at any other temperature it will sink to the bottom. When the ice melts and the temperature of the surface water begins to rise above 0* C , it becomes more dense and sinks, to be replaced by cooler water from below. This process continues until the entire lake is 4* C from top to bottom. Winds blowing across the surface create currents that are forced all the way to the bottom. The entire volume of the lake is mixed thoroughly at this time, using the energy of the wind.

ALMP Parameters Analyzed and What They Mean

The Illinois EPA ALMP provides in-depth studies and analyses of Illinois inland lakes. There are several water quality parameters that the Illinois EPA analyzes for under the ALMP to help assess the water quality of lakes including;

* *Transparency*: the primary measurement is the Secchi disk transparency or Secchi depth. The Secchi disk is simply a weighted circular disk about eight inches in diameter with four alternating black and white sections. Analyses of the Secchi disk measurements provide an indication of the general water quality conditions of the lake, as well as the amount of usable habitat available for fish and other aquatic life. Microscopic plants and animals (phytoplankton and zooplankton respectively), water color and suspended solids are factors that interfere with light penetration through the water column and lessen the Secchi disk depth. Approximately two times the Secchi depth is considered the lighted or euphotic zone of the lake. In this region of the lake there is enough light to allow plants to survive and produce oxygen, which is needed by most aquatic life to survive;

* *Total suspended solids*: this is a measure of all material (including algae and sediment) suspended in the water;

* *Volatile suspended solids*: this is a measure of organic solids such as algae, detritus and other organisms (non-volatile suspended solids are inorganic solids such as sediment);

* *Turbidity*: this is a measure of the opaqueness of the water due to light scattering and absorption. Clay, silt, organic matter, plankton and microorganisms contribute to turbidity;

* *Chlorophyll a*: this is the green photosynthetic pigment found in the cells of all algae, and is used to estimate algae biomass;

* *Chlorophyll b*: this type of chlorophyll is found in green algae and diatoms, and is used to estimate the biomass of these types of algae;

* *Chlorophyll c*: this type of chlorophyll is found in brown algae, and is used to estimate the biomass of this type of algae;

* *Nitrate-Nitrite Nitrogen (NO2, NO3)*: this is a measure of the nitrogen compounds which are oxidized and readily available for algae to use for nutrients;

* *Total Ammonia Nitrogen (NH3, NH4)*: this is a normal decompositional end product of nitrogenous organic matter. NH3 can be extremely toxic to aquatic organisms;

* *Total Kjeldahl Nitrogen (TKN)*: this is a measurement of both the ammonia and organic nitrogen forms which is important in assessing the nitrogen available for biological activities;

* *Total Phosphorus*: this is a measurement of the total phosphorus concentration, dissolved and particulate forms. Phosphorus is used by aquatic plants (algae and macrophytes) and organisms, and plays a vital role in energy transfer during metabolism;

* *Dissolved Phosphorus*: this is a measurement of the dissolved phosphorus fraction which is most readily available for plant and organism uptake;

* *Conductivity*: this is a numerical expression of the ability of an aqueous solution to carry an electrical current;

* *Total Alkalinity*: this is a measurement of the waters acid-neutralizing capacity. Total alkalinity is determined by the amount of acid needed to bring natural water to a pH of 4.5;

* *Phenothalene Alkalinity*: this is told by the amount of acid needed to bring the water to a pH of 8.3;

* *pH*: this is a measurement of the hydrogen ion concentration of the water, and measures acid (below 7) or alkaline (above 7) conditions. pH influences solubility, chemical forms and toxicity of many substances and strongly influences composition of plant and animal communities;

* *Chemical Oxygen Demand (COD)*: this is a measurement of the amount of oxygen required to chemically oxidize organic and oxidizable inorganic matter in water;

* *Dissolved Oxygen*: this is a measurement of the quantity of oxygen present in water in a dissolved state. Indicates the degree of biological activity, and the fitness of the water as an environment; and

* *Temperature*: this is among the most important factors determining lake water quality. Seasonal trends are characterized by summer and winter stratification periods and spring and fall circulation periods.

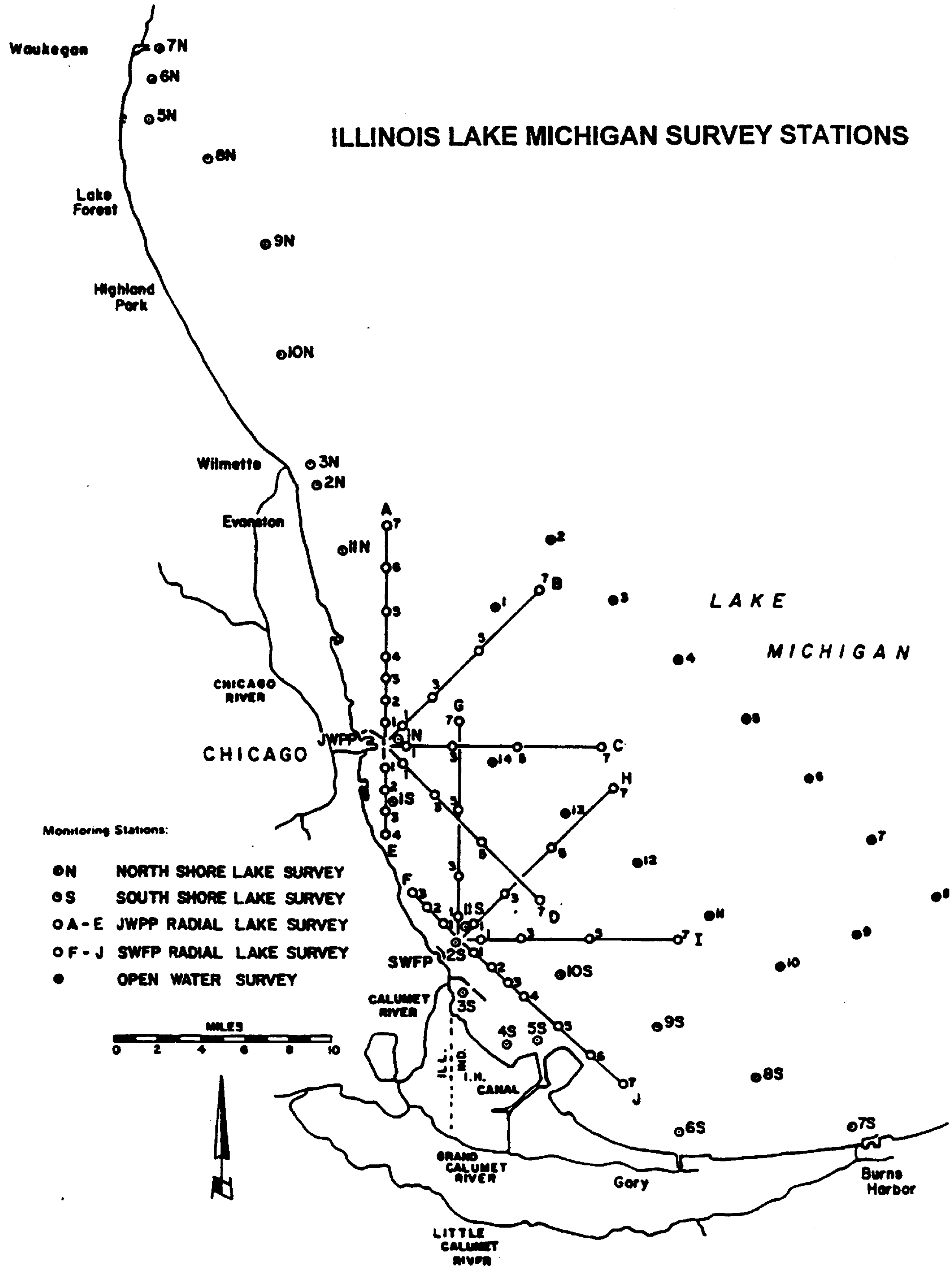
APPENDIX 8

Lake Michigan Monitoring Program

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

BUREAU OF WATER

ILLINOIS LAKE MICHIGAN SURVEY STATIONS



APPENDIX TABLE 8-A: ILLINOIS LAKE MICHIGAN SURVEY STATIONS

Lake Michigan

Sampling Agency: City of Chicago

Station No.	Latitude	Longitude	Current Sub-Network Parameters Yearly Frequency	Years of Record
Open Water Survey				76-Present
1	41 58 50	87 29 30	G/4	
2	42 01 30	87 26 30	G/4	
3	41 59 10	87 23 00	G/4	
4	41 56 50	87 19 40	G/4	
5	41 54 20	87 16 10	G/4	
6	41 51 50	87 12 40	G/4	
7	41 49 30	87 09 20	G/4	
8	41 47 00	87 06 00	G/4	
9	41 45 40	87 10 30	G/4	
10	41 44 20	87 14 50	G/4	
11	41 46 30	87 18 40	G/4	
12	41 48 40	87 22 20	G/4	
13	41 50 50	87 26 20	G/4	
14	41 53 00	87 30 10	G/4	

APPENDIX TABLE 8-B: ILLINOIS LAKE MICHIGAN SURVEY STATIONS

Station No.	Latitude	Longitude	Current Sub-Network Parameters Yearly Frequency	Years of Record
Jardine Water Puritication Plant Survey				70-Present
1A	41 54 10	87 35 30	G/3	
1B	41 54 00	87 34 40	G/3	
1C	41 53 20	87 34 20	G/3	
1D	41 52 40	87 34 40	G/3	
1E	41 52 30	87 35 30	G/3	
2A	41 55 00	87 35 30	G/3	
2E	41 51 30	87 35 30	G/3	
3A	41 56 00	87 35 30	G/3	
3B	41 55 10	87 33 00	G/3	
3C	41 53 20	87 32 00	G/3	
3D	41 51 30	87 33 00	G/3	
3E	41 50 40	87 35 30	G/3	
4A	41 56 50	87 35 30	G/3	
4E	41 49 50	87 35 30	G/3	
5A	41 58 40	87 35 30	IG KJ/3	
5B	41 57 00	87 30 30	G/3	
5C	41 53 20	87 28 30	G/3	
5D	41 59 40	87 30 30	G/3	
6A	42 00 20	87 35 30	G/3	
7A	42 02 00	87 35 30	G/3	
7B	41 59 30	87 27 10	G/3	
7C	41 53 20	87 23 50	G/3	
7D	41 47 10	87 27 20	G/3	

APPENDIX TABLE 8-C: ILLINOIS LAKE MICHIGAN SURVEY STATIONS

Station No.	Latitude	Longitude	Current Sub-Network Parameters Yearly Frequency	Years of Record
South Water Filtration Plant Survey				70-Present
1F	41 46 20	87 32 30	G/3	
1G	41 46 40	87 31 50	G/3	
1H	41 46 20	87 31 00	G/3	
1I	41 45 40	87 30 40	G/3	
1J	41 45 10	87 30 50	G/3	
2F	41 47 00	87 33 30	G/3	
2J	41 44 40	87 30 00	G/3	
3F	41 47 40	87 34 20	G/3	
3G	41 48 20	87 31 50	G/3	
3H	41 47 40	87 29 20	G/3	
3I	41 45 40	87 28 20	G/3	
3J	41 44 00	87 29 10	G/3	
4J	4143 30	87 28 10	G/3	
5G	41 51 00	87 31 50	G/3	
5H	41 49 30	87 26 50	IG J/3	
5I	41 45 40	87 24 50	G/3	
5J	41 42 30	87 26 30	IG J/3	
6J	41 41 20	87 24 40	G/3	
7G	41 54 30	87 31 50	G/3	
7H	41 51 50	87 23 30	G/3	
7I	41 45 40	87 20 00	G/3	
7J	41 40 10	87 22 50	G/3	

APPENDIX TABLE 8-D: ILLINOIS LAKE MICHIGAN SURVEY STATIONS

Station No.	Latitude	Longitude	Current Sub-Network Parameters Yearly Frequency	Years of Record
North Shore Lake Survey				70-Present
1N	41 53 20	87 35 00	G/7	
2N	42 03 50	87 39 00	G/7	inactive
3N	42 04 50	87 39 40	G/7	
4N	42 13 10	87 47 10	G/7	inactive
5N	42 18 40	87 48 40	G/7	
6N	42 20 20	87 48 30	G/7	inactive
7N	42 21 20	87 47 50	G/7	
8N	42 17 10	87 45 40	G/7	
9N	42 13 30	87 42 10	G/7	
10N	42 09 10	87 41 30	G/7	
11N	42 01 10	87 37 20	G/7	

APPENDIX TABLE 8-E: ILLINOIS LAKE MICHIGAN SURVEY STATIONS

Station No.	Latitude	Longitude	Current Sub-Network Parameters Yearly Frequency	Years of Record
South Shore Lake Survey				70-Present
1S	41 51 10	87 37 30	G/7	
2S	41 45 50	87 31 20	G/7	
3S	41 43 50	87 30 30	G/7	
4S	41 41 40	87 28 30	G/7	inactive
5S	41 41 50	87 26 40	G/7	
6S	41 38 20	87 19 20	G/7	
7S	41 38 50	87 10 40	G/7	
8S	41 40 40	87 15 50	G/7	
9S	41 42 50	87 21 00	G/7	
10S	41 44 50	87 26 10	G/7	
11S	41 46 50	87 31 10	G/7	

APPENDIX 9

AGENCY BIOMONITORING TEST RESULTS SUMMARY EXAMPLE

Reviewer's Name: Date Summarized: **July 13, 2001** Results Received: **05/15/01**

Facility Name: **Wastewater Plant # 3** NPDES No.: **IL0000000** Expiration Date: **02/28/02**
Receiving Water: **Indian Creek** Reach No.: **07120006-001/off**

Upstream 7Ql0: **0** CFS Discharge Average Low Flow (2000): **0.83** CFS
Dilution Ratio: **0** Instream Waste Concentration: **100%** Waste concentration in 25% of dilution water: **100%**

Facility Type: **Municipal** DID Number: **DTZX-111-03**
Treatment Level: **Rotating biological contactors (RBCs)**
Process Information:
Effluent Ammonia (total): **6.1** mg/L
Effluent Variability:
M.Z. Delineation Study: Effluent Chlorine (TRC): **<0.01** mg/L (not dechlorinated)

TOXICITY DATA

Bioassay Date: **04/04/01** Laboratory: **SF Analytical**

Dilution Water Source: **Indian Creek** Receiving Water Toxicity: **No effect**

Acute Bioassays: Screen *Ceriodaphnia:* **N/A** Definitive *Ceriodaphnia*: **No effect**
Screen Fathead Minnow*:* **N/A** Definitive Fathead Minnow: **No effect**

Chronic Bioassays: *Ceriodaphnia* NOEC: **N/A** Fathead Minnow NOEC: **N/A** Algae NOEC: **N/A**

Other Bioassays:

Test Date	Laboratory	Dilution Water Source	Acute Bioassays	Ammonia (total)
11/07/91	IEPA	Indian Creek	No effect to *Ceriodaphnia* No effect to fathead minnow	<0.3
05/26/98	NSSD Gurnee	Indian Creek	*Ceriodaphnia*: Mortality = 15% * No effect to fathead minnow	0.09 mg/L

* in 100% effluent

Date of Most Recent IEPA Biosurvey: October, 1996

Comments: Biosurvey conducted in 1984 showed at least one mile of degradation, but chlorine may have been at least partially responsible. The October, 1996 biosurvey found that Wastewater Plant #3 effluent had a slight impact to Indian Creek. Conductivity in Indian Creek at Station C1, just downstream of the STP outfall, was 5300 *u*mhos. No significant acute toxicity has been observed in four bioassays of this facility's effluent.

Recommendations:

At this time, no biomonitoring is recommended as a permit condition other than the routine four rounds of acute definitive testing with *Ceriodaphnia* and fathead minnow beginning 18 months before permit renewal. This recommendation is subject to change after review of the bioassay results required by this facility's permit.

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APPENDIX 10

Fish Contaminant Monitoring SOP (Draft)

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

BUREAU OF WATER

FISH CONTAMINANT MONITORING SOP

1.0 Objectives and Scope

In Illinois, contaminant levels in fish are monitored via a cooperative program with the Illinois Environmental Protection Agency (Illinois EPA), Illinois Department of Natural Resources (IDNR), Illinois Department of Public Health (IDPH), and the Illinois Department of Agriculture (IDOA). The objectives of the Illinois Fish Contaminant Monitoring Program (FCMP) are:

1.1 To investigate and detect the presence and build-up of toxic and potentially hazardous substances in fish, encompassing both fish toxicity and public health implications.

1.2 To determine the impact of fish contaminants upon the suitability of aquatic environments for supporting abundant, useful, and diverse communities of fish life in streams and impoundments of Illinois.

1.3 To aid in the location of sources of toxic material discharges and evaluate long-term effects of source controls and land use changes.

2.0 Data Usage

The data generated by this program will be used to achieve the above objectives in the following ways:

2.1 The comparison of composite filet data for compliance with either risk-based criteria adopted by the FCMP or action levels set by the U.S. Food and Drug Administration (U.S. FDA). The risk-based criteria or U.S. FDA action levels regulating commercial fisheries are the criteria adopted at the state level for Illinois in the issuing of sport fish consumption advisories. The list of parameters and the risk-based criteria or U. S. FDA action levels used for this comparison are as follows:

Parameter	U.S. FDA Action Level	Lab Detection Limits
Dieldrin	0.3 ppm	0.01
DDT and Analogs	5.0 ppm	0.01
Aldrin	0.3 ppm	0.01
Endrin	0.3 ppm	0.01
Methoxychlor	**	0.01
Heptachlor	0.3 ppm	0.01
Heptachlor Epoxide	0.3 ppm	0.01
Lindane	**	0.01
Benzene Hexachloride (BHC)	0.5 ppm	0.01
Toxaphane	5.0 ppm	1.00
Mirex	0.1 ppm	0.05
Hexachlorobenzene (HCB)	**	0.01

**No established USFDA Action level in fish

	Risk-Based Criteria for					
Parameter	Unlimited Consumption	1 meal/wk	1 meal/ mo	6 meals/yr	No Consumption	Lab Detection Limits
Polychlorinated Biphenyls	0-0.05 ppm	0.06-0.22 ppm	0.23-0.89	0.9-1.9	≥2.0	0.10
Chlordane	0-0.15 ppm	0.16-0.65 ppm	0.66-2.8	2.9-5.6	≥5.7	0.01
Mercury	0-0.05 ppm	0.06-0.22 ppm	0.23-0.89	0.9-1.9	≥2.0	0.10

2.2 Whole fish data will be used primarily for detecting trends and new contaminants not routinely analyzed for. As new contaminants are identified and trends in the concentration of routine contaminants are defined, the program shall adjust its sampling to meet these changes. (IJC, 1982)

2.3 Whole and/or composite fillet data will be used to identify lakes and streams with significant fish contaminant problems requiring more intensive investigation. These follow-up investigations will be designed to assess in greater detail, (I) the extent of the contamination, (ii) the potential sources of the contamination, and (iii) the development of a mitigation strategy.

3.0 Monitoring Network Design and Rationale

The statewide monitoring network consists of the following components:

3.1 Lake Michigan - Samples of Chinook and/or Coho Salmon, Lake, Rainbow, and Brown Trout, Yellow Perch, Rainbow Smelt, Bloater Chubs, and Alewives are collected annually from the open waters of Lake Michigan, according to the size ranges specified in Section 7.5.12 for salmon and trout and as available for the other species. In addition, selected harbors and/or tributaries are sampled for representative predators, omnivores, and bottom feeders as needed.

3.2 Basin Surveys - A minimum of one complete sample (i.e., 2 bottom feeders, 1 omnivore, and 1 predator) is collected from each basin scheduled for an intensive survey each year. Additional samples shall be collected at the discretion of the field sampling team where it is known or anticipated that the public can regularly fish in the water body (for example, presence of a boat launch, evidence of fishing activity such as discarded bait containers, etc.). Such samples shall focus on the species and sizes of fish known or anticipated to be sought by anglers. The FCMP may also request that the field sampling team attempt to obtain samples from specific water bodies within a basin scheduled for an intensive survey, for example in response to requests from the public or local officials.

3.3 Follow-Up Samples - Specific numbers and sizes of one or more species (often 2 sizes of bottom feeders, omnivores, and predators, plus 1 panfish and any other species regularly targeted by anglers) may be requested by the FCMP in order to follow up on bodies of water where previous samples have indicated that one or more species have contaminants above a level of concern (either risk-based or USFDA criteria). Such samples shall also be requested by the FCMP on a regular basis in order to evaluate the continued need for an existing advisory or a species or modifications of the existing advisory.

3.4 Lower Priority Samples - Bodies of water from which no species have been found to have contaminants above a level of concern (either risk-based or USFDA criteria) are assigned a lower priority for sampling frequency. Such bodies shall be re-sampled on a recurring basis (for example, every 5 to 10 years), as permitted by budgetary and laboratory capacity constraints.

3.5 Special Samples - As necessitated by special circumstances, such as investigations of spills, fish kills, and toxic chemical cleanup sites, the FCMP may request specific numbers and sizes of selected fish or other aquatic species be collected by field sampling teams or other personnel. Such samples may be designated as high priority for analysis by the Illinois EPA or other designated laboratory. Costs for collection and analysis of such samples shall be paid by the party(ies) responsible for the special circumstance to the maximum extent possible.

4.0 Monitoring Parameters and Their Frequency of Collection

A total of 20 pesticide/PCB analyses are performed on all composite fillet samples. These analyses comprise the 14 parameters, including related isomers, listed on page 1. The percent lipid or fat content is also determined for each sample. The estimated number of samples and resulting analyses routinely generated per year can be found in Appendix 3. In addition to the 20 pesticide/PCB analyses on whole fish, a gas chromatography/mass spectrometry "wide scan" analysis may be performed on whole fish samples as the need arises. The "wide scans" include up to 50 additional parameters, including both volatile and semi-volatile constituents. Their purpose is to aid in the identification of new contaminants of potential concern. Based on this information, it may be necessary at some point in the future, to expand or revise the list of parameters being analyzed routinely.

Additional analyses for mercury will be performed for all predator species samples and may be performed for other species on a selected or as needed basis. Other heavy metals are not routinely analyzed in fish tissue. Even though metal complexes may be present in fish tissue, metallic ions rarely accumulate in fish tissue to high levels, and are more readily observed and monitored in water and sediment (IJC, 1982.)

5.0 Sampling Procedures/Quality Control

The Illinois Department of Natural Resources - Division of Fisheries is responsible for the collection and preparation of all fish samples from those stations identified by the FCMP. Composite fillet and whole fish samples are collected and processed during the course of scheduled annual stream and lake fish population sampling, and follow the guidelines below.

5.1 Collection of Composite Fillet Samples

A minimum of 3 and preferable 5 or more fish of a single species of roughly similar size and weight comprise each composite fillet sample. The smallest fish in the composite sample must be at least 75% of the length of the largest fish in the sample. For example, if the largest fish is 20 inches, the smallest fish in the sample must be at least 0.75 x 20 = 15 inches. A minimum of 4 composite fillet samples are obtained at each station using the following species groups:

5.1.1 Inland Lakes and Streams

Composite 1

Predatory Species	Size
Largemouth Bass	2 lbs. and larger
Walleye or Sauger	2 lbs. and larger
Northern Pike	2 lbs. and larger
White Bass	1 2 lbs. and larger
Crappie (White, Black)	3/4 lbs. and larger

Composite 2

Omnivorous Species	Size
Channel Catfish	2 lbs. and larger
Blue Catfish	2 lbs. and larger
Flathead Catfish	2 lbs. and larger
Bullhead (species)	1 lb. and larger
Bluegill	1/4 lbs. and larger

Composite 3 and 4

Bottom Feeder Species	Size
Carp	3 lbs. and larger
Buffalo (species)	3 lbs. and larger
Carpsuckers	3 lbs. and larger

A replicate composite fillet sample is collected from the bottom feeders' group, resulting in the 4 composite fillet samples required at each station. The first species in each group should be used if available; other species are substituted according to the size requirement.

Additional composite fillet samples may be collected and submitted for analysis at the discretion of the District or Project biologist. For example, if white bass are important components of the creel in a given lake, the biologist may wish to submit a white bass composite fillet sample in addition to the largemouth bass sample, etc. Only during basin or special surveys, it is acceptable to use smaller fish.

5.1.2 Lake Michigan Species

Composite fillet samples from Lake Michigan are obtained for a minimum of 5 lake species: Coho salmon, Chinook salmon, Rainbow trout, Brown trout, and Lake trout. Additional samples of other species may be submitted at the discretion of the IDNR Lake Michigan Program Manager. Four composite fillet samples for each species are prepared based upon the ranges of size at the time of collection. A composite fillet sample from Lake Michigan consists of at least 5 fish per size group. Samples are to be grouped according to the indicated length ranges by species.

Species			Length	Ranges (inches)	
		1	2	3	4
Coho salmon	21	21-24	25-27	27	
Chinook salmon		25	25-30	31-35	35
Rainbow trout		10-15	16-20	21-25	25
Brown trout		10-15	16-20	21-25	25
Lake trout		20	21-25	25	--

5.2 Preparation and Identification of Composite Fillet Samples

IDNR biologists collecting the samples are to complete the following field information on the Field/Lab form. (See Appendix 7)

5.2.1 Station Code
5.2.2 Date
5.2.3 Collector's Name
5.2.4 Sampling Location (i.e., upstream of Rt. 121 Br., etc.)
5.2.5 Stream or Lake Name
5.2.6 Sampling Techniques
5.2.7 Weather Conditions
5.2.8 Fish Species
5.2.9 Individual Wts. and Lengths of Fish in Sample
5.2.10 Sample Type (Whole or Fillet)
5.2.11 Comments or Unusual Conditions
5.2.12 Materials Check List for Whole and Fillet Fish Sampling

1) Fillet knife
2) Sharpening stone
3) Aluminum foil
4) Cookie sheet or cutting board
5) Cooler with ice or ice packs
6) Plastic bags
7) Proper labeling material

The composite fillet samples are prepared by removing the scales and leaving the skin on the fish. Then, fillet to remove bones. If the fillet is too large, select a section from the anterior, middle and posterior portion of the fillet and place them in the composite sample. The total weight of the composite sample (all 5 fish) must range from 1 to 5 pounds. Keep the sample as clean as possible to avoid contamination. Composite fillet samples from catfish are prepared by removing skin and then filleting the fish to remove bones. The size of the composite sample must range from 1 to 5 pounds. Each composite fillet sample is securely wrapped in aluminum foil and labeled with a pre-printed, adhesive label (See Appendix 8). There are two pre-printed labels with the same sample number. One label is placed on the outside of each fish sample, and the other placed on the accompanying Field/Lab form in the area designated. This is essential so that the laboratories completing the analysis can identify each composite sample with the correct station. All composite samples collected from a sampling station are placed in an air tight plastic bag; this will help prevent contamination of samples and loss of identification numbers on pre-printed labels. The Field/Lab forms are not to be placed inside the plastic bags with the fish samples. The samples are then kept on ice, or dry ice during field sampling and frozen as soon as possible upon completion of field sampling.

5.3 Collection of Whole Fish Samples

IDNR biologists collect whole fish samples from specified contaminant stations. One whole fish sample is provided for each of the 4 composite fillet samples, with the whole fish sample being representative of the individual fish that comprise the composite fillet sample.

5.4. Preparation and Identification of Whole Fish Samples

The IDNR biologist completes the same field information on the Field/Lab form as described earlier for composite fillet samples. Securely wrap each whole fish sample in aluminum foil and label with the pre-printed, adhesive labels. Again, as with the composite sample, place one label on the outside of each whole fish, and the other label with the same pre-printed number on the appropriate Field/Lab forms in the area designated. All whole fish from a sampling station are placed in an air tight plastic bag and kept on ice, or dry ice, during field sampling. the samples are frozen as soon as possible upon completion of field sampling.

6.0 Follow Up and Special Requests/Studies

6.1 Follow Up Studies - These studies are designed to provide more extensive data results in those areas where potential fish contaminant problems exist. They will be conducted on an "as needed" basis and will include 50-100 supplemental samples per year (see Appendix 3). Sample analyses will be performed by Illinois EPA laboratories to insure as much consistency as possible with data generated from the routine network stations. Collection of these samples may include either IDNR and/or Illinois EPA biologists. Sample collections from additional sources (i.e., other States on boundary waters, U.S. Army Corp. of Engineers, U.S. Fish and Wildlife Service, or local government such as MWRD of Greater Chicago) may be utilized in follow up studies if the sampling protocols and field QA procedures documented in this agreement are used.

6.2 Commercial Requests - These samples are collected by IDNR at waterbodies which have been requested to be opened for commercial fishing. IDNR will contact Illinois EPA for assignment of station codes and documentation of sampling locations prior to the collection of these samples. In addition, the words COMMERCIAL FISH REQUEST should appear across the top of the Field/Lab sample sheet to clearly distinguish these sample from routine ones. These samples will be analyzed by the Illinois EPA laboratory.

6.3 Special Studies - The special studies provide a wide range of additional data and information which cannot normally be provided by the routine network data. For example, these studies may involve further addressing seasonal and species variability concerns which will add to the overall knowledge and understanding of contaminant levels in fish. They may also involve remedial investigation work at the request of Illinois EPA, Division of Land Pollution Control. The Illinois EPA laboratory will provide the analytical needs for these studies in the support of the overall Fish Contaminant Monitoring Program. It is this laboratory or Private Contract Laboratories that will determine the necessary laboratory capabilities, as well as any other laboratory considerations, at the time of the design of such studies.

7.0 Sample Chain of Custody Procedures

7.1 Delivery of Samples to Illinois EPA

All whole and fillet samples collected from the network are delivered directly to Illinois EPA, Division of Water Pollution Control, Surface Water Section. The address and contacts are as follows:

Illinois Environmental Protection Agency
BOW/Surface Water Section
4500 South Sixth Street
Springfield, IL 62706
Contact: Bill Ettinger
Phone - 217/786-6376

Transportation of samples to the Surface Water Section is routinely coordinated between the IDNR biologists and IDPH regional staff (See Appendix 4). However, in certain instances, the IDNR biologists may deliver samples directly or coordinate delivery with Illinois EPA regional staff (see Appendix 6) at their convenience. Surface Water Section staff should be notified prior to any delivery.

When custody of fish samples is transferred to Surface Water Section staff, the following quality assurance checks are implemented:

7.1.1 Insure all whole fish samples are wrapped in aluminum foil and placed in plastic bags per sampling guidelines.

7.1.2 Matching I.D. tags are firmly affixed to both the Field/Lab form and each whole fish sample. (I.D. tags on fish sample should be taped.)

7.1.3 Each Field/Lab form has all the necessary field information required.

7.1.4 Insure the whole fish samples targeted for "wide scan" analysis are prepared in the following manner:

The stations in which whole fish samples will be analyzed by GC/MS "wide scan" procedures are identified below:

The wide scan analysis will be performed on the whole fish representing the bottom feeders group from these stations. Usually this species will be carp. One whole fish from this group, plus a replicate whole fish may be collected by IDNR. Therefore, additional samples are not necessary; the 2 whole fish representing the bottom feeders from the selected stations are targeted for wide scan analysis plus the 14 routine parameters. These samples require the Special Organic Analysis form (Appendix 9) to be completed by Illinois EPA personnel as well as the Field/Lab form (Appendix 7) to be completed by IDNR.

Upon completion of these Q.A. checks, the Field/Lab form is signed and dated in the appropriate space by the person transporting the sample. All fish samples delivered are checked onto a sample log maintained by Illinois EPA quality assurance staff. Samples remain frozen until delivery to Illinois EPA laboratories, at which time the laboratory receiving agent initials the data form and date of sample receipt.

7.2 Prioritizing Analyses to Laboratory

Priority of analyses to laboratory will be coordinated by the FCMP and/or DWPC Surface Water Section.

7.3 Delivery of Fish Samples to Tissue Bank

Tissue banking is of value for retrospective analyses of contaminant levels and past human exposure (IJC, 1982). All whole and composite fillet samples analyzed by the participating laboratories are to be inventoried into the tissue bank. The laboratories are to provide a 250 gram ground subsample, from whole or composite fillet samples which have been analyzed, to be stored. Illinois EPA is responsible for the storage, transportation, and maintenance of the tissue bank samples. Each bottle containing a tissue bank sample needs to have the corresponding lab I.D. number issued to each Field/Lab form clearly written on the outside of the bottle in permanent ink. This will insure proper identification of the sample.

The tissue bank is located at:

Mid State Meat Company
2879 North 31st Street
Springfield, IL
217/525-0160

For the inventory list of fish in the tissue bank, and transportation arrangements contact:

Illinois Environmental Protection Agency
BOW/Surface Water Section
4500 South Sixth Street
Springfield, IL 62706

Contact: Bill Ettinger
Phone - 217/786-6376

8.0 Laboratory Calibration Procedures and Quality Control

8.1 Illinois EPA Laboratory

All calibration and quality control procedures used in the fish analyses by the Illinois EPA laboratory are referenced in the Illinois EPA Laboratory Methods Manual, Volume II (Page 3-1 thru 3-17). Copies of the documented procedures can be made available upon request. The Illinois EPA laboratory, will participate in QA/QC efforts with other States and Federal Agencies as needed. An in-house QA/QC program consisting of duplicates and blanks QC samples comprising 1 of every 10 analyses (10%), will insure precision and accuracy. In addition, the Illinois EPA laboratory will maintain participation in the U.S. FDA spike sample testing program. (See Performance and Systems Audit).

9.0 Data Dissemination

9.1 Data Handling of Composite Fillet Samples

All fish are taken by Surface Water Section Staff to the Illinois EPA laboratory. When the Illinois EPA laboratory has completed the analysis and entered the data into LIMS (Laboratory Information Management System), the completed field/lab forms are returned to Surface Water Section Staff. This information is then ready for entry into STORET (STORage and RETrieval). For any data that shows excursions, Illinois EPA staff will forward copies of the field/lab forms to IDNR and IDPH. All data will be transferred via SAS (Statistical Analysis System) program format printout on a regular basis.

9.2 Data Handling for Whole Fish Samples

All laboratory results for whole fish samples analyzed by Illinois EPA labs are forwarded to the Surface Water Section staff where the same procedures outlined above for composite fillet samples are implemented.

10.0 DATA MANAGEMENT QUALITY CONTROL

The Field/Lab forms received by Illinois EPA data management personnel are checked in on a program check-list and reviewed for missing or illegible values, station code errors, etc. These forms are held until the fish contaminant data is printed from LIMS (Laboratory Information Management Systems) each week by ISD (Information Systems Division) to a pre-edit report for verification against these forms. Fish contaminant data are then transferred by ISD into a STORET dataset. The data sets are printed out and compared with the original format to assure transfer of all data. Preliminary data editing is performed to correct errors discovered through the %store procedure. When error-free, the data sets are stored final. The data is then accessed to see if the storage run was successful. The data retrieved are verified from original lab forms and data printouts. Any errors are corrected, missing data added, etc. The corrections are checked and the procedure repeated as necessary until an error-free copy is obtained.

10.1 Data Representativeness; Comparability; Completeness

Data comparability must be assured by a) frequent interagency communication and review of sampling, analytical and assessment methodologies, and b) implementation of a quality assurance program which includes field, laboratory and data management quality control (IJC, 1982). Data representativeness and completeness needs to be assured through an established evaluation process of the monitoring program, altering the program as required (IJC, 1982). At a minimum, an annual meeting of the participating agencies will be conducted where these quality assurance characteristics are addressed.

10.2 Data Validation

The validation of data for the Fish Contaminant Monitoring Program is the prime responsibility of each participating Agency's quality assurance personnel. This process includes checks for internal consistencies, inter-agency consistencies, proper sample identification, sample delivery errors, etc.

10.3 Performance and System Audits

Spiked fish flesh samples obtained from U.S. Food and Drug Administration are utilized as a performance audit for the participating laboratories. The procedures used are as follows:

10.3.1 Each participating laboratory receives 125 grams of fish composite and an ampul containing a spiking solution from USFDA.

10.3.2 The ampul is weighed and compared to the weight recorded on the enclosed weight sheet. Any deviations greater than 25 mg are reported to Joseph Washer, USFDA, phone 612/349-3934.

10.3.3 The fish composite is thawed and mixed.

10.3.4 To 50 grams of the fish in a blender, 5.0 ml of spiking solution is added.

10.3.5 The 50 grams of spiked fish, along with a 50 gram inspect portion, are analyzed for chlorinated pesticides.

10.3.6 Results for both of these samples, worksheets, and chromatograms are sent to:

Illinois Environmental Protection Agency
Bureau of Water, Surface Water Section
1340 North Ninth Street
Springfield, IL 62702
Attention: Missy Cain
217/782-3362

10.3.7 The results of these samples from all of the participating laboratories are statistically summarized. Each laboratory is assigned an I.D. number known only to their laboratory, for comparison with other participants' results.

10.4 Advisories/News Releases and Reports

Review of data results for purposes of issuing sport fish consumptive advisories will be accomplished through an inter-Agency committee. Draft advisories, prior to release by IDPH, will be forwarded to DWPC Planning, ILLINOIS EPA's Toxicity Assessment Unit (TAU), and IDNR with adequate time for comments and review prior to final approval by the Inter-Agency Committee. After a committee review, and at such other times as deemed necessary or advisable by IDPH, IDPH will issue news releases and advisories in the performance of duties in protecting the public health.

IDPH will have the primary responsibility for responding to public and media inquiries regarding advisories, IDNR and TAU will also be available to assist with these inquiries. IDNR will annually publish a list of those waterbodies where consumption advisories exist in the "Guide to Illinois Fishing Regulations." This guide is available when purchasing fishing licenses. In addition, IDPH may publish and distribute additional outreach materials as needed. The data results will be published once every five years by Illinois EPA in the "Illinois Water Quality Report", 305(b). This report will also periodically include information relating to observed trends in contaminant concentrations. It is the Illinois EPA's responsibility to update and revise this document.

Literature Cited

International Joint Commission. 1982. Proceedings of the roundtable on the surveillance and monitoring requirements for assessing human health hazards posed by the contaminants in the Great lakes Basin ecosystem.

KEY TERMS/DEFINITIONS

Accuracy - Conformance with a known value.

Composite Fillet Sample - Fish sample prepared by removing the scales and bones from the edible portion of the fish.

Field/Lab Form - Sample sheet used in the Fish Contaminant Monitoring Program which records field, lab analysis, and computer coded information.

New Contaminants - Parameters which are not analyzed on a regular basis as part of the Fish Contaminant Monitoring Program.

Non-Permanent Stream Station -A site location where fish are collected which varies yearly, depending on station locations in the Illinois EPA/IDNR Basin Assessment Program.

Performance Audit - Independently collected measurement data using performance evaluation samples (i.e., spiked fish flesh samples).

Permanent Stream Station - A site location which remains fixed in the same river reach where fish are collected.

Precision - The reproducibility of repeated measurements.

Pre-Printed Adhesive Labels - I.D. tags used for fish samples.

Quality Assurance - A term used to describe programs and the sets of procedures including, but not limited to quality control procedures, which are necessary to assure data reliability.

Quality Control - A term used to describe the routine procedures used to regulate measurements and produce data of satisfactory quality.

Routine Contaminants - The 14 parameters which are analyzed in every fish sample. (See Page 7.1)

Significant Fish Contaminant Problem - For general purposes, a sample set of fish collected from a given water body which contain 30% or greater samples requiring “No consumption” advisories using risk-based criteria, or 30% or greater excursions of USFDA action levels for any given parameter.

STORET - USEPA storage and retrieval database used for fish data generated by the Fish Contaminant Monitoring Program in Illinois.

Systems Audit - A review of the total production process which includes on-site reviews of field and laboratory's operational systems and physical facilities for sampling, calibration, and measurement protocols.

Tissue Bank - Storage for separate fish samples, for which analysis values have been determined from a sub-sample, used for retrospective analyses of contaminant levels and past human exposures.

USFDA Action Level - Concentration of a particular chemical which cannot be exceeded in fish sold for human consumption.

Wide Scan Analysis - Illinois EPA laboratory procedure used to identify contaminants not routinely analyzed for.

APPENDIX 11

FY2001 Bureau of Water laboratory analysis summary

Samples	Chlorophyll	Inorganic	Organic	Bacteria	Total	Cost of Laboratory Analysis ($)	Totals ($)
WPA6 - AWQMN	0	27,785	0	102	27,887	643,114	
WPC6 - Pesticide Network	0	0	122	0	122	93,870	
WPE6 - FRSS	0	1,550	0	0	1,550	78,943	
WPF6 - Fish	0	100	400	0	500	276,582	
WPH6 - Intensive Basin	0	5,282	140	0	5,422	160,345	
WPM6 - Lake Michigan	75	1,950	20	0	2,045	39,285	
WPL6 - Ambient Lakes	450	3,876	56	0	4,382	85,450	
WPV6 - Volunteer Lakes	0	1,500	0	0	1,500	9,209	
WP03 - ALMP/VLMP/SWI	1,135	13,058	166	0	14,359	219,192	
Total Surface Water	**1,660**	**55,101**	**904**	**102**	**57,767**		**1,605,990**
WP02	0	15,864	144	0	16,008	247,681	
WP06 (106WPC)	0	15,864	144	0	16,008	358,509	
Total Field Operations	**0**	**31,728**	**288**	**0**	**32,016**		**606,190**
Ground Water	**0**	**7,236**	**552**	**0**	**7,788**		**352,164**
Grand Total - Water	**1,660**	**94,065**	**1,744**	**102**	**97,571**		**2,564,344**