WATER-USE DATA-COLLECTION PROGRAMS AND REGIONAL DATA BASE OF THE GREAT LAKES-ST. LAWRENCE RIVER BASIN STATES AND PROVINCES

By Deborah S. Snavely

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CONVERSION FACTORS AND ABBREVIATIONS

The following factors may be used to convert inch-pound units of measure in this report to metric (International System units.

Multiply Inch-pound unit	By	To obtain metric unit
inch (in.)	2.540	centimeter (cm)
inch (in.)	2.540×10^{-2}	meter (m)
foot (ft)	.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
acre	.4047	hectare
	$.4047 \times 10^{3}$	square meter (m^2)
	$.4047 \times 10^{-1}$	square hectometer (hm^2)
	$.4047 \times 10^{-3}$	square kilometer (km^2)
acre-feet	1233.5	cubic meter (m^3)
cubic feet per second (ft^3/s)	35.31	cubic meter per second (m^3/s)
cubic mile (mi^3	4.165	cubic kilometer (km^3)
gallon (gal)	3.785×10^{-3}	cubic meter (m^3)
million gallons per day (Mgal/d	.04381	cubic meter per second (m^3/s)
	3785	cubic meter per day (m^3/d)
	3785	cubic meter per year (m^3/y)

Other Conversions and Expressions

watt (w)	1000	kilowatt (kw)
kilowatt (kw)	1000	megawatt (Mw)
kilowatt hour (kwh)	3.6×10^{6}	Joule

$>$ greater than
$\geq$ greater than or equal to

Disclaimer

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

WATER-USE DATA-COLLECTION PROGRAMS AND REGIONAL DATA-BASE OF THE GREAT LAKES-ST. LAWRENCE RIVER BASIN STATES AND PROVINCES

By Deborah S. Snavely

ABSTRACT

The Great Lakes form the largest volume of unfrozen freshwater in the world (5,000 cubic miles of water) and supply drinking water for 26 million people in the United States and Canada. The Great Lakes also form a major shipping corridor and water supply for many uses, the largest of which are public supply; domestic, commercial, and industrial use; irrigation and livestock; recreation and tourism; powerplant cooling; hydroelectric-power generation; and mining extraction. The size and importance of this resource and the need for careful management by States and Provinces and the federal governments highlight the need for a data-collection program to provide a basis for future management decisions.

The Great Lakes Charter, prepared by the Council of Great Lakes Governors' Task Force on Water Diversion and Great Lakes Institutions and signed in 1985 by the governors and premiers of the eight States and two Provinces within the basin, mandates a survey to (1) identify agencies within each of the States and Provinces that have water-use data-collection programs, and to document the data categories within each program and the methods and frequency of data compilation, and (2) design a regional water-use data base for use by the participating organizations. The data will be used to decide the advisability of proposed water-diversion and consumptive-use projects and also may be used in hydrologic models to evaluate the effects of proposed water-management strategies.

The data-collection programs in the participating States and Provinces differ widely in their water-use-category definitions and in the methods and frequency of data collection. The category with the most data is public water supply; the least documented are mining and hydroelectric-power generation.

This report compares current data-collection programs with requirements for the regional data base to determine each agency's ability to supply the data. (No State or Province can provide complete records in all categories at present.) A table summarizes each State and Province's computer hardware and software capabilities and suggests the most efficient method of data transmittal to the regional data base. Some suggestions for acquiring missing data through institutional arrangements are included.

A possible future refinement of the data base will be to require records (rather than estimates) of withdrawals by any facility using more than 100,000 gallons per day; diversions and consumptive use would also be documented. Other possible refinements include aggregating data by smaller drainage basins within each State and Province; increasing the frequency of reporting; documenting public water-supply deliveries; lowering the minimum levels for reporting; and improving and standardizing estimation techniques and methods of data collection. Some sources of water-use data and research information in each water-use category are given in a table.

The Great Lakes Commission was recommended to be the regional data-base repository to the governors and premiers by the Water Resources Management Committee after cost estimates and proposals were reviewed. Questionnaires were sent to more than 30 agencies and ministries to evaluate their interest and ability to house and maintain the data base.

INTRODUCTION

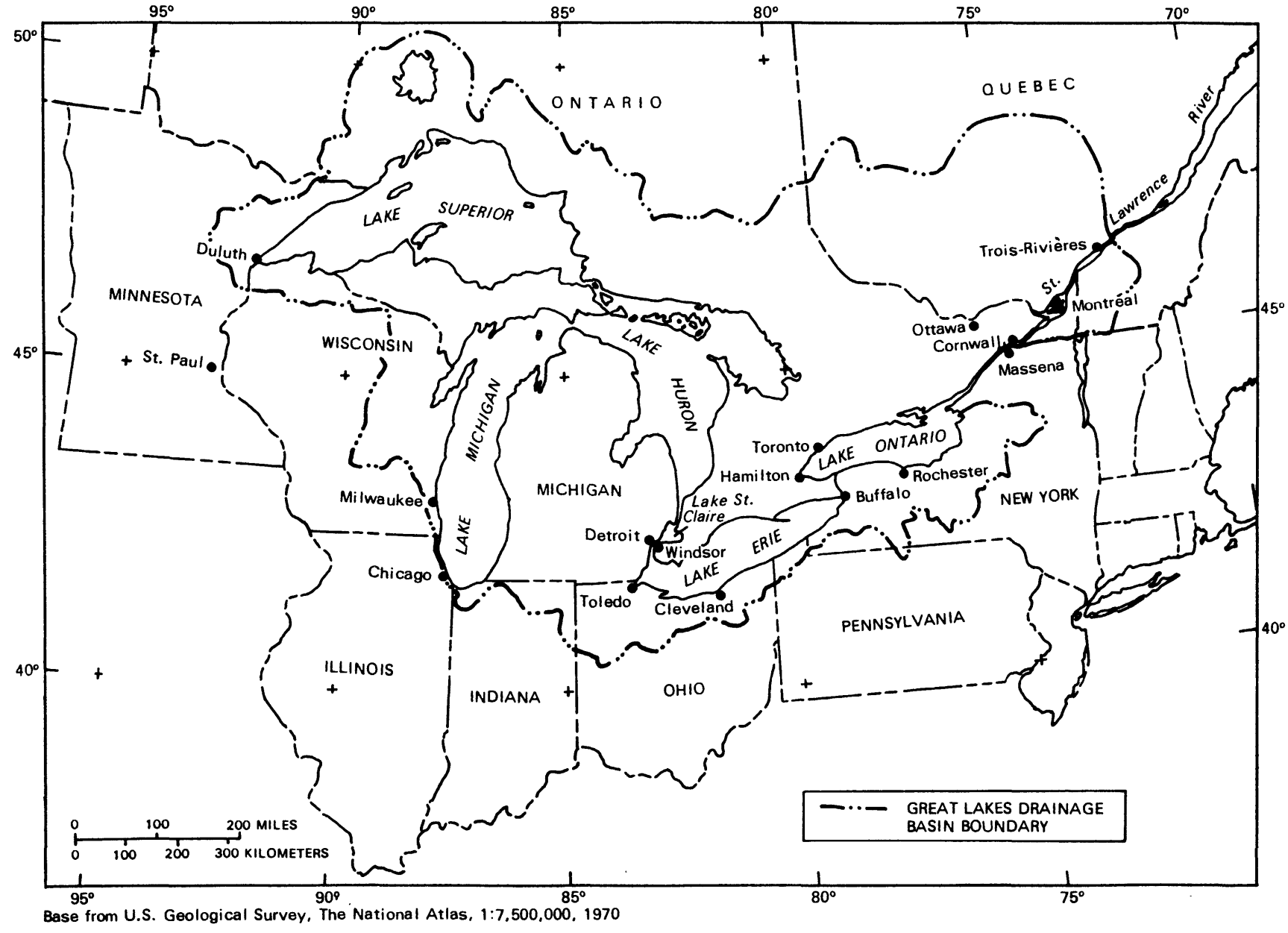
The Great Lakes, with a surface area of about 95,170 mi^2 and a volume of 5,000 mi^3, form the largest volume of unfrozen freshwater in the world. The drainage area of the Great Lakes-St. Lawrence River basin is 299,000 mi^2 at the streamflow-gaging station on the St. Lawrence River at Cornwall, Ontario (fig. 1). The drainage area of the St. Lawrence River upstream from Trois-Rivieres, Quebec, including the Ottawa River, is 100,000 mi^2. In the United States, the basin includes most of Michigan and parts of Minnesota, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania, and New York. The Canadian part of the Great Lakes basin is entirely within the Province of Ontario; The St. Lawrence drainage includes the Province of Quebec. Figure 1 indicates the part of each State and Province that is in the Great Lakes-St. Lawrence basin. The basin encompasses nearly all of Michigan but only about 75 mi^2 of Illinois.

Purpose and Scope

This report presents results of a survey of water-use data-collection programs within the Great Lakes, conducted by the U.S. Geological Survey in 1986 in cooperation with the Council of Great Lakes Governors. The first part briefly describes the economic setting and the legislation that prompted the survey. The second part describes (1) current water-use data-collection programs in each of the States and Provinces of the basin downstream to Trois-Rivieres, Quebec, and methods of data estimation used by each for categories in which no records are available, and (2) inconsistencies among the respective programs, by water-use category. The third part describes the design of the Great Lakes regional water-use data base and discusses (1) inconsistencies between the data required and the data currently available; (2) proposed refinements to the design, (3) methods for transmittal of data by each agency, (4) selection of the data-base repository location; and (5) how the data base could be used in water-management decisionmaking and in hydrologic models to determine effects of withdrawals, consumptive uses, and diversions on lake levels.

Acknowledgments

Thanks are given to those listed in the appendix who participated in the project. Special acknowledgment is extended to the following Geological Survey members, who materially contributed toward the completion of the project and of this report: James Crompton, Lee Trotta, George Gravlee, Ronald Allen, and Richard Lumia, who provided assistance in data compilation; Wayne Solley and James Peters, who coordinated many meetings and activities; Charles Merk, Nelson Williams, and Todd Augenstein, who provided much computer expertise.



Base from U.S. Geological Survey, The National Atlas, 1:7,500,000, 1970

Figure 1. Major geographic features of the Great Lakes-St. Lawrence River basin.

The Geological Survey's Acting National Water-Use Information Program manager coordinated meetings for report development and made computer experts available to research the technical computer aspects of the project, such as determining the compatibility of the many systems and how to transmit and reformat data. The Northeastern Region Assistant Program Officer attended cooperator meetings and acted as liaison between the project chief and headquarters.

U.S. Army Corps of Engineers provided information on their computer models of the Great Lakes. The International Joint Commission provided information on past and present research on Great Lakes levels and water use. Environment Canada presented information on Great lakes water-use modeling and projections.

GREAT LAKES AND ST. LAWRENCE RIVER

Economic Role

Large metropolitan areas have developed along the lakes and river, including Toronto, Hamilton, Windsor, Montreal, and Ottawa in Canada; and Chicago, Milwaukee, Detroit, Toledo, Cleveland, Buffalo, and Rochester in the United States (fig. 1). The lakes and rivers of the drainage system provide transportation, hydroelectric-power generation, fisheries, and water for industry, tourism, recreation, and public water supplies. As a joint Canadian-American resource and responsibility, the drainage system presents unique water-management problems that affect about 60 percent of Canada's population and 15 percent of the United State's population that lives near the lakes.

Historically, the economy of the Great Lakes basin has been largely industrial. One-fifth of United States manufacturing is based along Great Lakes shores, including 70 percent of the nation's steel production, more than half of its automobile and machine parts, and more than a quarter of its chemical production (Milliken, 1984, p. 13). Almost half the Canadian manufacturing is on the Great Lakes (Great Lakes Governors Task Force on Water Diversions and Great Lakes Institutions, 1985, p. 6).

Power generation represents the largest demand on water resources within the Great Lakes basin. In 1983, 23.7 billion kwh of hydroelectric power were generated in the United States and another 20 billion kwh in Ontario by water flowing through the lakes (Great Lakes Governors Task Force on Water Diversions and Great Lakes Institutions, 1985, p. 6).

The Great Lakes-St. Lawrence Waterway is the world's largest and one of the most important waterways; it is navigable for 2,400 mi from the Atlantic Ocean to the head of Lake Superior and is being continually developed and maintained by both the United States and Canada (Timbrell, 1984, p. 204).

Need for Water-Use Data

The two countries' vast and growing economic dependence on this lake and river system has caused an urgent need for documentation of water use and for a regionwide data base that represents the rates of withdrawals, diversions, and consumption within each category by each Great Lakes State and Province. The

following discussion provides an overview of the magnitude of withdrawals in the United States and Ontario, by water-use category. These data are derived from a variety of sources and methods of compilation in each State and Province and are presented for general comparison only.

Almost 70 percent of the water withdrawn in the basin is for hydroelectric powerplants (fig. 2A). Water use in the Great Lakes basin in the Province of Ontario is similar to that of the basin as a whole (fig. 2B).

The percentage of withdrawals that consist of ground water in the United States part of the basin are plotted by category in figure 3. The percentage of surface water in each of four categories in the United States part of the basin is shown in figure 4A, the percentage of ground water in figure 4B. Although nearly 36 Bgal/d of surface water is withdrawn, only about 2 Bgal/d of ground water is withdrawn. The reason for this discrepancy is that thermoelectric (fossil-fuel and nuclear) powerplant cooling accounts for a high percentage of water withdrawn and depends almost entirely upon surface water.

Water that is withdrawn can either be consumed or returned to the hydrologic system. The amount of water that is returned after use is plotted by category in figure 5. Most of the water withdrawn to cool thermoelectric power plants is returned, whereas only a small percentage of that withdrawn for irrigation is returned. The plot does not specify, however, whether the water is returned to the basin or diverted away.

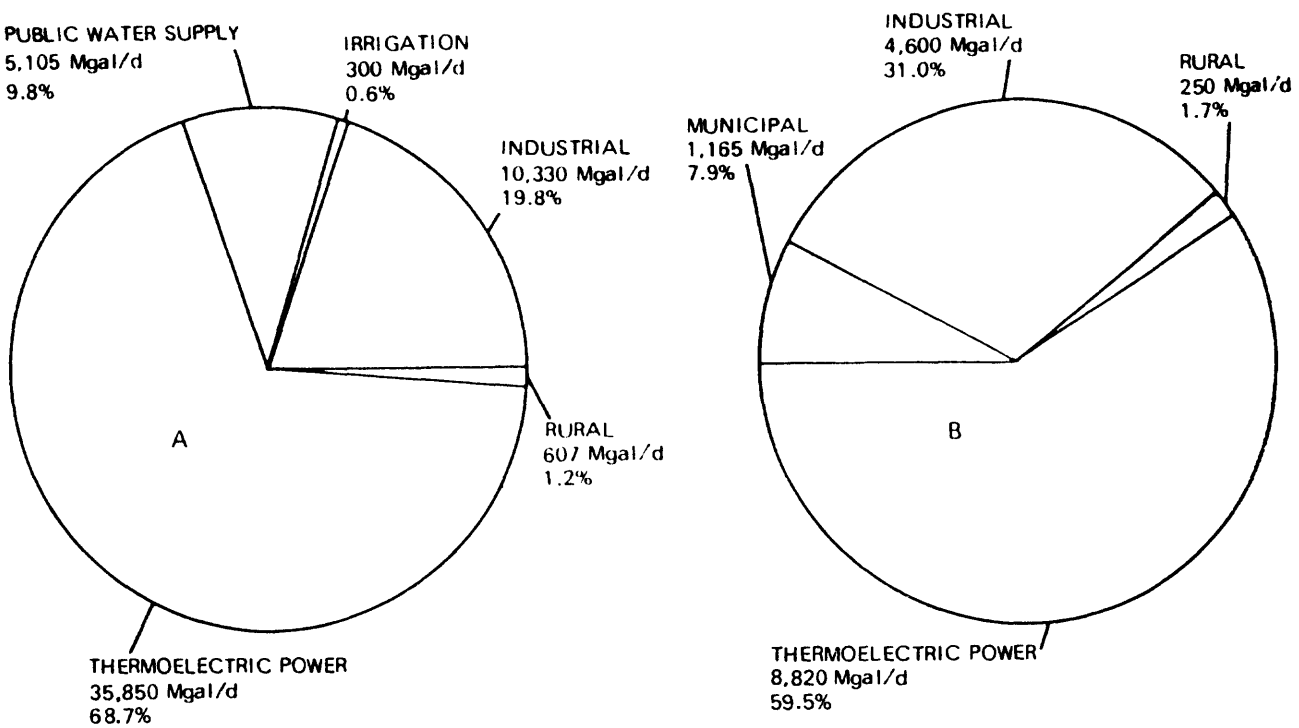
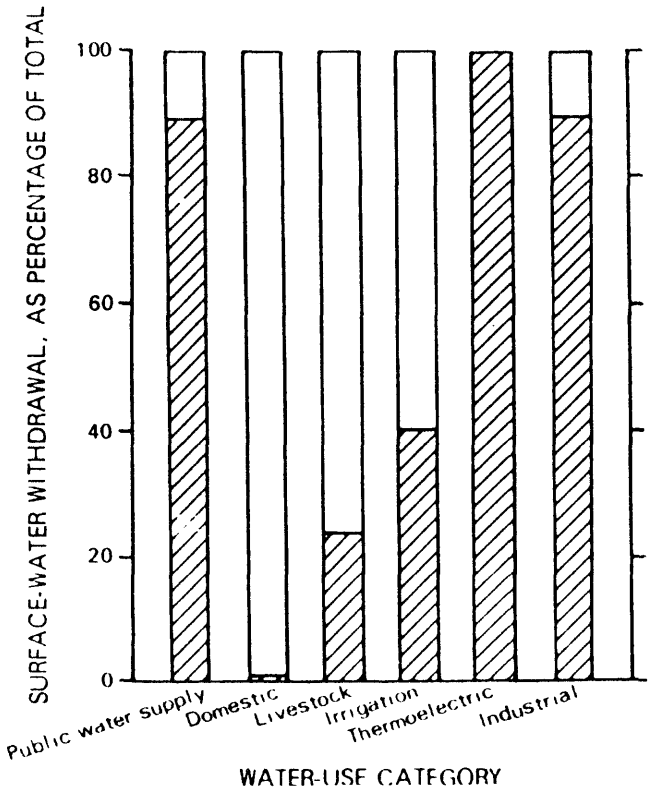


Figure 2. Total water withdrawals from the Great Lakes basin, by category: A. Entire basin. B. Province of Ontario. (Data from Solley and others, 1983 and Ontario Ministry of Natural Resources, 1984)



Category	Percent Surface Water
Public water supply	88.8
Domestic	1.1
Livestock	23.8
Irrigation	40.0
Thermoelectric power	99.9
Industrial	89.0

SURFACE WATER

GROUND WATER

Figure 3.

Ground-water withdrawals in relation to surface-water withdrawals in Great Lakes basin in the United States, by category. (Data from Solley and others, 1983)

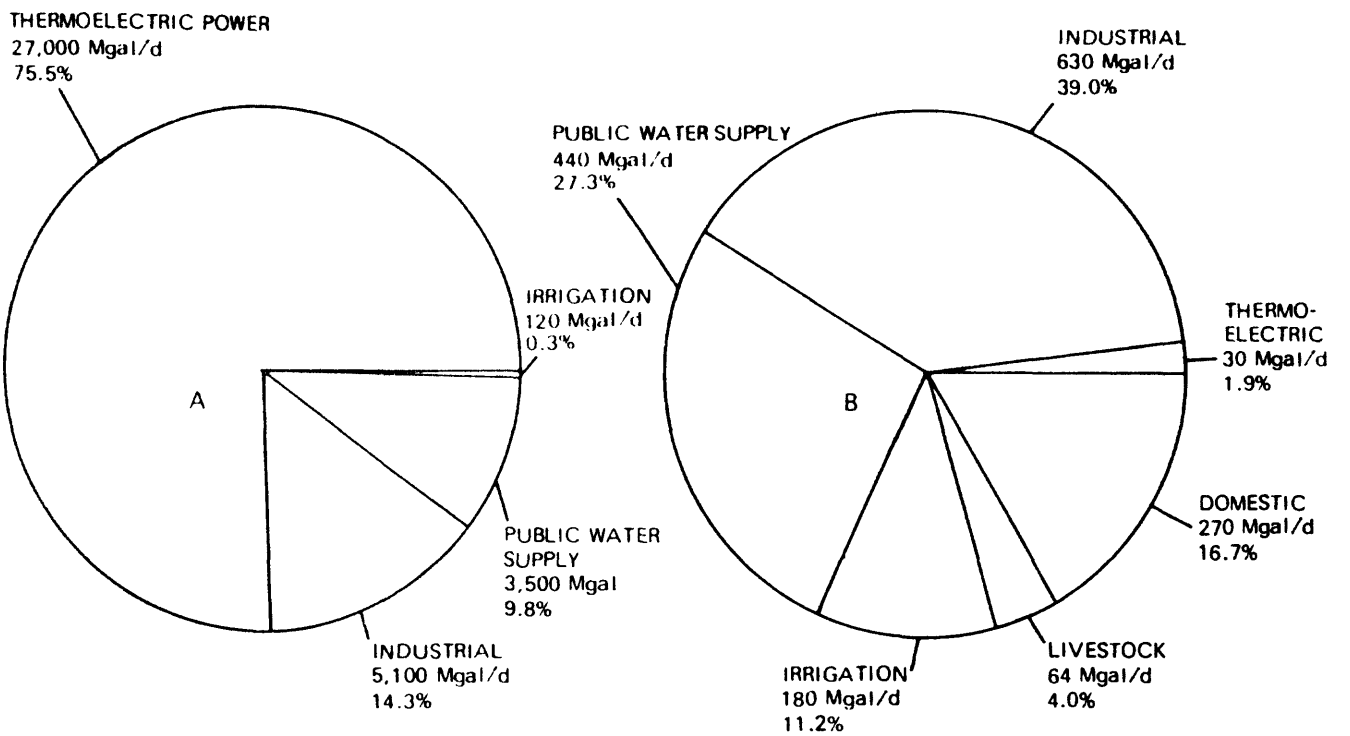


Figure 4. Withdrawals from the Great Lakes basin in the United States, by category: A. Surface water. B. Ground water. (Data from Solley and others, 1983)

Consumptive use in the United States part of the Great Lakes basin is plotted by category in figure 6; here industrial water use, thermoelectric, and public supply each represent approximately equal amounts of consumptive use and together account for more than 80 percent of total.

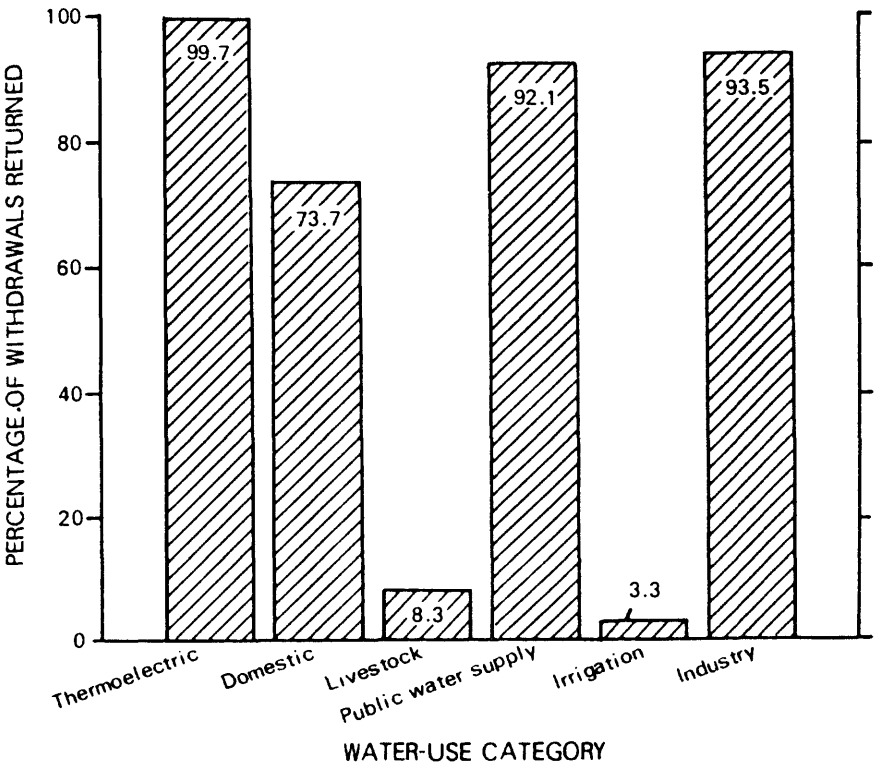


Figure 5.

Percentage of total withdrawals in the Great Lakes basin in the United States that are returned, by category. (Data from Solley and others, 1983)

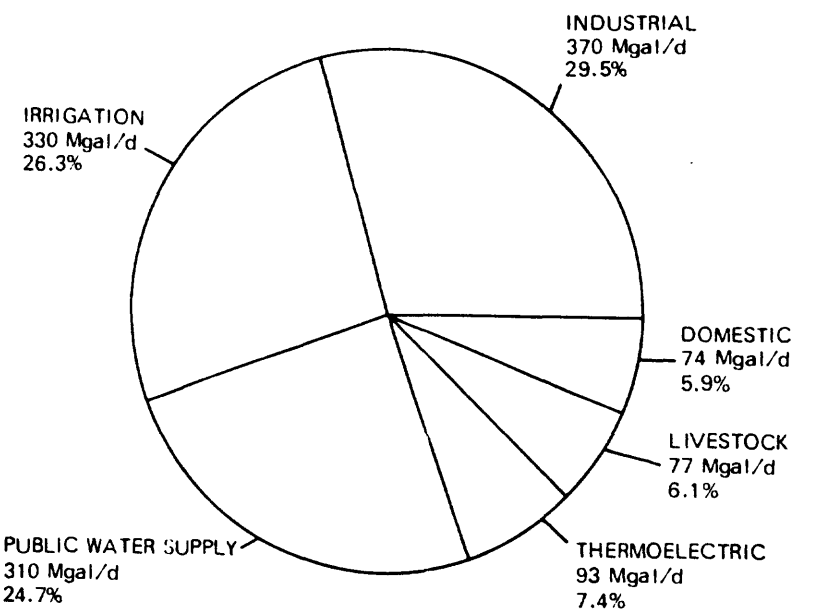


Figure 6.

Consumptive use in the Great Lakes basin in the United States, by category. (Data from Solley and others, 1983.)

Water-Management Participitation

The size and importance of this resource and the need for careful management by the State, Provincial, and Federal governments highlights the need for a data-collection program to provide a basis for future management decisions. To help meet these objectives, both countries have formed organizations and required agencies to monitor withdrawals and to promote the exchange of information.

The Council of Great Lakes Governors is an organization designed to develop, administer, and coordinate programs and projects that will stimulate economic, community, and environmental development in the six member States of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. This includes promotion of communication and cooperation among the States and Canada with regard to issues and problems of mutual concern and responsibility. The State of New York and the Commonwealth of Pennsylvania have the right to vote on water-related issues, and the governments of Quebec and Ontario are closely involved with the Council regarding management of the basin's water resources.

In May 1983, the Council of Great Lakes Governors adopted a resolution that called for the appointment of an interstate staff committee to examine various Great Lakes institutions and make recommendations for improving the structure of organizations in the region.

The Great Lakes Governors Task Force on Water Diversion and Great Lakes Institutions' final report to the governors and premiers of the Great Lakes States and Provinces (1985) presents information in three areas:

1. The need for Regional Action:
   This part of the report provides rationale for water management based upon factors such as the economic impact of the Great Lakes and describes the institutional and legal framework.

2. Protecting the Water Resource of the Great Lakes Basin:
   This part of the report includes the Task Force's findings and recommendations regarding diversion.

3. Institutional Capabilities in the Great Lakes Region:
   This part deals with individual Great Lakes organizations and the relationships between them.

Part two of the report declares the Great Lakes to be a valuable regional, national, and international resource and recommends a broad protection strategy to manage and use the Great Lakes resources. This protection and management policy is embodied in the document titled "The Great Lakes Charter," the purposes of which are to:

- conserve the levels and flows of the Great Lakes and their tributary and connecting waters;

- protect and conserve the environmental balance of the Great Lakes basin ecosystem;

- provide for cooperative programs and management of the water resources of the Great lakes basin by the signatory states and provinces;

- make secure and protect present developments within the region;

- provide a secure foundation for future investment and development within the region.

(Great Lakes Governors Task Force on Water Diversions and Great Lakes Institutions, 1985, p. 22.)

The Great Lakes Governors Task Force on Water Diversions and Great Lakes Institutions recommended that the governors and premiers of the Great Lakes States and Provinces sign and enter into the Great Lakes Charter, which they did in February 1985. The Great Lakes Charter represents a historically significant agreement in the Great Lakes region. It establishes an unprecedented commitment by all of the Great Lakes States and Provinces to cooperate in the management of basin water resources for the benefit of the region as a whole in the recognition that such cooperation is also to the advantage of the individual States and Provinces. The agreement stands as a firm expression of shared concern and joint political will regarding the region's economic and environmental future as it relates to shared water-resources management.

The signing of the Great Lakes Charter authorized formation of the Water Resources Management Committee, which is composed of representatives appointed by the governors and premiers of each of the Great Lakes States and Provinces.

The Committee was charged with the responsibility to:

- identify specific common water-data needs,

- develop and design a system for the collection and exchange of comparable water-resources-management data,

- recommend institutional arrangements to facilitate the exchange and maintenance of such information,

- develop procedures to implement the prior-notice and consultation process established in this Charter.

(Great Lakes Governors Task Force on Water Diversions and Great Lakes Institutions, 1985, p. 24.)

Great Lakes Project

To help meet the objectives stated above, the Council of Great Lakes Governors in 1985 formally entered into a cooperative agreement with the U.S. Geological Survey to assemble pertinent information on data-collection programms in the Great Lakes States and Provinces. This effort is hereafter referred to as the Great Lakes Project, the objectives of which are summarized in the following section.

Objectives

1. Analyze and describe the water-use data-collection activities in each State and Province in the Great Lakes-St. Lawrence River basin downstream to Trois-Rivieres, Quebec (fig. 1), and to describe the types of data collected and the methods of data collection, transfer, storage, and reporting.

2. Design a regional water-use-data base by specifying the categories, identifying those that are not currently addressed, and determining the methods by which each State and Province could best transmit data to the data base.

3. Identify gaps in each State's and Province's data programs and document inconsistencies relative to one another, relative to the mandates of the Great Lakes Charter, and relative to requirements for the regional data base.

4. Suggest methods of collecting missing data, including institutional arrangements.

5. Present the findings of the above objectives in a summary report.

Previous Study

A survey and preliminary evaluation of water-use data-collection systems in the Great Lakes region was made by the Great Lakes Commission's Water Data Collection Task Force; results are summaried in a report by the Great Lakes Commission (1985). The information and data given in that report provided a starting point for the Great Lakes Project.

Methods of Investigation

The Great Lakes project chief, based in the Albany, N.Y., office of the U.S. Geological Survey, requested the head of the Geological Survey's National Water-Use Information Program[1] in each of the other Great Lakes States (Illinois, Indiana, Michigan, Minnesota, Ohio, Pennsylvania, and Wisconsin) to document the programs in their State and to act as liaison between the Great Lakes project chief and the agencies that collect water-use data. Those Geological Survey members were incorporated into the Great Lakes project; their names are listed in the appendix.

A questionnaire about the collection, recording, storage, and reporting of water-use data was issued to the project representative in each State. One copy was to be filled out for each water-use category (such as public water supply)

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[1] The National Water-Use Information Program was designed by the U.S. Geological Survey as a cooperative program between the States and the Federal government to collect, compile, study, store, and publish water-use data (Mann and others, 1982). Geological Survey staff in each State work with local and State agencies on that program.

for each agency that collects data in that category. The questionnaire was completed through research and interviews with the agencies. The same procedure was followed with the provincial ministries of Quebec and Ontario. The Great Lakes project chief also held interviews in each State and Province to verify that all appropriate agencies and ministries had been identified and that the data-collection programs were accurately described. Descriptions of the programs in each State and Province were structured after those given in the preliminary evaluation report by the Great Lakes Commission (1985) to the extent possible.

A second questionnaire was circulated to obtain a description of the actual formats of data entry used in the agencies' computerized-data files. At this time it was also determined which data were stored both in local agency files and in Geological Survey water-use data bases, either locally or at Geological Survey headquarters in Reston, Va.

Many agencies, ministries, and other groups were contacted by questionnaire to ascertain whether they were using or storing basinwide hydrologic-budget models and(or) would like to be considered as the repository site for the regional water-use data base. Copies of all questionnaires are available from the Geological Survey office in Albany, N.Y.

A computerized bibliographic search was done at the Geological Survey's National headquarters in Reston, Va., to determine:

1. What groups or individuals may have water-use data that could be incorporated into the program at some later time, and

2. Who is doing research on water use and could possibly provide information on withdrawal, estimation procedures, or techniques of data collection.

The list of references at the end of this report contains some entries obtained through the literature search. The actual documents may be secured from the Great Lakes project representative in each Province and the Geological Survey offices in each State.

CURRENT WATER-USE DATA-COLLECTION PROGRAMS

This section describes the 1986 water-use data-collection programs within each State and Province within the Great Lakes-St. Lawrence River basin and also water-use programs conducted by the U.S. Geological Survey and Environment Canada. The latter two are included because they interface with the States and Provinces and may participate in the transmitting of data to the regional water-use data base.

A general overview of the water-use data-collection programs in each State and Province is given in table 1 (at end of report). The table is designed for use with the program descriptions that follow. The water-use-data-collection activities of each State and Province are given in table 2 and summarized by water-use category in table 3; category definitions that are recognized by the individual States and Provinces are given in table 4. All tables are at the end of the report.

The data-collection programs described below pertain primarily to the compilation of withdrawal data. Reference is made to the collection or availability of diversion or consumptive-use data, but most programs involve withdrawal data almost entirely. The lack of diversion and consumptive-use data has vast implications with regard to the requirements of the Great Lakes Charter.

Illinois

Program Description

Illinois is unique among the Great Lakes States in that the part of the State that drains to Lake Michigan is extremely small (75 mi^2) area (fig. 1). Withdrawals in all categories are relatively small because of the small area. However, diversions from Lake Michigan provide water for many people and a variety of uses, primarily as deliveries of public water.

The water-use data-collection activities in Illinois are done by two State agencies--Illinois Department of Transportation, Division of Water Resources (IDOT) and Illinois Department of Energy and Natural Resources, Illinois State Water Survey (ISWS).

IDOT.--This agency has the authority to issue allocation permits to any entity desiring to divert water from Lake Michigan. In 1967, the U.S. Supreme Court established a diversion limit of 3,200 ft^3/s of Lake Michigan water, equivalent to 2.1 Bgal/d (Barker, 1985, p. 1). The 3,200 ft^3/s limit applies to all Illinois uses of Lake Michigan water, including domestic and industrial. During 1977-80, the IDOT worked with the Attorney General of Illinois to modify the 1967 decree, and, on December 1, 1980, the U.S. Supreme Court approved several significant changes designed to allow Illinois to make more efficient use of its diversions and also requires a complete accounting of all diversions from Lake Michigan by Illinois.

Among the terms of the decree are procedures for applying for and obtaining an allocation permit. Regulations also require that all permittees with an intake structure on Lake Michigan submit, within 30 days of the end of each month, a report that gives the daily pumping rates, the monthly average pumping rates, and the average daily supply transferred to other facilities. This also applies to all permittees who are the first Illinois users of Lake Michigan water that is diverted out of the basin. All permittees who do not have intakes on Lake Michigan but use Lake Michigan water are required to report total water use annually. Copies of the monthly pumpage report and annual water-use forms are available from the U.S. Geological Survey office in Albany, N.Y. At present, 16 permittees submit monthly and annual reports, and 182 others submit annual reports only.

ISWS.--This agency does not have a legal mandate to collect water-use data, but as the State's water-research agency and repository for water data, it has assumed the responsibility. Each year, the ISWS circulates a computer-generated questionnaire to public-water suppliers and self-supplied industries regarding total annual water use. Although response is voluntary, the ISWS sends its questionnaire with the IDOT annual audit, which encourages response. The ISWS also uses drillers' logs and well schedules to identify larger diameter wells

(4-inch or 6-inch) to aid in estimating water use for irrigation. The ISWS also estimates self-supplied domestic and livestock water use, although Illinois has no water users for these categories in the Great Lakes basin.

Methods of Estimation

Illinois uses estimation techniques for three categories of water-use data--domestic self-supplied, irrigation, and livestock. The techniques used are described by Kirk and others (1985, p. 7) and summarized below.

Domestic.--Domestic withdrawals are computed by multiplying the population that is not served by public water supplies in each county by an estimated rural district per-capita water-use value. This district value is derived by averaging the per-capita water-use value of all public water-supply systems that serve 800 or fewer persons outside municipalities and that serve two, one, or zero commercial establishments. The derived rural domestic per-capita use ranges from 68.8 gal/d in the west district to 91.6 gal/d in the northeast district. This approach is used statewide; no domestic self-supplied users are in the Illinois part of the Great Lakes basin.

Irrigation.--Irrigation estimates are based on weekly regional rainfall deficits and the number of acres irrigated. The acreage values are listed in the annual Illinois Census of Agriculture published by the U.S. Department of Agriculture and are updated with the help of the University of Illinois Cooperative Extension Service and the ISWS Northern Regional Office. Rainfall deficits are calculated by the ISWS.

Livestock.--Withdrawals for livestock are estimated from a fixed amount of water used per head for each type of animal and the population of each of six types of livestock. County livestock populations are obtained from the U.S. Department of Agriculture through the annual Illinois Census of Agriculture; daily consumption rates obtained from previous studies by ISWS are tabulated below:

Animal class	Amount (gal/d)	Animal class	Amount (gal/d)
Milk cow	35	Sheep	2
Horse, mule, cattle	12	Chicken	0.06
Hog	4	Turkey	0.12

In summary:

1. The IDOT has allocation-permit authority with mandatory metering and reporting for all diverters of Lake Michigan water. The categories for which it has data are public supply and self-supplied industrial.

2. The ISWS conducts surveys and estimates water use through a program of voluntary response; it has no trigger levels. The categories for which the ISWS has water-use records are thermoelectric powerplants, industrial self-supplied, and public water supply; categories for which it provides estimates are domestic, irrigation, and livestock. ISWS collects both ground-water and surface-water data.

Indiana

Program Description

The water-use data-collection program in Indiana is conducted almost exclusively by the Indiana Department of Natural Resources, Division of Water (IDNR). In 1983 the Indiana General Assembly enacted the Water Resources Management Act, (IC 13-2-6.1), which is administered by the Indiana Natural Resources Commission through the IDNR. This statute requires the registration of all "significant water withdrawal facilities," which it defines as any facility with the total capability of withdrawing more than 100,000 gal/d of ground water, surface water, or ground and surface water combined. This would include all wells and surface-water intakes having an aggregate daily pumping capability of at least 70 gal/min.

Facilities in operation before July 1, 1984, were required to be registered with the IDNR by January 1, 1985; newly constructed facilities must register within 3 months of completion.

The IDNR water-registration form recognizes 14 categories of water use, which it combines into six major categories--public supply, industrial, irrigation, energy production, rural, and miscellaneous. In addition to requiring initial registration, the 1983 Act requires that owners of registered facilities report their annual water withdrawals beginning with calendar year 1985. Public-water supply information is also available from the Indiana State Board of Health (ISBH).

The State of Indiana has conducted surveys of water use in the past; one was an inventory of all water used in Indiana and published in the Governor's Water Resources Study Commission (1980a, 1980b). One of the recommendations was that inventories be updated. As a result, the IDNR began a new survey of water withdrawals in 1981.

Since the enactment of the Water Resources Management Act in 1983, the State will have comprehensive water-withdrawal data from users who take at least 100,000 gal/d; data on users characteristically beneath that limit are given in the earlier surveys. Two such categories are domestic self-supplied and livestock water use. Results of a 1980 survey of domestic self-supplied and livestock water uses in Indiana (Indiana Department of Natural Resources, Division of Water Resources, 1982) provides data in these categories and documents techniques of estimation.

Methods of Estimation

Indiana uses estimation techniques for only two categories--domestic self-supplied and agricultural-livestock--because withdrawals in all other categories generally exceed the mandatory registration/reporting limit of 100,000 gal/d. The estimation techniques are described in Indiana Department of Natural Resources, Division of Water Resources (1982).

Domestic Self-Supplied.--This calculation is based on the county population totals given by the U.S. Bureau of Census and the total number of public water

users in each county, as maintained by the IDNR and ISBH. The number of domestic self-supplied water users is obtained by subtracting the number of public-water users from the total population of each county.

Once the domestic self-supplied population for each county is determined, a quantity representative of per-capita domestic self-supplied use is calculated. Because the demand for water in the southern part of the State is significantly greater than in the north, an average per-capita figure is calculated for each of the two regions. Withdrawals by municipal water systems that serve primarily domestic water uses in each region were selected because they do not provide significant quantities of water for industrial users and therefore roughly approximate the per-capita use for domestic self-supplied populations. The estimated self-supplied domestic per-capita use of water in the north region is 76.46 gal/d, and that in the south region is 73.64 gal/d. (The Great Lakes part of the State is in the north region.)

Agricultural-Livestock.--This calculation is based on livestock-population and water-consumption values. Livestock-population estimates are obtained through annual crop and livestock summaries published by the U.S. Department of Agriculture. Population data for beef cattle, dairy cattle, hogs, and poultry are available by county; data for turkeys and sheep are available only by State total.

The water-consumption data for each livestock class are derived from several sources of information. Because each source is based on different variables, a range of values is used for this computation. (Variables that most strongly affect water use are the maturity and sex of the animal and environmental conditions at which the animal is kept.) Ranges obtained for each animal class are as follows:

Animal class	Amount (gal/d)	Animal class	Amount (gal/d)
Beef cattle	8 to 15	Sheep	10 to 2
Dairy cattle	15 to 30	Chickens	0.05 to 0.15
Hogs	2 to 6		.05 to .26

In summary:

1. The IDNR administers a program whereby any facility that withdraws 100,000 gal/d or more of ground water or surface water must register with the IDNR and report water withdrawal annually.

2. The IDNR estimates withdrawals for the smaller use categories of domestic self-supplied and livestock.

3. No agency is mandated to collect water-use information on hydroelectric powerplants, but IDNR has obtained a consultant in the past to provide this information.

Michigan

Program Description

The water-use data-collection and storage responsibilities have been divided among three agencies in Michigan--Michigan Department of Natural Resources (MDNR), the Michigan Department of Public Health (MDPH), and the U.S. Geological Survey (USGS). A fourth group, the Great Lakes and Water Resources Planning Commission (GLWRPC), was created in September 1985.

GLWRPC.--This organization was created as a temporary (2-year) commission to:

1. Compile the State and Federal laws, rules, and regulations and, common-law principles associated with the use and protection of the State's waters;

2. Compile all available information on the hydrologic cycle in Michigan;

3. Analyze and project the future water requirements of agriculture, industry, recreation, navigation, domestic consumption, and ecosystems in Michigan;

4. Identify the potential problems associated with meeting the projected demand for water described in item 3;

5. Analyze the environmental and economic effects of consumptive uses, redistributions, and water diversions on the waters of Michigan;

6. Determine whether an additional economic benefit would accrue to the State from new or expanded use of the waters, particularly through recreation and tourism;

7. Analyze the State's progress in meeting the objectives of (1) the Federal Water Pollution Control Act (Public Law 92-500, 86 Stat. 816), (2) the agreement between the United States and Canada (known as the Great Lakes Water Quality Agreement of 1978), and (3) Act No. 245 of the Public Acts of 1929 (sections 323.1 to 323.13 of the Michigan Compiled Laws);

8. Recommend legislation or policy needed to promote comprehensive and optimal use, management, and protection of State's water resources.

To fulfill this directive, the GLWRPC has adopted an operating structure to address eight priority issues covering:

- the role of local government in water resources management;
- competing water uses;
- point/nonpoint-source pollution;
- ground-water management;
- water-data needs;
- financial resources for and commitment to water-resources planning and management;
- assessment of water-related programs in government; and
- diversion and management of Great Lakes water.

The GLWRMC will issue a draft water-resources-management plan in early 1987. This plan will address, among other topics, the issue of water-use-data collection.

MDPH.--At present, the MDPH collects information on public water supply under legal mandate of the Michigan Safe Drinking Water Act, Act 399. Withdrawal information is collected by required metering; the public-supply operators submit monthly reports.

MDNR.--The MDNR collects water-use data in categories other than public water supply primarily through intermittent surveys. (This will be done by the GLWRPC in 1986-87.) The MDNR and the GLWRPC have been working with the U.S. Geological Survey office in Lansing to periodically compile, estimate, and computerize data for water-use reports and transmittal to the Geological Survey's National Water Use Data System, described further on.

Methods of Estimation

Estimation and compilation of water-use data by the U.S. Geological Survey in Michigan involves a variety of techniques applied to all categories of water use except public-water supply. The categories of irrigation and agricultural involve some data collection and application of coefficients; domestic self-supplied, commercial, industrial, and mining are estimated without data collection. The electrical power-generation categories have data based upon inventory. Following are the procedures used by the Geological Survey office in Lansing in 1986 for its 5-year data compilation on water use in the United States.

Domestic.--A listing of all water-supply systems in the State was obtained from the MDPH and analyzed for size of supply, population served, type of service (industrial, commercial, domestic), and degree of detail provided. It was found that the State's three largest water-supply systems supply over 90 percent of the State's public supplied water, and the largest of these, Detroit Metropolitan, supplies 60 percent. These larger systems, as well as the smaller ones, have reported the percentage of water supplied to domestic, commercial, industrial, and other meters. Hence, the percentage reported as supplied to domestic meters over the past 10 years of record was averaged, and the average multiplied against the total supply reported from the system for the last year. These same systems also report the amount withdrawn from surface- and ground-water sources, and from these data the percentage of surface water and ground water were obtained. The self-supplied domestic value was then calculated by subtracting the population on public supply from the total population. Public-supply water use ranged from a high of 142 gal/d per person in densely populated urban areas to a low of 63 gal/d per person in sparsely populated rural areas; the range of ground-water use for domestic self-supplied is from 3 to 100 percent. Consumption is estimated to be 38 percent.

Irrigation.--Withdrawal amounts are projected from sample populations established in a 1977 survey of irrigators (Bedell and Vantil, 1979), which is currently being followed up with 1980 data. The projections allow for changes in crop prices, number of acres under cultivation, and population changes. Consumptive use in this category is estimated to be 95 percent.

Thermoelectric Power.--Data on water use for thermoelectric-power generation in 1985 is acquired from the U.S. Department of Energy. The figures were compared to those developed by Westinghouse Hanford Engineering Development Laboratory (1985) and a survey made by the State of Michigan in 1983 of all thermoelectric-power generators, which received a 100-percent response. Consumptive use, although low, was assumed accountable and was reported to be 1.3 percent.

Hydroelectric Power.--The same procedure is used for the hydroelectric category as for thermoelectric, except that the State did not survey hydroelectric generators, and the consumptive use is considered to be zero.

Commercial and Industrial.--Commercial and industrial self-supplied withdrawals are estimated, in a fashion similar to domestic self-supplied, from the public water-supply records. The public-supply data can be used to determine a range of water-use coefficients for industries. Applying these coefficients to the number of industries reported in the Census of Manufactures (1986) yields an approximate water-use figure for industrial and commercial establishments. These are then compared to previous years' reported amounts to verify that they reflect the decline or increase in manufacturing that has taken place in recent years. The range of water-use coefficients is from 67 to 216 gal/d per person for commercial uses and from 160 to 4,074 gal/d per person for industry. Consumptive use was estimated to range from 3 to 10 percent in both categories. Commercial users are 80 percent public supplied, and industrial users are 90 percent self supplied.

Agriculture.--Data in this category are estimated from livestock population and per-capita-use figures supplied by the Michigan Department of Agriculture and the Agricultural Extension Service of Michigan State University. Six livestock categories representing 99 percent of all livestock raised in Michigan were used. These and their respective per-capita water-use values are:

Animal Class	Amount (gal/d)	Animal Class	Amount (gal/d)
Cattle	12	Hogs	3
Sheep	1	Chickens	.03
Horses	10	Turkeys	.12

Mining.--Mining water-use data are not collected and therefore must be estimated. The best sources from which to estimate the data were the U.S. Geological Survey's previous 5-year water-use reports and the Industrial Facilities Discharge file of the U.S. Environmental Protection Agency. The value obtained from the latter was disaggregated into use categories so that the mining operations with discharge permits could be identified. These operations were then identified as to type of mining, either minerals or sand and gravel. The reported discharges from these facilities were then compared to their permitted discharge amounts, and the reported mining water use was disaggregated from the U.S. Geological Survey's 1980 water-use report (Solley and others, 1983) to obtain a value. Because this number would be too high for sand and gravel operations, the value was divided to represent the differences inherent in the two types of mining, and the numbers adjusted to reflect the decline in this industry over the past 5 years. Consumptive use was considered 100 percent for saline waters and 23 percent for freshwater. An amount of freshwater equal to 5 percent of the total saline water withdrawn is used in the dilution of the saline waters and is included in the 23-percent freshwater consumption value.

In summary,

1. MDPH collects monthly public-water supply data by legislatively mandated reporting of metered flow.

2. MDNR makes an intermittent survey of irrigators and thermoelectric powerplants; a survey of irrigators was done in 1977, and a survey of thermoelectric-power generation and water use was done in 1983. These data are aggregated by county and drainage basin and stored in the National Water Use Data System of the U.S. Geological Survey.

3. The U.S. Geological Survey estimates withdrawals for the remaining categories every 5 years in conjunction with the MDNR.

Minnesota

Program Description

The water-use data collection-program in Minnesota centers around the authority granted the Minnesota Department of Natural Resources, Divison of Waters (MNDNR) by Minnesota Statute 105.41. The law requires appropriation permits of all users withdrawing more than 10,000 gal/d or 1 Mgal/yr. This permit authority essentially covers all but domestic users. Applications must be submitted for each ground-water or surface-water source from which water is proposed to be appropriated. The permittee is required to report water use annually to the MNDNR (Minnesota Land Management Information Center, 1984). The report must also include total number of gallons withdrawn each month, so data are reported monthly as well as annually. Annual water-use-report forms are computer generated for all active permittees from an annually updated mailing list.

The water-use data for Minnesota are stored on the Minnesota State Water Use Data System (herein referred to as MNSWUDS). The development of MNSWUDS was a combined effort of the MNDNR, the Minnesota State Planning Agency/Land Management Information Center (LMIC), and the U.S. Geological Survey (Minnesota Land Management Information Center, 1984). The MNSWUDS is stored on the Prime 9955 minicomputer at LMIC. The system uses the INFO relational data-base-management system developed by Henco, Inc. of Waltham, Mass. The MNSWUDS is made up of six separate data bases corresponding to the six MNDNR administrative regions. All data bases have the same design; each has six main data files describing ownership, location, water-resource type, water-use type, and volumes of water appropriated and discharged (Minnesota Land Management Information Center, 1984).

The annual reported data are edited by the MNDNR and keyed at the Minnesota Information Management Bureau, and the files are sent to the University of Minnesota CYBER computer for Fortran sorting and finally to the LMIC, where they are stored on the Prime 9955 in the MNSWUDS. From there the file can be downloaded to the IBM-XT personal computer at the MNDNR, which has INFO for the personal computer installed on it.

The annual reported water-use information also has been aggregated every year since 1980 by major use category, county, and watershed for the Geological Survey's National Water Use Data System, which is stored on the mainframe computer in Reston, Va. (The MNDNR major watersheds are the same as the Geological Survey's hydrologic-unit boundaries.)

The MNDNR also conducts surveys for projects and particular needs such as estimating consumptive use. For one such 2-year allocation project, it mailed

survey forms to all industrial and commercial permit holders and to all municipal water suppliers. The MNSWUDS data base also is supplemented by estimates of unreported water use for municipal, industrial, and commercial water withdrawals. These methods are explained below.

Methods of Estimation

The MNDNR estimates withdrawals for the categories of public-water supply, industrial, and commercial self-supplied for facilities that do not have an allocation permit or do not submit annual reports of water withdrawal.

Public Water Supply.--For nonpermitted users, the MNDNR obtains lists of companies from the Minnesota Health Department (MDH) and the Minnesota Pollution Control Agency (MPCA). The MDH list indicates all facilities in the State that have their own water supply; the MPCA list indicates all facilities that have a National Pollution Discharge Elimination System (NPDES) permit from the U.S. Environmental Protection Agency. Both lists give withdrawal values.

For permitted users, the MNDR calculates annual water use for municipalities under a MNDNR grandfather permit from the population served. Until 1966, municipalities were exempt from reporting annual water use to the MNDNR, and MNDNR did not require a water-appropriation permit until 1973. Consequently, a few municipalities remain referenced by a MNDNR grandfather permit number. The MNDNR water-appropriation staff is making an effort to issue MNDNR permits to all such facilities, however.

Industrial and Commercial Self Supplied.--The MNDNR estimates withdrawals by nonpermitted (including MNDNR grandfather permits) self-supplied industrial and commercial users by comparing MNDNR-permitted appropriators with the NPDES active-permit list maintained by the Minnesota Pollution Control Agency. Annual withdrawals are calculated from the annual discharge from industrial and commercial facilities by multiplying:

Daily discharge rate (Mgal/d) x number of months x 30.4 days/mo

Domestic.--The U.S. Geological Survey office in St. Paul estimates withdrawals by subtracting the number of people on public-water supply systems from total population, by county, to obtain the estimated self-supplied domestic population. This value is multiplied by the MNDNR per-capita value of 88 gal/d to obtain total domestic withdrawals. Domestic consumptive use is estimated to be 85 percent. All withdrawals are considered to consist of ground water.

Livestock.--The U.S. Geological Survey obtains the numbers of animals in each of 17 classes from the Crop Reporting Board, Statistical Reporting Services; Minnesota Agricultural Statistics Service; U.S. and Minnesota Departments of Agriculture,; or from the U.S. Census Bureau, Census of Agriculture. Per-animal water-use estimates are given on page 21.

Sources are estimated to be 85 percent ground water and 15 percent surface water, from reports from Agricultural Extension agents. Consumptive use is estimated to be 100 percent.

Animal Class	Amount (gal/d)	Animal Class	Amount (gal/d)
Milk cows	18.4	Turkeys	0.12
Beef cows	8.7	Milk goats	6.0
Hogs and pigs	2.6	Other goats	1.0
Sheep and lamb	2.0	Ducks	0.04
Horse, pony, mule, burro and donkey	12.0	Geese	0.04
Laying hens	0.061	Mink	0.01
Non-laying hens	0.039	Other poultry	0.04
Chicks	0.03	Rabbits and chinchillas	0.05
Broilers	0.037		

Hydroelectric Powerplants.--The U.S. Geological Survey obtains information on individual powerplants from the Minnesota Department of Energy and Economic Development, Energy Division. Withdrawals are calculated from the following formula:

$$W = (P \times 7.63)/(H \times e)$$

where: W = withdrawal, in million gallons per day
P = capacity, in kilowatts (net annual generation=kwh/8760 h)
H = available head for power generation, in feet
e = efficiency of plant (Where "e" is unavailable, an average of 75 percent will be used.)

In summary,

1. MNDNR collects water-use data by appropriation permit and annual reporting of monthly withdrawal for the categories of public-water supply, irrigation (agricultural and nonagricultural), thermoelectric power, industrial and commercial self-supplied, and mining.

2. MNDNR estimates withdrawals for municipal, industrial, and commercial water use that is not under permit.

3. Water use in Minnesota is reported annually to the National Water Use Data System of the U.S. Geological Survey; the Geological Survey estimates water withdrawal for domestic, livestock, and hydroelectric powerplants.

New York

Program Description

Water-use-data collection and processing in New York is done by the New York State Department of Health (NYSDOH), New York State Department of Environmental Conservation (NYSDEC), and the U.S. Geological Survey office in Albany, N.Y.

NYSDOH.--Collection of public water-supply data by NYSDOH is mandated by the U.S. Environmental Protection Agency's Safe Drinking Water Act of 1974 and Part

5 of the New York State Sanitary Code. These laws require reporting of water withdrawal by community systems such as municipalities and apartment complexes and noncommunity systems such as hotels and camps. Metering has been required since 1975 on new or improved public water-supply facilities. The system operators are required to record the location of the public-supply system and the source of the water with the NYSDOH, Division of Environmental Protection, Bureau of Public-Water Supply Protection. The operators also file daily operation records monthly with the County Health Department or regional or district staff of the NYSDOH. These monthly values are submitted to the central office of the NYSDOH once a year, where they are keyed and computerized. The amounts of water withdrawn, used, or sold are updated annually for most water-supply systems.

The NYSDOH also collects data for noncommunity systems; these include some enterprises such as hotels and parks, which may also be classified as commercial.

NYSDEC and U.S. Geological Survey.--The other water-use categories are investigated in special projects. The NYSDEC and Geological Survey are compiling or estimating water-use data through an established cooperative program and storing the data in the State Water Use Data System (SWUDS) computer program. The Geological Survey is also collecting or estimating all categories of water use for inclusion in a publication on water use in all States that appears every 5 years.

Methods of Estimation

The NYSDEC and Geological Survey use several estimation techniques for all categories of water use except public supply. These methods use a variety of coefficients, calculations, and sources of information.

Domestic.--Total population is periodically obtained by county from the U.S. Bureau of Census, and the population served by public-water supplies is calculated by county from information on individual suppliers received from NYSDOH. The formula used for each county is:

Self-supplied domestic population = Total population - Population on public water supply

Total withdrawals for self-supplied domestic = Self-supplied domestic population X 100 gal/d

The distribution of the self-supplied individuals (and of water withdrawals) by drainage basins is obtained from a distribution table provided by the Geological Survey's National Water Use Information Program. The distribution, based upon U.S. Bureau of Census population tracts, gives the percentage of each county's population that resides in each drainage basin. These percentages can be used to apportion the self-supplied domestic population into the drainage areas.

Domestic consumptive use is estimated to be 10 percent of the total domestic withdrawals.

Irrigation.--The Census of Agriculture, periodically published by the U.S. Department of Commerce, Bureau of Census, gives the number of acres irrigated in New York State and the amount of water applied, in acre-feet. From these data, the number of acre-feet of water applied per acre irrigated is derived by county. The values range from 0.2 to 2.0 acre-feet per acre. These values can be applied to later Census of Agriculture data when only the number of acres irrigated is available.

The data on numbers of irrigated acres and amount of water used are arranged by drainage basin from a table provided by the Geological Survey's National Water Use Information Program that lists the percentage of each county that lies in each drainage basin. The Census of Agriculture sometimes indicates how many acres were irrigated by surface water and how many by ground water in each county, so that the values can be apportioned into surface-water and ground-water sources from the latest census that contains this information.

Data on methods of irrigation are obtained from Cornell University, which includes the acre values by irrigation method and by crop.

Consumptive use is estimated to be 100 percent of the total irrigation withdrawals.

Thermoelectric Powerplants.--Water use for all powerplants with an installed capacity over 25 megawatts (Mw) was obtained from a report by the Hanford Engineering Development Laboratory (HEDL) of the Westinghouse Hanford Company (1985). The estimated withdrawals are the product of water-use values (based on design conditions) multiplied by a reported net generation.

For powerplants with an installed capacity below 25 Mw, the NYSDEC estimates the per-plant withdrawals by obtaining the plant names and locations from the Federal Energy Regulatory Commission and the New York State Energy office, then applying the values given in the HEDL publication (1985) to plants of similar type and comparing the estimated value with the discharge figures reported for each plant in the NYSDEC State Pollution Discharge Elimination System (SPDES) data base.

Hydroelectric Powerplants.--NYSDEC calculates withdrawals for plants exceeding 25 Mw from water-use estimates given in HEDL (1985). Data for plants below this capacity were obtained from the NYSDEC Dam Inventory, the NYSDEC Division of Fish and Wildlife Hydropower Status Report, and hydropower project files from the NYSDEC Division of Regulatory Affairs. Data given in the HEDL (1985) report were used with the amount of power generated to calculate withdrawals. Where discharges from the dam, but not the power generated, were available, the potential capacity was estimated from the following formula:

$$\text{Potential capacity} = H \times \frac{DA}{7}$$

where: potential capacity is in kilowatts
H = head, in feet
DA = drainage area, in mi^2

This formula assumes 88 percent turbine efficiency and 95 percent generation efficiency (Brown and others, 1979).

Industrial.--The NYSDEC estimates industrial withdrawals from a magnetic tape that gives the addresses of more than 30,000 industries and their numbers of employees. Water use is calculated from the number of employees, multiplied by a per-capita water-use value given by Standard Industrial Classification (SIC) code (U.S. Office of Management and Budget, 1972).

The initial per-capita values were generated from the Census of Manufacturers (1977) which lists industry type by SIC code and also presents water use for each industry type, by State. The coefficients were refined through comparison with values given in a report on industrial water use in the Hudson River basin (Lawler, Matusky, and Skelly Engineers, 1979) and through an industrial-water use questionnaire that NYSDEC sent to industries withdrawing more than 20,000 gal/d. The estimated withdrawal values also were sent to county agencies such as planning departments with a request to break them into their ground-water, surface-water, and public-supply components. Finally, the withdrawal estimates were compared with State Pollution Discharges Elimination System discharge rates and with discharge data from the NYSDEC files of the Industrial Pre-Treatment and Permit Compliance Systems. The water-use estimates were then broken down by county and drainage basin area.

The withdrawals per day per employee for some SIC codes, as given in Lawler, Matusky, and Skelly (1979), are listed below.

SIC Code	Description	Withdrawal (gal/d)
20	Food and kindred products	3069.08
21	Tobacco products	358.13
22	Textile mill products	1073.41
23	Apparel and other finished products	29.04
24	Lumber and wood products	4094.69
25	Furniture and fixtures	393.69
26	Paper and allied products	6430.18
27	Printing, publishing and allied	28.00
28	Chemicals and allied products	7343.96
29	Petroleum and coal products	3646.98
30	Rubber, miscellaneous plastics products	2870.05
31	Leather and leather products	1243.79
32	Stone, clay, glass products	3317.83
33	Primary metal industries	3962.17
34	Fabricted metal products	1093.35
35	Machinery, except electrical	1046.51
36	Electric, electronic equipment	364.79
37	Transportation equipment	469.94
38	Instruments, related products	529.48
39	Miscellaneous manufacturing industries	542.06

A general consumptive-use value of 10 percent was used, but the following consumptive-use values were considered before the 10-percent figure was chosen (Lawler, Matusky, and Skelly, 1979):

SIC code		Percent consumption
20	Food and kindred products	15.8
22	Textile mill products	2.6
24	Lumber and wood products	5.0
26	Paper and allied products	7.89
28	Chemicals and allied products	3.97
30	Rubber, miscellaneous plastic products	16.67
32	Stone, clay, glass products	9.13
33	Primary metal industries	1.00
34	Fabricated metal products	0.04
35	Machinery, except electrical	0.13
36	Electrical, electronic equipment	11.10
37	Transportation equipment	0.33
38	Instruments, related products	6.00
39	Miscellaneous manufacturing industries	0.03

Agricultural (Livestock).--The Geological Survey obtains the number of animals by county from the Census of Agriculture and calculates withdrawals for each class of livestock by applying the values from Todd (1970) and modifying them as follows:

Animal Class	Amount (gal/d)	Animal Class	Amount (gal/d)
Pig	2	Broiler	0.0050
Horse	10	Turkey	0.0080
Chicken	0.0027	Cattle and calves	10.5
Pullet	0.0035	Sheep	0.05
Hen and pullet (laying age	0.0065		

Consumptive use is estimated as 90 percent of the total withdrawals in this category. Ground-water and surface-water sources are estimated as 65 percent and 35 percent of the total, respectively, from the distribution published by the U.S. Geological Survey every 5 years.

The data are redistributed by drainage area according to the percentage of each county that lies within each drainage area.

Commercial.--No standard methods of estimation are used at this time.

Mining.--Data on withdrawals for gravel and stone mining are kept by the NYSDEC in a State Pollution Discharge Elimination System permit file, which gives the location and amount of water discharged from each quarry. The numbers and locations of oil and gas wells are obtained from the NYSDEC Division of Mineral Resources files on oil and gas production. The withdrawal values for wells, per drilling, are:

Oil well - 8,400 gal
Gas well - 21,000 gal

The U.S. Bureau of Census (1982) is used as a cross-reference.

Consumptive use is estimated as 10 percent of the total mining withdrawals for quarries and sand and gravel operations; consumptive use for salt mines is 90 percent.

In summary,

1. NYSDOH local offices record daily withdrawal data for public supply and commercial self-supplied once a month; their central office records the monthly data annually.

2. The NYSDEC and(or) U.S. Geological Survey calculates or estimates data for all other categories.

Ohio

Program Description

Responsibility for collecting and maintaining water-use data in Ohio is divided among the Ohio Environmental Protection Agency (OEPA), Ohio Department of Natural Resources, Division of Water (ODNR), and the U.S. Geological Survey.

OEPA.--The OEPA is largely mandated by the Federal Safe Drinking Water Act of 1974, Public Law 93-523, and Sections 6109.04, 6109.12, and 6111.42 of the Ohio Revised Code to collect public-supply withdrawal data monthly, annually, or triennially. Data are collected from systems serving 25 or more individuals or having 15 or more connections and operating at least 60 days of the year. Many of the noncommunity systems are commercial facilities. Metering is required for systems that withdraw more than 1 Mgal/d or serve more than 10,000 people; otherwise measurements are reported. Systems that serve more than 10,000 people must report daily values monthly; smaller systems that use surface water report annually; and ground-water systems or systems that purchase water report once every 3 years. Onsite inspections are done by the district offices of the OEPA. The system operators send the annual and triennial survey forms to the OEPA headquarters, where the information is keyed and entered into the Model State Information System (MSIS) of the U.S. Environmental Protection Agency (USEPA). The data are kept on disk just long enough to forward to the USEPA and to copy to magnetic tape and microfiche.

The 1980 public water supply data are stored as county and drainage-basin aggregates in the National Water Use Data System on the Geological Survey mainframe in Reston, Va. The Geological Survey office in Columbus is also receiving the public water-supply and commercial data by the microfiche method of data transfer and re-keying it into the State Water Use Data System on the Geological Survey Prime minicomputer in Columbus.

ODNR and U.S. Geological Survey.--These agencies calculate or estimate data for the remaining water-use categories. The ODNR has been conducting inventories of water and related natural resources since at least the 1950's. Section 1521.03(B) of the Ohio Revised Code states that the ODNR shall

> ...have authority to conduct basic inventories of the water and related natural resources in each drainage basin in the state; to develop a plan on a watershed basis that will recognize the variety of uses to which water may be put...

Consequently, the ODNR has published several basin studies and water plans and conducted statewide inventories of water use.

An ODNR report based on 1955 data (Woldorf, 1959) summarizes withdrawals for rural domestic water use, golf-course irrigation, agricultural irrigation, and livestock usage by county and watershed; a report by Rudnick (1959), also published by ODNR, summarizes Ohio water use in all categories. A report organized by Standard Industrial Classification Code, by Rudnick (1960), summarizes data on industrial water use in Ohio by county and watershed. A report by Rudnick (1962) summarizes data on municipal water supplies in Ohio during 1955-57; this represents every municipal supplier identified in 1985.

In 1967 the ODNR made a regional water plan for northwestern Ohio and updated it in 1986; it also did one for northeastern Ohio in 1972 and plans to update it in 1987. Both plans include public water-supply-withdrawal data and compare uses with resources and recommend future surveys.

The ODNR also has produced comprehensive water-use reports in cooperation with the U.S. Geological Survey, one on the water use in Ohio in 1975 (Eberle and Hathaway, 1981) and one for 1980 (Eberle and McClure, 1984). Both present six categories of withdrawal data by county and drainage basin. The data in these reports are also stored in National Water Use Data System of the Geological Survey.

Data used by Woldorf (1959) and Rudnick (1960) were derived primarily from ODNR questionnaires that were sent as part of a 1955 inventory. The agricultural irrigation questionnaire was sent in conjunction with the Agricultural Extension Service, and individual farmers were visited to establish a solid base of data. Questionnaires were sent to irrigators again in 1963 and to industries as recently as 1978. All regional water plans in the State include data from municipal public-water suppliers with more than 500 taps. Data from municipal water-supply systems are summarized in Rudnick (1977). ODNR periodically estimates domestic self-supplied water use and did a study of golf-course irrigators in 1955 and updated it in 1982. Findings and data are given in a report on golf-course irrigation in Ohio (Black, 1983).

The ODNR obtains agricultural irrigation data approximately every 10 years from the Agricultural Extension engineer at Ohio State University. The data indicate the number of acres irrigated by each method of irrigation, the types of power units, number of irrigation wells, and number of irrigated acres containing each type of crop.

U.S. Geological Survey.--The categories for which withdrawals are estimated or generated primarily by the Geological Survey include livestock and thermoelectric and hydroelectric powerplants. Agricultural statistics published annually by the Ohio Crop Reporting Service are used to estimate livestock population and water use. Thermoelectric withdrawals are obtained from the individual plants, and the data for 1985 are being stored in the State Water Use Data System in Columbus, Ohio. Water use by hydroelectric plants is estimated every 5 years, but Ohio has no hydroelectric plants in the Great Lakes basin.

In addition to the collection and estimation of withdrawal data, the State of Ohio has the capability of documenting diversions. Section 1501.30 of the

Ohio Revised Code requires any potential diverter of water out of the Lake Erie basin or Ohio River basin to secure a permit from the director of the ODNR.

Methods of Estimation

The ODNR and U.S. Geological Survey estimate withdrawals for the categories of domestic self-supplied, irrigation, industrial self-supplied, thermoelectric and hydroelectric powerplants, and agricultural.

Domestic Self-Supplied.--The ODNR estimates withdrawals in this category by multiplying the number of persons not served by public-water supply systems by 90 gal/d or the number of households by 350 gal/d. The Geological Survey obtains the total population for each county from the U.S. Bureau of the Census' latest publication. The population using public water-supply systems (obtained from OEPA) is subtracted from the total population to give the self-supplied population; this value is multiplied by 75 gal/d. The withdrawals are estimated to be 90 percent ground water and 10 percent surface water.

Irrigation.--The ODNR uses the method of Black (1983) to estimate withdrawals for golf-course irrigation. The total withdrawals in this category are calculated from the number of golf holes per county and the withdrawal rate for three type of systems. The technique is based on three assumptions: (1) all golf courses are irrigated; (2) the quantity of water applied is uniform, regardless of local differences in soil types, precipitation rates, etc.; and (3) the three types of irrigation systems used in the estimate equation are used in the same relative proportion throughout the State. Data on the types of systems, their withdrawal rates, and their relative proportion in the State were provided by the landscape architecture firm of Kidwell and Hurdzan, Inc. (Black, 1983). The following table summarizes this information.

Type of system	Estimated percentage of total golf courses	Irrigation rates per 18-hole course
a. Manual tee and green	15	135,000 gal/week throughout irrigation season
b. Automatic tee and green, manual fairway	35	Tees and greens: 115,000 gal/week throughout irrigation season; fairways: 450,000 gal/week avg.
c. Fully automatic tee, green, and fairway	50	1,300,000 gal/week throughout irrigation season

The length of the irrigation season depends on weather conditions, which vary from year to year. For this estimate, a season length of 105 days (15 weeks) was used. The weekly data in the above table, when applied to a 15-week irrigation season, give the seasonal rates shown on page 29.

Type of system	Estimated 105-day season withdrawal rate per 18-hole course
a. Manual tee and green	(135,000 gal/week) x 15 weeks = 2,025,000 gal or 2.025 Mgal per season
b. Automatic tee and green, manual fairway	(115,000 gal/week) x 15 weeks = 1,725,000 gal (450,000 gal/week) x 15 weeks = 6,750,000 gal or 8.475 Mgal per season
c. Automatic tee, green, and fairway	(1,300,000 gal/week) x 15 weeks = 19,500,000 gal or 19.500 Mgal per season

County water-withdrawal rates for golf-course irrigation for each type of system were calculated from the above Mgal/season values by the following equations:

a. Manual tee and green: $W = .15n\ (2.025\ Mgal)$

b. Automatic tee and green, manual fairway: $W = .35n\ (8.475\ Mgal)$

c. Automatic tee, green, and fairway: $W = .50n\ (19.500\ Mgal)$

Where: W = total withdrawal for system category, Mgal
n = number of 18-hole courses in category

The number of 18-hole course equivalents represents the total number of holes divided by 18. Daily withdrawal rates during the irrigation season are the seasonal withdrawal, in gallons, divided by 105 days.

The Geological Survey in Ohio estimates irrigation water use by securing a list of estimated farm acreages from the Ohio State University, Department of Agricultural Engineering, and estimating the application of water assuming 89 percent consumptive use and no conveyance loss.

Industrial.--A list of industries and their discharge data are secured from the U.S. Environmental Protection Agency Industrial Facilities Discharge file. Coefficients are multiplied by the amount discharged to estimate withdrawal; these coefficients were supplied by the Geological Survey National Water Use Information Program in Reston, Va.

Thermoelectric and Hydroelectric Powerplants.--In years when the Geological Survey in Columbus does not contact electrical power-generating facilities directly, estimates of water use by powerplants, given by the Hanford Engineer Development Laboratory, Westinghouse Hanford Company (1985), are used.

Agricultural.--The Geological Survey estimates water use for livestock by securing the number of animals from the Ohio Crop Reporting Service, multiplying by coefficients for each animal type, and estimating 60 percent to be groundwater and 40 percent surface water.

In summary,

1. The OEPA collects withdrawal data monthly, annually, or triennially from public water suppliers that have either required metering (>10,000 people served) or required reporting. It also collects information on commercial self-supplied facilities.

2. The ODNR estimates water use for the categories of domestic, irrigation, and industrial from periodic surveys.

3. The ODNR obtains irrigation data from the Agricultural Extension.

4. The Geological Survey, as part of a cooperative program with ODNR, estimates livestock, thermoelectric-plant, and hydroelectric-plant withdrawals.

Ontario

Program Description

Collection of water-use data in The Province of Ontario is carried out primarily by the Ontario Ministry of the Environment (OMOE) (Permit to take water program--guidelines and procedures manual, revised February, 1984, p. 1).

Section 20 of Ontario Water Resources Act (1980) states that a permit will be required for any person who withdraws more than 50,000 liters (12,500 gal) water in a day,

> a) by means of a well or wells that are constructed or deepened after the 29th of March, 1961; or
>
> b) by means of an inlet or inlets from a surface source of supply, where the inlet or inlets is or are installed in the source of supply or is or are enlarged after the 29th day of March, 1961; or
>
> c) by means of a structure or works constructed after the 29th day of March, 1961, for the diversion or storage of water; or
>
> d) by any combination of the means referred to in clauses (a), (b) and (c)...
>
> (Ontario Water-Resources Act, 1982, p. 2)

Withdrawals that are always exempt from the permit legislation, regardless of the date of construction or the amount of water taken, are those taken:

> . by an individual for ordinary household purposes;
> . for the watering of livestock or poultry;
> . for firefighting
>
> (Ontario Water-Resources Act, 1982, p. 6).

Certain withdrawals normally do not require a permit, but, depending on the circumstances and if they are likely to cause interference, they can be regulated

under Section 20(4). Withdrawals that are normally exempt from the permit legislation but to which the above applies, include those that:

- are done by means of works installed before March 29, 1961;
- constitute less than 50,000 liters (12,500 gal) in a day;
- are for storage for subsequent use in watering poultry or livestock.

If withdrawals in these categories interfere, in the opinion of an OMOE Director, with any public or private interest in any way, a notice can be issued under Section 20(4) prohibiting the withdrawal without a permit. The withdrawal in question can then be handled in the same manner as those that normally require authorization by permit (Guidelines, Ontario Ministry of the Environment, 1984, p. 7).

The request for a permit is made to the regional office of the OMOE, who reviews it and grants and files the permit. The OMOE has six regional offices in Ontario.

The permit carries a 5-to 10-year renewal interval, at which time the permit can be cancelled or altered. The permit is actually an allocation that states the maximum allowable withdrawal. The permitting authority also extends to the authority to request water-use reports or a withdrawal record. Since 1973 such reports have not been requested often; instead, the permittee has been requested to keep records of water withdrawal.

The OMOE files of allocation permits provide an excellent inventory of water-use sites, and the OMOE also has the legislative authority to collect annual water-use data. To support the personnel and facilities necessary to collect and record reported data annually, the OMOE is considering a permit-fee system. A computer system is being designed for the OMOE to store the information.

Some advantages of the OMOE systems are that:

1. the permits state the allocations,
2. the laws allow reporting of water use,
3. the regulations cover all categories of water use except the three low-use activities (domestic self-supplied, livestock, and firefighting)
4) the trigger level for permit requirement is low (approximately 12,500 gal/d)

Methods of Estimation

No standardized methods of estimation are routinely used at this time.

In summary:

1. The OMOE can collect water-use data for all categories of water use except domestic self-supplied and agricultural livestock use.

2. The OMOE can estimate withdrawals for domestic and livestock use.

Pennsylvania

Program Description

Both the Pennsylvania Department of Environmental Resources, Bureau of Water Resources Management, State Water Plan Division (PaDER), and the U.S. Geological Survey compile water-use data in Pennsylvania.

PaDER.--Public water-supply data are collected by virtue of the Federal Safe Drinking Water Act and Chapter 109 (December 8, 1984) of the Pennsylvania Safe Drinking Water Act, The Act of May 1, 1984 (P.L. 206, No. 43). The Pennsylvania Safe Drinking Water Act states (Section 2.a.) that:

- The Federal Safe Drinking Water Act provides a comprehensive framework for regulating the collection, treatment, storage, distribution of potable water.
- It is in the public interest for the Commonwealth to assume primary enforcement responsibility under the Federal Safe Drinking Water Act.

This enforcement is handled through the PaDER.

PaDER mails to all public suppliers an Annual Water Supply Report form that must be filled out and returned. Records for half the public-water suppliers in computer storage are updated each year.

The PaDER mails survey questionnaires intermittently to users in the categories of irrigation and self-supplied industrial. In 1977-78, the PaDER requested that the County Conservation District offices compile a list of farmers within their jurisdictions who irrigate, then sent irrigation surveys to these farmers. The County conservation officials made followup contact when additional information was needed or when no questionnaire had been received. This was a one-time survey.

The PaDER circulates questionnaires approximately every 5 years to self-supplied industries (including mineral industries). The manufacturers that receive survey forms are those given in the list of manufacturers provided by the Pennsylvania Department of Commerce. Lists of mineral industries are obtained from the State Bureau of Topographic and Geologic Survey. After the 1972 and 1977 surveys, consultants were contracted to do a more detailed study of manufacturing plants that withdraw more than 100,000 gal/d.

For the category of thermoelectric power generation, PaDER and the electric utility companies of Pennsylvania have a cooperative agreement. Each power-generating company compiles an annual list stating the rated-capacity cooling-water requirements of its thermoelectric generating units and submits this to the PaDER. This procedure began in 1974 and resulted in an annual release that gives the location and characteristics of each powerplant, the type and capacity of generating facilities, the type of cooling, the total water withdrawals, and the consumptive water use at rated capacity for each plant. The list includes fossil-fueled, nuclear, and thermoelectric plants.

Water-use data compiled by the PaDER are stored on an agency mainframe in a computer system called the Water Resources Data Systems (WARDS).

U.S. Geological Survey.--The Geological Survey office in Harrisburg estimates withdrawals for irrigation, livestock, and commercial self-supplied water use every 5 years. Some of these data are stored in the National Water Use Data System of the Geological Survey. The PaDER estimates water use for domestic self-supplied.

Methods of Estimation

The methods of estimating withdrawals in the self-supplied domestic, irrigation, agricultural, and commercial self-supplied categories are as follows.

Domestic.--Withdrawals in this category are estimated by PaDER by multiplying domestic self-supplied population by 50 gal/d where:

Domestic self-supplied population = Total population - Population on public water supply.

Total population figures are acquired either from the Pennsylvania State Data Center at Pennsylvania State University or the U.S. Bureau of the Census, depending on the year. The public-supplied population is obtained from annual surveys that the PaDER sends out to public-water suppliers.

Comsumptive use is estimated to be 10 percent of the total withdrawals.

Irrigation.--Withdrawals for irrigation are calculated from the number of acres irrigated per farm, the number of farms that irrigate, and the withdrawals per farm. A survey of irrigators by PaDER in 1978 indicated that the Census of Agriculture (1982) has recovered data on 75 percent of the acres irrigated and 50 percent of the farms that use irrigation. Estimates for this category are based on this information.

The amount of rainfall in the 1978 growing season is used as an index to estimate whether more or less irrigation is required in a given year.

Eighty-nine percent of the irrigation water is from surface-water sources.

Agricultural.--Withdrawals for agriculture are estimated from the numbers of livestock, by county, as given in an annual summary jointly published by the Pennsylvania Crop Reporting Service, the Pennsylvania Department of Agriculture, and the U.S. Department of Agriculture. To these totals, the following per-head withdrawal values are applied:

Animal class	Amount (gal/d)	Animal class	Amount (gal/d)
Milk cows	40	Sheep	3
Cattle	15	Fowl	0.15
Hogs	6		

Eighty-seven percent of water used for livestock is ground water, and 13 percent is surface water.

Commercial.--No standard methods of estimation are used at this time.

In summary:

1. The PaDER issues allocation permits to public-water suppliers that withdraw surface water and receives annual water-use survey report forms from all operations.

2. PaDER obtains much information for the categories of industrial self-supplied, irrigation, and mining from results of surveys.

3. Water use by thermoelectric-generating facilities is supplied on survey forms returned annually by the utility companies. Data on the plants and water use, including consumptive use, are extensive.

4. PaDER's water-use computer program (WARDS) is comprehensive.

5. The Geological Survey estimates withdrawals for irrigation, agricultural, and commercial; PaDER estimates domestic self-supplied water use.

Quebec

Program Description

Water-use data in the Province of Quebec are collected by the province ministry, Environment Quebec (EQ). EQ has a comprehensive computer program that was developed in 1979; and water-use data were collected regularly until 1983, when funds were curtailed. The data base of user identifications and withdrawal information is still maintained and available for updates, however, and a program of data acquisition and updating has been reinstated.

EQ does not require a permit to withdraw water, but users would benefit from securing a permit in the event that another user challenges their right to the water or a group protests environmental consequences of the water use. EQ has a COBOL program to record on a mainframe computer the location and characteristics of water users and their monthly and annual water-use figures.

The water-use data base is divided into five categories:

- Municipal - all municipalities;
- Public and Private - schools, instititions, government buildings, commercial, privately owned public-service systems that serve 10 or more people, agricultural, etc.;
- Industrial - primarily manufacturing and others;
- Hydroelectric and thermoelectric powerplants.

The present system uses 11 different forms for municipal, public and private, or industrial withdrawals and four forms for powerplants.

EQ acquires information for some categories through surveys. It can mail forms requesting voluntary monthly or annual data to users at any time. In January 1986, forms for updating the inventory were sent to the 780 municipalities of the Great Lakes basin. The goal is to eventually survey all users in all categories of the data base. Although not all users can be inventoried every year, at least some would be updated each year. The St. Lawrence River

basin contains nearly 500 industries that use 5,000 gal/d or more. Of these, 86 are partly or totally self-supplied, and 26 of those are in the Montreal area. Since January, the survey is done either by mailing forms, by telephone, or by visiting the industry.

In compliance with privacy constraints, the data base does not contain the names and addresses of industrial users but has an identification number for each, which is shared with the Direction Generale de l'Administration des Entreprises, where the industry name is legally stored and available for cross reference by the ministry. The data base also allows data on withdrawals and discharges by the same facility to be stored together, which allows computation of consumptive use.

The thermoelectric and hydroelectric powerplants that are owned and operated by Quebec Hydro are surveyed annually by the owner, who transmits the data to EQ. EQ stores data on plants having a capacity of 5,000 kilowatts or greater. Plants that are not owned by Quebec Hydro are to be surveyed by EQ in the future.

The categories for which data must be estimated include domestic self-supplied, irrigation, and agricultural.

Methods of Estimation

EQ estimates withdrawals in the categories of domestic self-supplied, irrigation, and agriculture. Domestic use is calculated by multiplying the domestic self-supplied population by 100 gal/d. Domestic self-supplied population represents all users not on municipal or privately owned public-water-supply systems. Therefore,

Domestic self-supplied population	=	Total population	-	municipally served population	+	privately served population

All withdrawals are assumed to be ground water.

The EQ estimates consumptive use as follows:

Category	Percent Consumed
Industrial pulp and paper industry	10
Thermoelectric power	10
Hydroelectric power	0
Irrigation	90-100

In summary,

1. The data base of EQ accepts a wide range of information on identification and characteristics of water users and water-use amounts.

2. Data for the categories of public-water supply (municipal), industrial, powerplants, commercial, and mining are to be collected through EQ surveys in the future.

3. Data for domestic self-supplied, irrigation, and agricultural water-use categories will be estimated by EQ.

Wisconsin

Program Description

The Wisconsin Department of Natural Resources, Bureau of Water Resources Management (WDNR), administers an extensive system of water-use registration, permitting, allocation, and reporting. The two primary divisions involved with the WDNR are:

1. Division of Environmental Standards--Bureau of Water Resources (WDNR-BNR), the Bureau of Water Supply (WDNR-BWS), and the Bureau of Water Resources Management (BWRM)

2. Division of Enforcement--Bureau of Water Regulation and Zoning (WDNR-BWRZ).

Several State laws govern these bureaus and the requirements of the water users.

Section 30.18 of Wisconsin Statutes, administered by the WDNR-BWRZ, requires a permit for withdrawal of any amount of water from streams for the purposes of irrigation, agriculture, or maintaining or restoring the normal level of a navigable lake or flow of a navigable stream. Section 30.18 permits require monthly reporting during the 6-month (April to September) irrigation season; other nonirrigation permit holders must provide monthly reports for the entire period specified in the permit. Section 30.18 also requires a permit for withdrawals from streams or lakes that result in a water loss (consumptive use or interbasin diversion) in excess of 2 Mgal/d.

Section 144.025 of the Wisconsin Statutes requires an allocation permit from WDNR-BWS for all persons (facilities or individuals) having the capacity to withdraw ground water at a rate of 70 gal/min or more; these facilities report daily withdrawal monthly. Categories of users who are required to have a permit and to report monthly data include public water supply, irrigation, thermoelectric, industrial, and commercial. The trigger level for public supplies is serving 25 or more people; the lower limit for the other categories is 70 gal/min or 100,000 gal/d pumping. In addition, Section A 144.025 requires all public water utilities that withdraw from surface waters to report daily data once a month.

Construction of wastewater-treatment plants, public powerplants (thermoelectric and hydroelectric), and public water-supply plants requires prior plan approval by WDNR. Under Section 144.04 of the Wisconsin Statutes, proposed withdrawals that will result in a water loss of 2 Mgal/d or more must comply with the provisions of Section 144.026 Wisconsin Statutes governing water-loss approvals.

A new regulation, created in 1985 by Wisconsin Act 60 and enacted November 13, 1985, requires (1) the registration of any facility withdrawing 100,000 gal/d (20 gal/min) or more in any 30-day period, and (2) a water-loss permit for

approval of any project involving a diversion or consumptive use of 2 Mgal/d or more in any 30-day period. This legislation came about as a direct result of the Great Lakes Charter and created Section 144.026 of the Wisconsin Statutes. Act 60 also amended the regulations cited above (Sections 30.18, 144.025, and 144.04) to ensure consistency with the provisions of the newly created Section 144.026.

As a result of these laws and regulations, WDNR regularly collects water-use data in the categories of public-water supply, irrigation, self-supplied industrial and self-supplied commercial, thermoelectric plants, agricultural, mining, and domestic self-supplied (surface water). Data for the categories of domestic self-supplied, hydroelectric power, agricultural, and mining are also estimated by the U.S. Geological Survey and the WDNR. The Geological Survey has acquired information from the Wisconsin Public Service Commission on the distribution of publically supplied water to commercial, industrial, residential, or other municipal users.

Part of the WDNR's cooperative program with the Geological Survey in Wisconsin includes the storage of water-use data on a State mainframe and minicomputer and the reformatting of data for input into both the State Water Use Data System at the Geological Survey in Madison, and a WDNR water-use-retrieval program. The data stored in both systems include:

1. Public water supply, ground-water pumpage, and delivery to users, and

2. Commercial, industrial, agricultural, and irrigation pumpage data for wells with capacity equal to or greater than 70 gal/min.

Another component of the WDNR-Geological Survey cooperative program is the publication of water-use reports (Daniel and Mara, 1975; Lawrence and Ellefson, 1982; and Lawrence and others, 1984).

Methods of Estimation

The U.S. Geological Survey estimates withdrawals in the categories of domestic self-supplied, hydroelectric power, agricultural, and mining.

Domestic.--Withdrawals are calculated by multiplying the domestic use by an average water-use rate, by county. Population estimates are obtained from the Wisconsin Department of Administration. The population served by public-supply systems (taken from public-supply records) is substracted from the total county population. The average water use rate is calculated by multiplying the per-capita rate of public-supply systems by the population served by self-supply systems.

Hydroelectric Power.--Withdrawals are estimated by the following formula:

$$T = \frac{1.25 \text{ Kwh/yr}}{1000 \text{ H}}$$

where: T = total annual withdrawal, in Mgal/d
H = head (difference between headwater and tailwater), in feet

Agricultural.--Withdrawals are calculated by multiplying the number of farm animals in each county, obtained from Wisconsin Agricultural Reporting Service, by a standard consumptive value for each type of farm animal, obtained from the U.S. Department of Agriculture.

Mining.--No standard methods have been devised for estimating water use by mines.

In summary,

1. Data on all withdrawals exceeding 100,000 gal/d are now being collected in all categories except hydroelectric. Withdrawals for rural domestic, hydroelectric power, and agricultural use are estimated by the U.S. Geological Survey in cooperation with WDNR.

2. Data are computerized by the WDNR, and much information is stored as site-specific data or aggregations in both the WDNR system and U.S. Geological Survey's State Water Use Data System.

3. Data on withdrawals for mining are now required by the U.S. Geological Survey for inclusion in a national water-use summary and will be collected every 5 years henceforth. No estimation procedures for mining withdrawals in Wisconsin have yet been developed.

4. Legislation is in place that will require registration of users withdrawing 100,000 gal/d or more in any 30-day period and an approved permit for users diverting or consuming 2 Mgal/d or more in any 30-day period.

U.S. Geological Survey

In the past, national efforts to collect and compile water-use data were carried out on an irregular, infrequent basis by several Federal agencies and other interested organizations. Generally the resulting data compilations pertained either to a specific category of use or covered only a particular geographical area. Although the Geological Survey has published reports every 5 years on water withdrawals in the United States (MacKichan, 1951, 1957; and Solley, Chase, and Mann, 1983), the estimates used in all but the latter (1983) report were derived from a variety of sources and have a wide range of accuracy. Thus, these reports do not constitute a single source of accurate, consistent, timely, and accessible water-use information.

The National Water-Use Information Program operates as a cooperative effort between the Geological Survey office in each State and the State or local governmental agencies. The Geological Survey compiles the data collected locally and estimates or derives values for records not collected. The data may be stored in the National Water Use Data System (NWUDS) or the State Water Use Data System (SWUDS) computer programs and form a basis for local water-use reports as well as the Survey's 5-year water-use summaries.

In 1977, the U.S. Congress, recognizing the need for uniform, current, and reliable information on water use, directed the U.S. Geological Survey to establish a National Water-Use Information Program to complement its programs on the availability and quality of the nation's water resources. Thus, the

National Water-Use Information Program (NWUIP) became part of the U.S. Geological Survey's Federal-State cooperative program (Mann and others, 1982).

The four goals of NWUIP are to: (1) collect and compile reliable water-use information, (2) develop and refine computerized water-use information systems at both the State and national levels, (3) devise new methods and techniques to improve the collection and analysis of water-use information, and (4) disseminate the information in ways that meet the needs of a variety of users. Each of these goals is described in detail below.

Methods of Data Collection and Compilation

Water-use data can be collected by several methods. Direct methods include personal visits to all users in a category or to a sampling of users. Indirect methods include using reported data, conducting phone or mail surveys, and estimating the values through statistical or other estimation techniques.

The NWUIP has identified 12 major water-use categories, and each user is classified into one of these categories. The Standard Industrial Classification[1] (SIC) code that best describes the use is assigned to each user and enables similar water uses to be aggregated for analysis. The 12 categories are: (1) irrigation, (2) nonirrigation agriculture, (3) commercial, (4) domestic, (5) industrial, (6) mining, (7) generation of electricity (fossil-fuel), (8) geothermal power, (9) hydroelectric power, (10) nuclear power, (11) public water supply, and (12) return of water through sewage treatment.

The data are further classified as either withdrawal, return flow, or usage, and are identified as to source (surface or ground water). The Geological Survey's 5-year summaries of water use are based on these data.

Federal and State laws require permits for the return of wastewater to surface-water bodies. Data on volume and chemical quality of the discharged waters are being made available to the National Water-Use Information Program. Return-flow data are unavailable for many states, however; this information can be provided only if special programs are implemented.

Estimation of consumptive use and losses in the respective categories requires data on the amounts of water delivered to and released from the many users. The larger the amount of data available, the more accurate the estimates will be.

Development of a Computerized Data-Storage and Retrieval System

The second goal of the National Water-Use Information Program is to develop a computerized system to store and retrieve the data collected at both the national and State levels. The system consists of two parts--the National Water-Use Data System and the State Water-Use Data System.

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[1] This document classifies establishments by type of activity in which they are engaged for purposes of promoting uniformity and comparability in the presentation of statistical data collected by various agencies.

The National Water-Use Data System (NWUDS) was designed as the national-level computer file for water-use information and became operational in July 1979. It is designed to store and disseminate data on withdrawal, consumptive use, and return flow (discharge). It is an integral part of the Geological Survey's National Water Data Storage and Retrieval System (WATSTORE). The NWUDS contains aggregated information on (1) the amount of water withdrawn from surface- and ground-water sources and the amount returned to the sources, and (2) how much water was received at the place of use and how much water was discharged after use. The data are stored on a mainframe computer at the Geological Survey's headquarters in Reston, Va.

The State Water-Use Data System (SWUDS) was designed specifically as the State-level computer file for water-use information and became operational in November 1982. It is designed to contain the withdrawal measurements and estimates for individual users or facilities on a State-by-State basis. The types of data collected and stored in the system are: name of user, location of withdrawal and return point, type of source (ground water or surface water), annual and monthly values of withdrawal and returns, quality of withdrawal (fresh or saline), irrigated area for each type of crop, volume of water applied to each type of crop area, population served by public supplies, monthly and annual power production, and monthly and annual power-production capacity. This computer program is installed on many of the Prime minicomputers in local Geological Survey offices.

Improvement of Methods and Techniques

Historically, much water-use information has been compiled from mailed questionnaires and personal interviews. This approach is too costly to be used as the primary means for data acquisition in a comprehensive information program, however. Techniques are now being developed to statistically sample for a particular water-use category within a State or water-resources region. Methods also are being developed to indirectly estimate current withdrawals and predict future demands, such as for irrigation use and industry. Examples of techniques now being tested are remote sensing, which has been used in some areas to measure the areas of irrigated lands, and calculating the relationship between withdrawals and consumptive use in industrial processes. This emphasis on refinement of methods is the result of the rapidly growing need for accurate information, especially in States whose laws do not mandate water-use data reporting.

Dissemination of Water-Use Information

The data stored in the NWUDS are available through WATSTORE and can be accessed by all registered users of WATSTORE and the National Water Data Exchange (NAWDEX). Users not registered with one of these systems can obtain information through one of the Geological Survey's NAWDEX assistance centers at the Geological Survey office in each State. The NAWDEX Program Office may be contacted as follows:

National Water Data Exchange
U.S. Geological Survey
421 National Center
Reston, Va. 22092

Several reports have been published through the various States to summarize water use by category. The Geological Survey also has issued 5-year national summaries since 1950. The most recent (Solley and others, 1983) reflects improvements in the data-collection system. In addition to the 5-year summaries, the Geological Survey is compiling data for a national water summary for 1987.

Data are exchanged among Geological Survey offices and sometimes with local government agencies through the Survey's Distributed Information System (DIS). During 1982-85, the U.S. Geological Survey installed more than 70 large minicomputers in its offices across the country. These computers are connected by a communications network that allows information to be shared among computers in each office. The DIS allows for the transfer and exchange of data between any terminal, microcomputer or minicomputer, or mainframe on the network.

Environment Canada

Environment Canada is a Canadian federal department created to preserve and enhance the quality of the environment. One of its five service components, the Environmental Conservation Service, Inland Waters Directorate (IWD), plans and participates in national and international water-management programs. The Water Planning and Management Branch of the IWD forecasts changes in Great Lakes water levels and implements federal-provincial water-management projects relating to flood damage and control and shoreline management. Water-use data collection, research, and forecasting are carried out in this branch.

The water-use program began in 1973-74 when the IWD senior economist circulated water-withdrawal questionnaires to Canadian manufacturing firms. As stated in the resulting report (Tate, 1977, p. 1):

> ...This report outlines the results of a water use survey for manufacturing, designed to begin the collection of primary data for various water-using activities in Canada.

Firms surveyed included all those known or suspected to withdraw 10 Mgal or more annually on the basis of size and production, or those with special water-use characteristics such as high pollution-emitting potential. The data resulting from the industrial water-use survey of 1972 withdrawals are considered to account for at least 95 percent of the total water withdrawal by all manufacturing establishments. The Survey of Industrial Water Use was repeated for 1976 withdrawals; the resulting report (Tate, 1983) presents figures and discussion on various aspects of water use by industry, such as intake, recirculation, and discharge. The survey was again repeated in 1981; results are given in Tate (1985).

In conjunction with the Provinces, the IWD established a data base called MUNDAT, which contains municipal water-supply data. Through a 1983 letter survey to 600 water districts, water rates and infrastructure rates were secured. Since then, the data base has been expanded to include 1,700 municipalities and is continuously updated. The industrial and municipal water-use data are stored on an IBM-XT personal computer.

Another area the IWD is investigating is the econometrics of water use through construction of an environmental/economic model. The model gages how water withdrawals, supply, and discharges affect the economy through factors such as the cost of cleanup. In industrial water use, the costs of water intake, recirculation, treatment, and discharge are modeled against the value of the product. Water availability (and cost) is also plotted against product price to develop a relationship analogous to industrial production and the cost of energy. The cost of municipal infrastructure replacement, public taxations and subsidies, and rising or declining water rates are all considered.

Since 1976 the IWD has focused research on modeling and forecasting of water demands (Tate, 1978). Projections have been made of water withdrawals (Tate, 1985a), and the availability of water is also shown to be a constraint on the development of other activities and industries such as energy development in Canada (Tate, 1985b). A water-use forecasting model (WUFM) has been developed and continues to evolve in technical improvements and expanded applications. The urgent need to develop a capability for examining current and future water demands in the context of water availability has caused the IWD, in cooperation with the Department of Energy, Mines and Resources, and Acres International Ltd., to expand the model from a means of identifying water-supply constraints to energy development into the Water Use Analysis Model (WUAM), a general tool for examining water supply-water demand balances. This simulation model is microcomputer based but can be adapted to a mainframe or minicomputer. It integrates water supply and demand in a finite area by partitioning a basin into nodes and applying a surface-water-supply value and a demand value to each node for any number of water-use categories (such as irrigation,, industrial, etc.) The model is modular, so various parts can be used or eliminated, depending upon the situation being simulated. Output from one part of the model can also show the effect of an interbasin diversion by treating the diverted water as a loss at the node or nodes.

Some of the assumptions applied are:

Water-use category	Percent water consumed
Domestic self-supplied	70-100
Livestock	70- 95
Irrigation	70- 80
Public-water supplied residential	20

Environment Canada as a department publishes a yearbook that covers different aspects of Canada's water resources in each edition, such as climate, streamflow, water quality, data collection, research, water management, and the economy. In 1985, the subject of the yearbook (Environment Canada) was water use, which reflects both the heightened awareness of water-use issues and the increased availability of water-use data.

INCONSISTENCIES AMONG DATA-COLLECTION PROGRAMS

This section describes the water-use data-collection activities in each State and Province, by water-use category, to indicate the types of data that are currently available; it also points out discrepancies among the programs. Several aspects of data collection and storage by the participating organizations are compared and summarized in table 3 (at end of report); major similarities and differences based on data from table 3 and other information obtained during the study are given below.

Comparison of Programs, by Category

Public Supply

All 10 States and Provinces are collecting public-water-supply data; Illinois has two such agencies. All data are computerized in some way; and 10 agencies and ministries (hereafter called participants) are collecting data on users withdrawing more than 100,000 gal/d. Half the participants have a permit or registration program; eight have required metering or reporting, and one (Ontario) has the legal authority to request reports but does not exercise the authority at regular intervals. Illinois SWS and Quebec rely upon voluntary reports of water withdrawal, and Michigan DNR provides estimates for data that are not collected. Only four participants collect strictly annual data; the other eight have some combination of daily, monthly, or annual data. The frequency of recording ranges from monthly to every 5 years, and all participants but one (MDNR) record at least triennially. Among the participants with regularly scheduled collection programs, the lag times between data collection and release range from 6 weeks to 1 year.

Use of trigger values for reporting ranges from all users to only those who withdraw at least 100,000 gal/d. The two agencies without trigger values are the Illinois SWS and Michigan DNR. Data are available by drainage basin from nine participants, are specified as ground-water or surface water by all participants, and by surface-water name from all participants except Michigan DNR.

In addition to withdrawal data, information on delivery, conveyance loss, or consumptive use is maintained by Illinois DOT, New York, Ohio, and Pennsylvania.

Domestic Self-Supplied

All participants but one (Ontario MOE) are deriving or estimating withdrawals in this category. Registration is required in Indiana for withdrawals above 100,000 gal/d, but no domestic users are within this range. Illinois SWS does a survey but estimates all other information, primarily through the cooperative program with the U.S. Geological Survey. Three participants estimate data every 5 years; nine participants provide one value representing a yearly average. The three annual estimates are available by March (one participant) and September (two participants). Most participants compile the data as aggregates, and all but Ohio DNR classify them by drainage basin. All participants can specify withdrawals as ground water or surface water, but only Indiana includes the name of the surface-water source.

No data collection is needed in this category for facilities exceeding the trigger value of 100,000 gal/d because none would approach this amount. Seven participants computerize data in the domestic water-use category.

Irrigation

All 10 States and Provinces and 13 agencies or ministries (participants) collect or estimate irrigation withdrawals. Four States or Provinces have a permit or registration program, and nine conduct a survey or derive estimates. The only State and Province that estimate with no data-collection program are New York and Quebec. Four participants record data monthly or annually, and nine have no trigger level. Three States and one Province (Indiana, Minnesota, Wisconsin, and Ontario) have trigger values; these range from 10,000 gal/d to 100,000 gal/d. Wisconsin has a 100,000-gal/d trigger level for ground-water withdrawals and collects irrigation data from all surface-water users.

The date of release for annual data ranges from March to December; availability from four States and Provinces is sporadic. Geological Survey estimates are available only every 5 years. Eleven participants can provide data by drainage area; all 13 can specify withdrawals as ground water or surface water, and six can specify the name of the surface-water body. Three States (Indiana, Minnesota, and Wisconsin) routinely collect data from users withdrawing more than 100,000 gal/d. Ontario records data at variable intervals. Nine participants computerize data in this category.

Thermeoelectric-Powerplant Cooling

All States and Provinces and 12 agencies or ministries (participants) collect or estimate withdrawals by thermoelectric powerplants. Eight States or Provinces acquire data through surveys or cooperative programs, and four (Indiana, Minnesota, Ontario, and Wisconsin) have permit or registration programs. Eight participants use voluntary reporting or derive estimates; the four listed above require reporting of data. Seven participants have only a yearly average, and 10 record data either annually, every 5 years, or at variable intervals.

The data are processed any time between March and December. Use of trigger values ranges from all powerplants in one State (Pennsylvania) to none in six others. All 13 participants can identify withdrawals as ground water or surface water, and 10 of these can identify surface-water withdrawals by water-body name. Ten participants can provide data by drainage basin, and six can collect data on users withdrawing more than 100,000 gal/d under the present legal framework. Pennsylvania DER also has information on the consumptive use of water.

Hydroelectric Power Generation

Seven States and Provinces and eight agencies or ministries (participants) are collecting information on withdrawals by hydroelectric powerplants. (The category is not applicable to Illinois; the data are not collected in Pennsylvania; and Indiana plans to continue its contractual procedure with a consultant to acquire data in this category.) Of the eight participants that

acquire data, six are using estimates obtained through the U.S. Geological Survey cooperative program, and one (Quebec EQ) obtains values voluntarily reported through surveys. Ontario MOE requires allocation permits.

Six of the participants collect annual data; two collect monthly data. Three--the U.S. Geological Survey office in St. Paul, Minn., Wisconsin DNR, and Quebec EQ--record data annually. Information is available every 5 years from the U.S. Geological Survey's Michigan and New York offices and at variable intervals from New York State DEC and Ontario MOE.

All withdrawals in this category are from surface water. Four participants can identify the water body by name; six can supply the data by drainage basin, and five have their information computerized. Environment Quebec routinely collects data on withdrawals exceeding 100,000 gal/d; Ontario MOE collects this information occasionally.

Illinois DOT and Pennsylvania DER provide information on consumptive use as well as withdrawal.

Industrial Self-Supplied

All 10 States and Provinces and 13 agencies or ministries (participants) collect or estimate industrial withdrawals. Eight of the 13 participants obtain data through the U.S. Geological Survey cooperative program or through surveys, and five (Illinois DOT, Indiana DNR, Minnesota DNR, Ontario MOE, and Wisconsin DNR) require permits or registrations. Only four estimate industrial withdrawals--the U.S. Geological Survey in Michigan, New York, and Ohio, and the New York State DEC. Eight participants collect yearly data, and five States or Provinces record data monthly or annually.

One State (Illinois DOT) has trigger levels for all diverters of Lake Michigan water; another (Pennsylvania DER) records all industrial withdrawals, and six have no trigger levels. The rest have trigger levels for some withdrawal amounts. Dates of data availability range from March to December; the Geological Survey provides estimates every 5 years. Four participants (New York DEC, Ohio DNR, Ontario MOE, and Environmental Quebec) gather data intermittently. All can identify withdrawals as surface water or ground water, but only eight can distinguish between river and lake withdrawals. Two (New York DEC and Ontario MOE) cannot easily provide data by drainage basin.

Illinois DOT and Pennsylvania DER have data on consumptive use as well as withdrawals.

Agricultural

Only Indiana collects withdrawal data; all other States and Provinces except Ontario provide estimates. Four estimate data every year, the other four estimate every 5 years. All can supply data by drainage basin and specify withdrawals as ground water or surface water, but only two can identify the surface-water bodies by name. Only Indiana and Wisconsin collect data on users who withdraw more than 100,000 gal/d; all others use estimates. Indiana DNR and Wisconsin DNR have trigger values of 100,000 gal/d and all surface-water withdrawals in Wisconsin. Minnesota DNR has a trigger value of 10,000 gal/d or 1 Mgal/yr but no data-collection program for agricultural water use.

Commercial Self-Supplied

All States and Provinces except Illinois collect or estimate data on commercial self-supplied water use. Four agencies or ministries (participants) require permits or registrations, and six have a legislative mandate to collect data or have a cooperative program with U.S. Geological Survey. Data are available as daily, monthly, or annual values and are recorded monthly, annually, every 3 years, every 5 years, or at variable intervals. All participants make data available by November; the U.S. Geological Survey provides estimates at 5-year intervals.

All participants can identify withdrawals in this category as ground water or surface water; seven can name the surface-water body. Eight computerize data, and only three (U.S. Geological Survey in Michigan, New York, and Pennsylvania) do not collect data on users who withdraw 100,000 gal/d.

Mining

All States and Provinces except Illinois and Ohio collect or estimate withdrawals for mining. Three obtain data through cooperative programs; two conduct surveys. Three agencies or ministries (Indiana DNR, Minnesota DNR, and Ontario MOE) have allocation-permit or registration programs; five have voluntary reporting or derive estimates; five have only annual averages; and three record data monthly or annually.

Six participants have trigger levels; two have none. The number of users to which they apply ranges from all to only those using more than 100,000 gal/d. Each of these participants can identify withdrawals as surface water or ground water; seven can provide data by drainage basin, and six can identify the surface-water source by name. Five participants (Indiana DNR, Minnesota DNR, Pennsylvania DER, Environment Quebec, and Wisconsin DNR) can provide data on users who withdraw 100,000 gal/d; Ontario MOE has the legislative framework to require reporting.

The Pennsylvania DER has a provision for determining consumptive use.

Discrepancies Among Category Definitions

The definitions of water-use categories that the States and Provinces use determine which activities fall into which category and thus affect the amount of water reported for each category. The effects of these differences must be taken into account until uniform definitions of the categories are adopted by all participants. The following paragraphs describe the major differences in category definitions among the participating agencies and ministries. The definitions recognized by each participant are given in table 4 (at the end of the report).

Public Water Supply

All States and Provinces have a definition of public water supply. Most incorporate the concept of retailing water, whether by a municipality, water

utility, or private enterprise. Many regard the use of trigger levels as a way of defining the system as public. Most participants divide the concept of public supply into smaller units; for example, Ontario uses "municipal" and "public supply," where "municipal" signifies that the installation is a purveyor of water, and "public supply" means the water is withdrawn and used in a public or semipublic place. Quebec uses the terms "municipal water suppliers" and "public and private suppliers" in the same way. Wisconsin uses the terms "community system," "public system," and "municipal system" for purveyors of water and "other community system" and "other use" for groups that may not only withdraw water and sell it (such as a water district) but may also withdraw water and use it (such as schools).

Domestic Self-Supplied

All States and Provinces except Michigan use this category. New York uses the U.S. Geological Survey National Water-Use Information Program definition. Wisconsin limits the category to one- and two-family units. Illinois includes small communities not served by a "public water supply"; therefore, the definition of "domestic" includes public water supply to small numbers of people. Ohio includes livestock watering (agricultural) in this category.

Irrigation

All States and Provinces but Illinois and Quebec define this category. All definitions include watering crops or grounds except Pennsylvania, which considers golf-course watering as institutional (commercial).

Thermoelectric-Power Generation

Seven States and Provinces define this category, four of which use the U.S. Geological Survey definition. Ontario treats this category as industrial.

Hydroelectric-Power Generation

Five States and Provinces lack definitions, and four use the U.S. Geological Survey definition. Ontario combines it with industrial.

Industrial

New York uses the U.S. Geological Survey definition; seven States and Provinces consider it simply as industry or manufacturing. Illinois combines industrial with commercial. Ontario includes thermoelectric-power generation, hydroelectric-power generation, and mining with industrial.

Agricultural

Three States and Provinces do not define this category. Three use the U.S. Geological Survey definition; Ohio combines it with domestic. Ontario and Wisconsin mention only the types of animals but not the lots or machinery requirements associated with the animals.

Commercial

Two States and Provinces do not recognize definitions for this category. Illinois combines commercial with industrial; Pennsylvania includes golf courses. All others' definitions imply the selling of a product or service.

Mining

Ontario includes mining with industrial. The only others who have definitions are Ohio, Minnesota, and New York, which use the U.S. Geological Survey definition and consider mining to end at the processing, manufacturing, or refining stage.

GREAT LAKES REGIONAL WATER-USE DATA BASE

The water-use data collected by the States and Provinces in the Great Lakes-St. Lawrence River basin are to be stored in the Great Lakes Regional Water-Use Data Base, hereafter referred to as the data base. Initially, the data base will accept a wide variety of water-use data supplied by the participating States and Provinces; later, the goal will be to prepare the data to specified standards regarding the Great Lakes Charter trigger levels before transmittal to the data base. Eventually, the States and Provinces may wish to make further refinements to the structure of the data base or to the transmitted data.

Data Requirements

The Great Lakes Charter states, in regard to the "common base of data":

> In order to provide accurate information as a basis for future water resources planning and management, each State and Province will establish and maintain a system for the collection of data on major water uses, diversions, and consumptive uses in the Basin.

The data base, as currently designed, addresses the questions regarding the withdrawal, diversion, and consumptive use in the Great Lakes-St. Lawrence River basin.

Data-Base Design

The data base contains the 11 elements listed below; each of which is described in detail in the following paragraphs.

1. Categories of use
2. Withdrawal source
3. Geographic area
4. Annual amount of withdrawal
5. Amount diverted from basin
6. Amount consumed
7. Level of accuracy
8. Level of aggregation
9. Number of facilities withdrawing 100,000 gal/d or more
10. Total amount withdrawn by above facilities
11. Amount of diversion into basin

ELEMENT 1. CATEGORIES OF USE

(a) Public water supply.--water withdrawn for all uses by public and private water suppliers and delivered to users that do not supply their own water. Water suppliers provide water for a variety of uses such as residential, commercial, industrial, and public supply.

(b) Domestic, self-supplied.--water supplied by individual homeowners and used for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens.

(c) Irrigation.--artificial application of water on lands to assist in the growing of crops and pastures or maintaining recreational lands such as parks and golf courses.

(d) Industrial, commercial, mining:

Industrial.--water used in the manufacture of metals, chemicals, paper, and allied products.

Commercial.--water used by motels, hotels, restaurants, retail stores, office buildings, and civilian and military institutions.

Mining.--water used in the extraction or washing of naturally occurring minerals (solids, such as coal and ores; and liquids, such as crude petroleum and natural gas.) Also includes quarrying and milling.

(e) Agricultural (livestock).--water used by cattle, sheep, goats, hogs, poultry, etc.

(f) Thermoelectric power (fossil fuel).--water used to cool powerplants that use coal, oil, or natural gas.

(g) Thermoelectric power (nuclear).--water used to cool powerplants fueled by nuclear energy.

(h) Hydroelectric power.--water used to drive turbines to generate electric power:

instream use.--once-through plants
offstream use.--pumped-storage (recycled) systems

These definitions are developed further in table 5 (at end of report).

ELEMENT 2. WITHDRAWAL SOURCE

(a) Surface water.--Great Lakes or St. Lawrence River.

(b) Other surface water.--any tributary streams, lakes, ponds, and reservoirs within the Great Lakes-St. Lawrence River basin, including tributaries to the St. Lawrence River.

(c) Ground water.--wells or springs tapping an aquifer.

ELEMENT 3. GEOGRAPHIC AREA

(a) State or province.--Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Ontario, Pennsylvania, Quebec, and Wisconsin.

(b) Drainage subbasin.--Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario, and St. Lawrence River.

A method will need to be adopted whereby the definition of drainage-basin delineation will be understood and accepted by all participating States and Provinces. The drainage-basin delineations in Canada will be those that the Provinces are already using; maps would be distributed to all participating agencies to indicate the drainage divides. One way to attain uniformity in the United States would be to adopt the U.S. Geological Survey drainage-basin delineations referred to as hydrologic units. These were developed by assigning to each basin (1) a two-digit region delineation (such as Atlantic Ocean or Great Lakes), (2) a two-digit subregion number to indicate the major river basin, followed, by another two digits to represent the accounting unit (river basin), and a fourth set of digits (cataloging unit). This system is illustrated below, with three New York State drainage basins as examples:

	Region	Subregion	Accounting Unit	Cataloging Unit
1.	04 Great Lakes	12 Drainage to Lake Erie and the Niagara River	01 Buffalo River basin	03
2.	04 Great Lakes	15 Drainage to Lake Ontario	01 Black River basin	01
3.	04 Great Lakes	15 Drainage to the St. Lawrence River	03 Oswegatchie River basin	02

Each State could adopt such a system and provide data at the 6-digit level. This would enable all areas to recognize each others' delineations without question or overlap. The data base could aggregate the data by drainage basin (accounting unit); this would also allow for use and comparison of data stored in the Geological Survey's State Water-Use Data Bases.

ELEMENT 4. ANNUAL AMOUNT OF WITHDRAWAL (AVERAGE DAILY)

(a) Volume, in Mgal/d.--the average for the reporting year (divide total amount by 365 days).

(b) Year.--the year in which the data were measured.

These data are to be updated annually. The data base will accept other units of measure if necessary but will convert them to Mgal/d. The best check for accuracy would be for the group originating the data to do the conversion.

The data represent the calendar year in all States and Provinces except Illinois, which recognizes the federal water year, October 1 to September 30.

All zero withdrawal values will be reported to distinguish them from lack of data.

ELEMENT 5. AMOUNT OF WITHDRAWAL DIVERTED

The Great Lakes Charter definition of diversion is:

> "a transfer of water from the Great Lakes Basin into another watershed, or from the watershed of one of the Great Lakes into that of another."

To document the diversion of water out of or within the Great Lakes basin, the data base will record both types of diversions--those out of the basin (interbasin transfer) and those between subbasins (intrabasin transfer).

The amount of water will be reported in Mgal/d and by water-use category; that is, the amount diverted will represent the total amount or a fraction of the amount withdrawn, by category.

The destination of the diverted water will also be given as one or more of the Great Lakes-St. Lawrence River subbasins or as a diversion out of the Great Lakes-St. Lawrence River basin.

ELEMENT 6. AMOUNT OF WITHDRAWAL CONSUMED

This represents the volume of water that is no longer available because it has been evaporated, transpired, incorporated into products or crops, consumed by man or livestock, or otherwise removed from the water environment. Also referred to as water consumption and water consumed. The Charter defines consumptive use as:

> "that portion of water withdrawn or withheld from the Great Lakes Basin and assumed to be lost or otherwise not returned to the Great Lakes Basin due to evaporation, incorporation into products, or other processes."

The amount will be reported by category, as in element 5.

ELEMENT 7. LEVEL OF ACCURACY

(a) all measured
(b) partially measured (over 50 percent of the withdrawals)
(c) calculated or estimated (from a sample or from a coefficient related to a known characteristic)

ELEMENT 8. LEVEL OF AGGREGATION

(a) Over 50 percent of the water is from a site-specific source (data base)
(b) Over 50 percent of the water is from an aggregated source

ELEMENT 9. NUMBER OF FACILITIES WITHDRAWING 100,000 GAL/D OR MORE

To be reported by water-use category; for example, number of public-water suppliers, number of irrigators, etc. (if known)

ELEMENT 10. TOTAL AMOUNT OF WATER WITHDRAWN BY FACILITIES IN ELEMENT 9

The amount reported for each category will be less than or equal to the total amount of water withdrawn in each category.

ELEMENT 11. AMOUNT OF WATER DIVERTED INTO THE BASIN, BY CATEGORY OR BY STRUCTURE (AQUEDUCT, MAN-MADE CANAL, ETC.)

The amounts will be listed individually for each structure or water-use category.

A copy of the proposed coding form is shown in figure 7 to clarify the requirements and the units in which the data are to be provided.

A critical factor in determining what data belong in which water-use categories is a precise definition of the categories and a listing of the activities they encompass. Table 5 (at end of report) describes each category and lists the activities, as defind by Standard Industrial Classification (SIC) Manual (1972) codes that fall into each category.

As previously indicated, the original data base will accept data from the States and Provinces by water-use category, regardless of trigger level. Adaption to standardized trigger levels will be developed later in the program.

Present Ability of States and Provinces to Meet Data-Base Requirements

This section compares the States' and Provinces' current category definitions with the established definitions of the regional data base. Because many of the States and Provinces do not plan to modify their present category definitions, it is important that the discrepancies be noted.

Differences Among Category Definitions

Public Water Supply.--Aside from the inclusion of trigger levels in some States' and Provinces' definitions, the primary disparity within this category is the inclusion of self-supplied activities. Ontario could correct this by indluding only "municipal" supplies; Quebec could alter their "public and private suppliers" category and Wisconsin their "other community systems" and "other use" categories to include only the retailers of water that withdraw it and distribute it without using it. (If the water is withdrawn and used, it is considered domestic self-supplied, commercial self-supplied, etc.; see table 5.)

GREAT LAKES REGIONAL WATER-USE DATA BASE

State or Province _____ Year _____

Subbasin _____
(see item 3)

1. CATEGORY OF USE: (circle one)
   (a) Public Water Supply
   (b) Domestic
   (c) Irrigation
   (d) Industrial, Commercial, Mining
   (e) Agriculture
   (f) Thermo-electric (fossil fuel)
   (g) Thermo-electric (nuclear)
   (h) Hydro-electric

2. WITHDRAWAL SOURCE: (circle one)
   (a) Surface water (Great Lakes or St. Lawrence River)
   (b) Other surface water
   (c) Ground water

3. GEOGRAPHIC AREA (subbasin)
   Circle subbasin in which withdrawal occurred:
   Lake Superior
   Lake Michigan
   Lake Huron
   Lake Erie
   Lake Ontario
   St. Lawrence River

4. AVERAGE DAILY AMOUNT OF WITHDRAWAL FOR THE YEAR: Total Mgal/365 d) _____ Mgal/d.

5. AMOUNT OF WITHDRAWAL DIVERTED
   A. OUT OF GREAT LAKES-ST. LAWRENCE BASIN: _____ Mgal/d.
   B. TO ANOTHER SUBBASIN: _____ Mgal/d. RECEIVING SUBASIN: _____. (name)

6. AMOUNT OF WITHDRAWAL CONSUMED: _____ Mgal/d.

7. LEVEL OF ACCURACY: (circle one)
   (a) measured
   (b) 50% to 100% measured
   (c) Estimated

8. LEVEL OF AGGREGATION: (circle one)
   (a) more than 50% from site-specific source or data base
   (b) more than 50% from aggregated source

9. NUMBER OF FACILITIES WITHDRAWING 100,000 GAL/D OR MORE (30-day avg.): _____.

10. TOTAL AMOUNT OF WATER WITHDRAWN BY FACILITIES IN ELEMENT 9: _____ Mgal/d.

DIVERSION INTO BASIN:
(a) Name of structure (canal, aqueduct, etc.)
   1. _____ _____ Mgal/d.
   2. _____ _____ Mgal/d
   3. _____ _____ Mgal/d
(b) Total _____ Mgal/d.

Figure 7.--Proposed regional data-base coding form showing types of data required for each of the 11 data-base elements.

Domestic Self-Supplied.--Discrepancies within this category are that the Ohio DNR combines domestic and agricultural, and Illinois SWS includes some small community systems within the domestic category.

Irrigation.--Pennsylvania DER includes golf-course irrigation within the institutional or commercial categories.

Industrial.--Ontario MOE combines the power categories with mining and industrial, and Illinois SWS combines industrial with commercial.

Each agency and ministry will be responsible for supplying data as required and when required. Table 6 (at end of report) summarizes each States' and Provinces' ability to do so by water-use category and indicates where difficulties lie.

Suggestions to Attain Uniformity

Data may be either unavailable or in a format unsuitable for transmittal to the data base for several reasons, such as those listed below. The water-use data-collection programs in each State and Province were reviewed in relation to the data-base requirements, and the reasons for inconsistency or incompleteness of data were noted. A complete summary is given in table 6 (at end of report); the reasons are listed below.

A. Not all data for a category are collected or estimated annually.
B. The data are not stored or readily available by drainage subbasin.
C. Withdrawal data are not identified as ground-water or surface-water source.
D. Data having a surface-water source do not indicate the name of the water body; hence lake withdrawals are indistinguishable from river withdrawals.
E. Data are not stored on a basis smaller than county, basin, municipality, or watershed aggregates.

It would be expedient for each State and Province to determine the gaps in their data-collection and processing programs by noting all "no" entries listed in table 6 and the reasons. To be in complete compliance with the data-base requirements, all entries would need to be "yes". Some general guidelines and suggestions are given below:

1. Data not available should at least be estimated.
2. If consumptive use is unknown, it should be estimated through consistent techniques.
3. Determination of diversions will require research at least into the systems operating near the drainage divides.
4. Any new reporting program should include questions about diversion and consumptive use.
5. The number of facilities withdrawing 100,000 gal/d would be most easily determined through a registration program with a trigger level no higher than 100,000 gal/d.
6. Annual computation of data could be realized through mandatory annual reporting.
7. All current data-collection programs should either be annual or should include procedures for estimating the values at least every other year.
8. All data that will be estimated should be revised annually.

9. Categories for which withdrawals are estimated should be developed into a data-collection or reporting program. (Except for the smaller use categories, a method for determining which categories can be estimated without loss of accuracy is described further on.)
10. If data are acquired from other agencies that do not provide data annually (such as the U.S. Geological Survey), arrangements must be made to acquire the estimates or data for the years when values are unavailable. (An example is the U.S. Geological Survey's water-use program, in which data are updated every 5 years. Agencies that use this information will need either (1) to arrange for the Geological Survey to provide annual processing in their State, or (2) to independently obtain the information for missing years.)
11. States and Provinces with data-collection and reporting legislation that is not enforced will need to strengthen the enforcement.
12. Failure to distinguish between lake withdrawals and river withdrawals can be corrected by requiring this distinction in data-collection/reporting programs or providing estimates.

The original data-base design emphasizes the acquisition of data annually. Of the data elements listed in table 6, the most basic is the "amount withdrawn," which should be collected or estimated annually. Reporting the "amount diverted" will require site-specific investigation, as will identification of surface-water sources. The "amount consumed" can be estimated, at least initially. Determining the "number of facilities withdrawing 100,000 gal/d" and the "amount withdrawn" is desirable at present and will be mandatory for the future refined data base, described below. The refined system will emphasize not only the transmittal of all data as originally required, but also ability to provide accurate (not estimated) numbers of facilities at the 100,000 gal/d level and their total withdrawals.

Future Refinement

The initial data base should undergo refinement to increase its usefulness and accuracy by (1) developing better techniques for estimating withdrawals and consumptive use, (2) increasing data collection to reduce the amount of estimation, and (3) reaching agreement on methods and techniques to ensure uniformity of procedures. The name of the refined data base will be The Great Lakes Charter Regional Water-Use Data Base.

Objectives

A major step in the effort to achieve uniform reporting of data will be the adoption of uniform trigger levels (withdrawal rates above which reporting is mandatory). Local data bases and trigger levels can remain at any value the agencies and ministries deem necessary, as long as the data transmitted to the data base conform to the specified levels. The most logical set of values to adopt are those recommended by the Great Lakes Charter in the "Progress toward Implementation" section, which discusses use of the data and steps toward water management:

> . . . the right of any individual State or Province to participate in the prior notice and consultation process, either before or after

approval of formal procedures by the Governors and Premiers, is contingent upon its ability to provide accurate and comparable information on water withdrawals in excess of 100,000 gallons (380,000 litres) per day average in any 30-day period and its authority to manage water withdrawals involving a total diversion or consumptive use of Great Lakes Basin water resources in excess of 2,000,000 gallons (7,600,000 litres) per day in any 30-day period.

These values (100,000 gal/d for withdrawals and 2 Mgal/d for diversions or consumptive use) will be adopted initially.

Data elements 9 and 10, which call for the number of facilities withdrawing more than 100,000 gal/d and the amount each withdraws, are included in the initial data base in anticipation of this requirement. The difference between the initial data base and the refined data base is that the latter will require the States and Provinces to document the number of such facilities and their withdrawals, whereas in the initial data base it is only desirable.

A further recommended refinement is that the amount of water diverted and the amount consumed by these facilities (in item 9) will also be documented by water-use category and added to the data base.

The reason the data base is not being changed to exclude users that withdraw less than 100,000 gal/d is that the cumulative effect of the smaller users should not be lost. Including a set of regional data for all users that withdraw more than 100,000 gal/d gives a consistent set of data from across the region that conforms to Charter mandates but also gives aggregated data on smaller users in the States and Provinces. The trigger levels used by the individual States and Provinces are documented by water-use category in table 1 so that all will know what the data base represents.

Categories that will never have users that withdraw more than 100,000 gal/d, such as domestic self-supplied, can continue to be estimated. Withdrawals by larger users would need to be documented, however.

In summation, adherence to the Great Lakes Charter Regional Water Use Data Base would include conformance to the requirements of the original data base with the following additions:

1. Ability to identify the facilities that withdraw an average of 100,000 gal/d in any 30-day period, possibly through a registration program;
2. Ability to document the amount of water such facilities are withdrawing, possibly through required reporting;
3. Ability to identify the amount of water diverted and consumed by these facilities.

The Great Lakes Charter also requires the ability to grant permits or otherwise manage facilities that withdraw and divert or consume more than 2 Mgal/d in any 30-day period. Although this is not strictly part of the data base, it is part of the regional water-use management strategy.

Suggestions

Refinement of both the initial data base and the refined (Charter) version will require substantial effort by the agencies and ministries. Inherent in the refinement concept is the assumption that the successor to the Council of Great Lakes Governors, Water Resources Management Committee, will continue to meet at least annually to discuss development of data-collection procedures and refinement of the data-base structure. The following paragraphs describe the rationale and suggestions for improvement in five aspects.

Geographical Area.--The refined data base would accept United States data that represent U.S. Geological Survey's 8-digit hydrologic unit (drainage-basin) divisions described earlier; this will allow for more accurate documentation of withdrawal locations without demanding a site-specific approach. The data would also be reorganized and entered as county aggregates. A similar system could be established for Canada, which would allow for comparison of data gathered by other groups such as the U.S. Geological Survey, the U.S. Army Corps of Engineers, and Environment Canada. Eventually a site-specific data base that uses software such as the State Water Use Data System of the Geological Survey or the site-specific data bases used by Quebec, Minnesota, Indiana, Pennsylvania, or Illinois, for example, could be used, given sufficient time and funding for acquisition and reformatting of data.

Frequency of Reporting.--Updates are to be provided annually, and the values will represent a daily, monthly, or yearly average. Estimated values are provided yearly, which seems reasonable for all categories except irrigation, which is highly seasonal. The data for this category could be reported and recorded in the data base monthly during the growing season, and the data could be collected either daily or monthly. This also implies site-specific data, at least for users whose withdrawals exceed 100,000 gal/d. Values for the rest of the users could be estimated, but the estimate would be made monthly rather than yearly and based on a rational coefficient.

Public Water Supply.--To document the distribution of public-supply water, a section would be added to the data base that gives number of gallons distributed to residential, industrial, and commercial users within each State or Province. Also included would be the amount of water consumed within each of these three categories to replace the single figure now used for public-water supply consumption.

Trigger Levels.--Some States and Provinces do not have trigger levels for all categories. The method described here provides a way of determining an appropriate trigger level for a specific category:

(1) Distribute the total water withdrawals by water-use category. (This information should be available in each U.S. Geological Survey office by January 1987.) Any category that represents less than 10 percent of the total withdrawal can be permanently estimated without significant loss of accuracy on the regional scale.

(2) For each category that exceeds 10 percent, determine what percentage of the total withdrawal for all categories is represented by users who exceed 100,000 gal/d. If these users withdraw 90 percent of the total, the trigger level in that category need not be below 100,000 gal/d. If they use less

than 90 percent of the total, however, users who withdraw less than 100,000 gal/d need to be surveyed until a withdrawal rate is found that represents 90 percent of the total; that represents a usable trigger level for that category, and the remaining 10 percent can be estimated.

This procedure follows for all categories that require data. The water diverted and consumed by each sector above the trigger level should be determined also.

Methods and Techniques.--A program of improving estimation techniques, refining values, and improving methods in each State and Province would benefit all members, especially until the data base receives more reported data and fewer estimated values. A list of estimation coefficients and the source of the coefficients is given in table 7B (at end of report); the Standard Industrial Code listing of the various types of user in each category (U.S. Office of Management and Budget, 1972) is included. A list of several agencies, groups, and companies that have information on techniques, instrumentation, or data on the categories or on consumptive use is given in table 8 (at end of report). This list serves as a source of aid to developing programs.

In summary, the refined Charter data base could include some or all of the following improvements over the present program:

1. Geographical area: Report data by 8-digit hydrologic unit and by county; also report site-specific data.

2. Frequency of reporting: Report yearly for all categories except irrigation, which would be monthly.

3. Public water supply: Report the amount of water distributed to and consumed by residential, industrial, and commercial users.

4. Trigger levels: Collect data for all categories that represent more than 10 percent of the total State or Province withdrawal; set a data-collection trigger level to encompass 90 percent of the total withdrawal in each category within that State or Province.

5. Methods and techniques: Improve methods of estimation and techniques of collecting data and calculating consumptive use. Agree to some uniformity of methods within the region.

TRANSMITTAL OF DATA TO THE GREAT LAKES REGIONAL DATA BASE

This section describes the States' and Provinces' options for transmitting data to the regional data base and indicates which would be feasible for each. It also indicates, by water-use category, which agencies within each State and Province will be responsible for data compilation and transmittal, and whether the data in each of 10 categories will be measured or estimated. This discussion is based mainly on withdrawal data in the current data-collection programs on the assumption that diversion and consumptive-use information will be included by the lead agency or ministry in the States and Provinces for transmittal to the regional water-use data base.

Methods of Data Transfer

Entry

The methods of data transfer that can be used for entry into the regional data base are as follows.

Coding Forms.--All agencies and ministries will be permitted to fill out coding forms (fig. 7) and mail them to the data-base-repository site. The agency maintaining the data base will be responsible for data entry and data verification. All agencies will be permitted to produce additional coding forms on inhouse duplicating machines.

Cards.--Although punch cards are rapidly becoming obsolete, a predetermined format will be prepared for agencies that wish to punch the data onto cards. The cards will be mailed to the data-base repository for loading into the data base.

Diskette.--Agencies that use IBM personal computers (PC's) or PC-compatible machines may write data in a predefined format on 5 1/4-inch floppy diskettes and mail them to the data-base repository for loading into the data base.

Data may be put on the diskette in the predefined format in one of three ways: (1) by using a text editor to key the data into the predefined format directly on the diskette; (2) by designing and writing a program to pull data directy from the participating agency's data base and writing it back on the diskette (such a program should be written by the participating agency); and (3) by using a prompting routine that asks the data-entry operator for each item in the data dictionary, who then writes those items onto the diskette. (This program should be designed and written by the agency that designs and writes the main data base.)

Nine-Track Tape.--Agencies that use mainframes or minicomputers equipped with nine-track tape drives may copy data from online storage units to tape. Tapes would be sent to the data-base repository, which would load the data from tape into the data base. Data could be written to the tapes in much the same way as to diskettes.

Direct Entry (interactive).--Participating agencies may directly access the computer that houses the data base and enter data through the main entry

routines of the data base, thus bypassing intermediate steps and avoiding the cost of loading data from forms, cards, etc. The participating agencies and ministries may directly access the computer system through a modem or a multiplexor hook-up. The cost of any communications equipment, installation fees, telephone lines, or computer time would be the responsibility of the participants.

Direct Entry (batch).--Methods for connection to the computer that houses the data base are identical to those for the direct entry in interactive mode, but the programs used for data entry differ. The participating agency would transfer data in a predefined format, as mentioned in item (3), to the computer that houses the data base, then execute a batch-entry program to populate the data base.

Retrieval

Methods of making retrievals from the regional data base include:

Requests.--The participating agencies may make requests by mail or telephone. The data-base management would be responsible for processing the request. The data requested could be provided in several forms--on standard computer paper, on high-quality bond from a letter-quality printer, on diskette, or on nine-track tape. The requesting agency would be responsible for manpower and materials costs.

Direct Access.--Participating agencies could directly access the computer that houses the data base and retrieve data by (1) using the retrieval programs specifically written for the data base, or (2) developing and executing retreval routines in the data-base language. As with direct access for data entry, the participating agency would pay for all equipment, telephone charges, and computer charges. If a participating agency requests that a new retrieval routine be written, the data-base management would design and write the new program, but the requesting agency would be responsible for the programmer's labor cost and overhead charges.

Data-Transfer Capability, by State and Province

Illinois

The Illinois Department of Transportation (IDOT), Division of Water Resources, will be responsible for transfer of data to the Regional Data Base. The IDOT's capability for data transfer, in addition to coding forms, is summarized below.

Cards and direct access.--The IDOT does not have a card punch, a VT100 terminal, nor a VT100 emulator package for the IBM-PC; thus neither cards nor direct access are options.

Diskettes.--The IDOT has an IBM-AT personal computer but not a Fortran compiler for the PC. Hence, they may use diskettes for data transmission by any of the options mentioned previously (editor, reformatting program, or independent prompting program) but do not have the ability to modify the independent prompting program.

Tapes.--The IDOT does not have a computer that produces nine-track tapes.

The simplest way for Illinois to submit data would be by mailing coding sheets.

Responsibility for compiling data to be submitted to the IDOT for transfer to the data base is as follows:

Category	Agency[1]	Type of information	Category	Agency	Type of information
Public water supply	IDOT	Data	Industrial	IDOT	Data
Domestic self-supplied	ISWS	Estimate	Commercial	n.a	
Irrigation	ISWS	Estimate	Mining	n.a.	
Power, fossil fuel	ISWS	Data	Agricultural	ISWS	Estimate
Power, Nuclear	ISWS	Data	Hydroelectric	n.a.	

[1] IDOT = Illinois Department of Transportation
ISWS = Illinois State Water Survey

Indiana

The Indiana Department of Natural Resources (IDNR), Division of Water, is the agency chosen to transmit data to the data base. The IDNR's data-transfer capabilities, in addition to coding forms, are as follows:

Cards, diskettes, direct access.--The IDNR does not have access to a card punch, an IBM-PC, or a VT100 terminal, so use of cards, diskettes, or direct access is not possible at present.

Tapes.--The IDNR has access to a computer that produces nine-track tapes and has a Fortran compiler, which enables use of the independent prompting program for data preparation.

The most efficient way for Indiana to transmit the required data is for the IDNR to make customized data retrievals from their own computerized data base and to complete the coding forms.

Responsibility for transmittal of data to the data base is as follows:

Category	Agency[1]	Type of information	Category	Agency	Type of information
Public water supply	IDNR	Data	Industrial	IDNR	Data
Domestic self-supplied	IDNR	Estimate	Commercial	IDNR	Data
Irrigation	IDNR	Data	Mining	IDNR	Data
Power, fossil fuel	IDNR	Data	Agricultural	IDNR	Estimate
Power, nuclear	IDNR	Data	Hydroelectric	n.a.	

[1] IDNR = Indiana Department of Natural Resources

Michigan

The Michigan Department of Natural Resources (MDNR) has the primary responsibility for transmitting data to the data base.

The most expedient method of transmitting data to the data base has not been finally decided. The Great Lakes and Water Resources Planning Commission probably will request the legislature to mandate annual reporting of data for the categories of self-supplied industrial, thermoelectric power, and irrigation. Estimation techniques and surveys would continue to be used as needed for the categories of domestic self-supplied, livestock, hydroelectric power, commercial self-supplied, and mining; the USGS would provide data at least every 5 years. The Michigan Department of Public Health (MDPH) would continue to provide public water-supply data.

The MDNR has been granted permission to install a new computer system to store natural-resource data and may decide to electronically link with the Prime minicomputer of the U.S. Geological Survey in Lansing and implement its site-specific water-use software package, the State Water Use Data System (SWUDS). SWUDS would provide the option to store more detailed water-use information without developing new software.

In addition to coding forms, the MDNR has the following data-transfer capabilities:

Cards.--The MDNR does not have access to a card punch.

Diskette.--The MDNR has an IBM PC and plans to buy a Fortran compiler. Hence, they may send data on a diskette by any of the related options.

Tape.--The MDNR has access to a computer that produces nine-track tapes.

Direct Access.--The MDNR has neither a VT100 terminal nor VT100 terminal emulator package for their IBM PC; therefore, direct access for data entry and retrieval is not currently an option.

The large volume of data probably makes transmission via nine-track tape the best option for data entry. The data sets for tape should probably be created through some type of reformatting program. The computer being used has a Fortran compiler, which enables use of the independent prompting program as well. This analysis may change, however, depending upon implementation of the new computer, which may allow direct access or use of the U.S. Geological Survey's State Water-Use Data System, which could be stored either on the new computer or on the Geological Survey's Prime minicomputer.

The most efficient options for Michigan would be to:

(1) Load Michigan water-use data into SWUDS on the local Geological Survey minicomputer and purchase a VT100 terminal or VT100 terminal emulator package for the IBM PC to obtain direct access to the Prime and SWUDS. The SWUDS data could then be retrieved, reformatted, and sent on tape to the regional data-base site.

(2) MDNR could write a computer program to store Michigan data on the new computer and send the required data on tape to the data base.

The first alternative might be preferable if an immediate program of site-specific water-use data is desired; the second would be easier if the objective were to transmit the required aggregated data without site-specific detail.

Responsibility for compilation and transmittal of data to the regional data base is as follows:

Category	Agency[1]	Type of Information	Category	Agency	Type of information
Public water supply	MDPH	Data	Industrial	MDNR/USGS	Estimate
Domestic self-supplied	MDNR/USGS	Estimate	Commercial	MDNR/USGS	Estimate
Irrigation	MDNR/USGS	Data/Estimate	Mining	MDNR/USGS	Estimate
Power,-fossil fuel	MDNR/USGS	Data/Estimate	Agricultural	MDNR/USGS	Estimate
Power, nuclear	MDNR/USGS	Data/Estimate	Hydrolelectric	MDNR/USGS	Estimate

[1] MDPH = Michigan Department of Public Health
MDNR = Michigan Department of Natural Resources
USGS = U.S. Geological Survey

Minnesota

Either the Land Management Information Center (LMIC) or the Minnesota Department of Natural Resources (MNDNR) will transmit data to the regional data base, depending on which assumes the lead in the process of data organization. The MNDNR capabilities for data transfer, in addition to coding forms, are as follows:

Cards.--The MNDNR does not have access to a card punch.

Diskette.--The MNDNR has an IBM PC and Fortran compiler, which enables use of the independent prompting program source code.

Tape.--The MNDNR has access to the LMIC computer, which can produce nine-track tapes, and also a Fortran compiler, which will allow use of the independent prompting program.

Direct Access.--The MNDNR has a VT100 terminal, which can be used for direct access entry and retrieval, but does not have a VT100 emulator package for their IBM PC. Thus they will be unable to use the IBM PC for direct access.

Minnesota has a large volume of data to be collected; therefore the best option for data entry would be transmittal by tape. A reformatting program could be used to prepare the data for transmission. Either the MNDNR could reformat the data and send it electronically to the LMIC for transfer to tape, or the LMIC could reformat the data and make the tape. In either case, estimates made by the Geological Survey will need to be included on the tape. The most efficient means would be for the Geological Survey to reformat its data and supply it directly to the LMIC or the MNDNR for transmittal to the regional data base.

Responsibility for compilation of data for the regional data base is as follows:

Category	Agency[1]	Type of information	Category	Agency	Type of information
Public water supply	MNDNR	Data	Industrial	MNDNR	Data
Domestic self-supplied	USGS	Estimate	Commercial	MNDNR	Data
Irrigation	MNDNR	Data	Mining	MNDNR	Data
Power, fossil fuel	MNDNR	Data	Agricultural	USGS	Estimate
Power, nuclear	MNDNR	Data	Hydroelectric	USGS	Estimate

[1] MNDNR = Minnesota Department of Natural Resources
USGS = U.S. Geological Survey

New York

The U.S. Geological Survey office in New York has been selected to store the New York water-use data; the New York State Department of Environmental Conservation (NYSDEC) will also be transmitting data to the Geological Survey and possibly to the regional data base. In addition to coding forms, NYSDEC's capabilities for data transfer are as follows:

Cards.--The NYSDEC has access to a card punch and therefore can submit data for entry via cards.

Diskette.--The NYSDEC has an IBM PC with a Fortran compiler and thus will be able to submit data for entry via diskette.

Direct Access.--The NYSDEC has both a VT100 terminal and a VT100 emulator package for their IBM PC, which makes all options for direct access feasible.

The Geological Survey's capabilities, in addition to coding forms, are as follows:

Cards.--The Survey does not have a card punch.

Diskette.--The Survey does not currently have access to an IBM-PC but plans to purchase one. Until then they cannot use this option.

The best method of transmittal is by tape. The Geological Survey in Albany will probably store the data required by the regional data base. It would begin collecting data cooperatively with NYSDEC every year instead of every 5 years and would reformat the data to met the data-base requirements. Data storage in SWUDS in New York has already begun.

Responsibility for data compilation for transmittal to the regional data base from New York is as follows:

Category	Agency[1]	Type of information	Category	Agency	Type of information
Public water supply	NYSDOH	Data	Industrial	USGS/NYSDEC	Est.
Domestic self-supplied	USGS	Est.	Commercial	USGS	Est.
Irrigation	USGS	Est.	Mining	USGS	Est.
Power, fossil fuel	USGS/NYSDEC	Est.	Agricultural	USGS	Est.
Power, nuclear	USGS/NYSDEC	Est.	Hydroelectric	USGS/NYSDEC	Est.

[1] NYSDOH = New York State Department of Health
NYSDEC = New York State Department of Environmental Conservation
USGS = U.S. Geological Survey

Ohio

The Ohio Department of Natural Resources (ODNR) does not have a computerized water-use data base, but the transfer of data from the Ohio Environmental Protection Agency (OEPA) will be through the ODNR as lead agency. The data-transfer options available to the OEPA, in addition to coding forms, are as follows:

Cards.--The OEPA does not have access to a card punch.

Diskette.--The OEPA has an IBM PC but not a Fortran compiler. Hence, they may use diskettes for data entry but may not use the independent prompting program source code (to modify it for their own purposes). If they choose the independent prompting program, they must use the source code only.

Tape.--The OEPA has access to a computer that can produce nine-track tapes and has a Fortran compiler, making it possible to use the independent prompting program for preparing tapes. A reformatting program could be used to read in data from the current files and write it to tape in the predefined format.

Direct Access.--The OEPA has both a VT100-compatible terminal and a VT100 emulator package for their IBM PC-compatible microcomputer. Both are connected to modems; thus the OEPA may use all options involved with direct access.

The most efficent way for the OEPA to transmit data is by reformatting their computerized information and mailing a nine-track magnetic tape. The noncomputerized data must be transmitted as well, though.

At present, water-use data are available every 5 years through the U.S. Geological Survey in Columbus and intermittently when ODNR conducts a survey or writes a regional water plan. The first issue to be addressed is the annual compilation of data. Until a registration/reporting system can be implemented, the required data could obtained through either:

1) a data-compilation program conducted by ODNR that includes generation of required data and use of information from OEPA and Geological Survey, or,

2) an expanded cooperative water-use project with the Geological Survey that includes an annual data-collection and update program in addition to the data provided every 5 years.

If the latter option is chosen, the OEPA could store data on the Geological Survey minicomputer and prepare tapes for transmittal to the regional data base after ODNR review. The OEPA has already begun to store site-specific public-water supply, commercial, and thermoelectric-power data in SWUDS on the Geological Survey Prime minicomputer. When the loading of OEPA data into SWUDS is complete, a reformatting program could be used to pull data from SWUDS and reformat it for the regional data base. The aggregated data could also be stored on the Geological Survey minicomputer as aggregates for data categories that do not have site-specific data. A program could be implemented through which increased site-specific data collection enables a reduction in amount of estimation and aggregation. Increased amounts of data could be stored in SWUDS and reformatted to produce regional data-base aggregates. Three questions to be addressed by ODNR are (1) how to acquire annual data, (2) how to produce data in the regional data-base format, and (3) how to transmit data to the regional data base.

One approach would be to develop a program reliant upon computerized data rather than coding forms every year without benefit of computer retrievals, and the ODNR is working toward a computerized water-use data base. Meanwhile, the ODNR may want to discuss the delegation of tasks with the Geological Survey and the possible increased implementation of the SWUDS.

Responsibility for data compilation is as follows:

Category	Agency[1]	Type of information
Public water supply	OEPA	Data
Domestic self-supplied	ODNR/USGS	Estimate
Irrigation	ODNR/USGS	Estimate/Survey Data
Power, fossil fuel	USGS	Survey Data
Power, nuclear	USGS	Survey Data
Industrial	ODNR/USGS	Estimate/Survey Data
Commercial	OEPA/USGS	Data/Estimates
Mining	none	none
Agricultural	USGS	Estimate
Hydroelectric	USGS	Estimate

[1] OEPA = Ohio Environmental Protection Agency
ODNR = Ohio Department of Natural Resources
USGS = U.S. Geological Survey

Ontario

The Ontario Ministry of the Environment (OMOE) will compile and transmit all data. It is now investigating a permit-fee system and complete computerization of reported data. The options for data transmittal, in addition to coding forms, are as follows:

Cards.--The OMOE has a card punch for data entry.

Diskettes.--The OMOE has an IBM PC with a Fortran compiler and thus may use any of the options availible for data entry by diskette.

Tapes.--The Environmental Service Division has access to a computer that produces nine-track tapes and has a Fortran compiler. Therefore, the OMOE may send data on tapes and may use the independent prompting package to create the data sets for the tapes.

Direct Access.--The OMOE has a VT100-compatible terminal that connects to a modem, which enables direct access to the data base for data entry and retrieval.

Once the OMOE institutes a procedure for regular annual reporting and loads the data onto the IBM mainframe, the best data entry option is sending nine-track tapes to the repository because of the large volume of data to be collected and processed. A reformatting program that takes data from present files and writes it on tape in the required format would be the most efficient method of preparing data for transmittal via tape.

The legislative framework for collecting data is in place for all water-use categories except domestic self-supplied and agricultural. Some of the remaining steps are to:

1. Possibly initiate a fee system to fund the data collection.
2. Notify all permittees that annual reporting of water use will be required.
3. Provide a reporting form upon which the permittee will submit annual data.
4. Allocate personnel to review the filled-out report forms and key the data.
5. Have a water-use-data program on the mainframe to store the data.
6. Have a program to reformat and aggregate the data into the format required for the regional data base.
7. Establish procedures to acquire population figures, number of people on public-water services, numbers of livestock, and per-capita and per-animal water-use values to estimate water use for the domestic self-supplied and agricultural categories.
8. Combine all data on tape for transmittal to the regional data base.

Pennsylvania

The principal water-use data-collection agency in Pennsylvania is the Pennsylvania Department of Environmental Resources (PaDER), Bureau of Water Resources Management, State Water Planning Division. In addition to coding forms, the PaDER has the following options for data transfer:

Cards.--The PaDER does not have a card punch.

Diskettes.--The PaDER has an IBM PC-compatible microcomputer but not a Fortran compiler. Thus, they may use diskettes for transfer of data but will not be able to modify the independent prompting program for their purposes. The independent prompting program may be used only with the executable code.

Tapes.--The PaDER has access to a computer that can produce nine-track tapes and has a Fortran compiler. Hence, they may send data for entry via tapes and may use the independent prompting program for creation of data sets to copy onto the tapes.

Direct Access.--The PaDER has a VT100 emulator package for their IBM PC-compatible microcomputer, which enables direct access entry and retrieval.

The most efficient method of data transfer would probably be coding sheets, owing to the small amount of data to be processed annually.

The PaDER would be able to make retrievals for the categories of public-water supply, industrial, mining, and electrical powerplants, and they could estimate values in conjunction with the Geological Survey for the categories of domestic self-supplied, irrigation, agricultural, and commerical self-supplied. They could then mail the coded forms to the repository site.

One concern is the frequency with which the data are updated. Although the PaDER mails reporting forms to public-water suppliers each year, they update only half each year. Mining updates, especially for coal extraction, must be frequent because the locations change frequently. Manufacturing withdrawals are updated every 5 years, and powerplant data are updated annually.

The frequency of water-use estimates by the Geological Survey is every 5 years. Either the cooperative program with PaDER will need to call for annual updating of estimates, or PaDER will need to make yearly estimates within the 5-year intervals.

Responsibility for data compilation for transmittal to the data base is currently as follows:

Category	Agency[1]	Type of information	Category	Agency	Type of information
Public-water supply	PaDER	Data	Industrial	PaDER	Data
Domestic self-supplied	PaDER	Estimate	Commercial	USGS	Estimate
Irrigation	PaDER/USGS	Estimate	Mining	PaDER	Data
Power-fossil fuel	PaDER	Data	Agricultural	USGS	Estimate
Power-nuclear	PaDER	Data	Hydroelectric	none	none

[1] PaDER = Pennsylvania Department of Environmental Resources
USGS = U.S. Geological Survey

Quebec

The ministry responsible for water-use data is Environment Quebec (EQ), who also will transmit the data to the regional data base. EQ's capabilities for data transmittal, in addition to coding forms, are as follows:

Cards.--EQ has a card punch and therefore can enter data in this manner.

Diskettes.--EQ has an IBM PC-compatible microcomputer but not a Fortran compiler; thus, they can send in data by diskette through any of the related options, but to use the independent prompting program, they must access only the executable code. They do not have the ability to use the source code for the independent prompting program at present.

Tapes.--EQ has access to a computer that reads and writes nine-track tapes and also has a Fortran compiler. Hence, EQ may use nine-track tapes for data entry and may use the independent prompting program to create the data sets to write to tape.

Direct Access.--EQ does not have a VT100 terminal or a VT100 emulator package for their IBM PC-compatible microcomputer and therefore are unable to use this option.

EQ will be collecting and processing a large amount of data; thus, the best method for data entry probably is direct access. However, since this is not currently an option, the most efficient method of preparing the data for transfer by tape would be to obtain a program to read in their present data and write it to tape in the required format for transmittal via nine-track tape.

The Great Lakes Charter has prompted a great increase in the data-collection activity within Quebec, and the program requires refinement and standarization to obtain regular annual updates. The EQ goal is to store data for as many water-use categories as possible and to annually update as many as possible. The following approach will probably be used:

1. Update the municipal data base from survey results and elicit responses from as many municipalities as possible. Develop a rotating system of updating so that survey forms are sent to at least a third of the municipal water suppliers each year.

2. Develop a similar standardized survey system for industrial water users and powerplants not operated by Quebec Hydro.

3. Continue to receive and process annual survey forms from Quebec Hydro.

4. Begin to develop water-use coefficients that can be used to update data, such as per-capita withdrawals in various manufacturing categories, in municipalities, and in privately owned public-supply systems, and the volumes used per kilowatt generated by each electrical generating plant.

5. Develop techniques for estimating irrigation, agricultural, and commerical self-supplied withdrawals.

6. Store all on computer so that they can be transmitted to the regional data base by nine-track tape.

Transmittal data to the data base will be as follows:

Category	Agency[1]	Type of information	Category	Agency	Type of information
Public water supply	EQ	Data	Industrial	EQ	Data
Domestic self-supplied	EQ	Estimate	Commercial	EQ	Data
Irrigation	EQ	Estimate	Mining	EQ	Data
Power, fossil fuel	EQ	Data	Agricultural	EQ	Estimate
Power, nuclear	EQ	Data	Hydroelectric	EQ	Data

[1] EQ = Environment Quebec

Wisconsin

The Wisconsin Department of Natural Resources (WDNR) will transmit the required data to the regional data base. The central office within the WDNR will be the Bureau of Water Resources Management (BWRM), which will aquire the information from the Bureau of Water Regulation and Zoning (WDNR - BWRZ), the Bureau of Water Supply (WDNR-BWS) and the Geological Survey. The BWRM will also take the lead in reformatting the data into the required format. The WDNR has the software and equipment to use all options for data transmittal. Tape would probably be the simplest method.

Responsibility for data compilation and transmittal to the data base is as follows:

Category	Agency[1]	Type of information
Public water supply	WDNR-BWS	Data
Domestic self-supplied	WDNR-BWRM	Estimate and Data
Irrigation	WDNR-BWRZ/BWS	Data
Power, fuel fossil	WDNR-BWRM	Data
Power, nuclear	WDNR-BWRM	Data
Industrial	WDNR-BWS/BWRM	Data
Commercial	WDNR-BWS/BWRM	Data
Mining	WDNR-BWRM/BWS	Estimate and Data
Agricultural	WDNR-BWRZ/BWS	Estimate and Data
Hydroelectric	WDNR-BWRM	Estimate

[1] WDNR = Wisconsin Department of Natural Resources
BWS = Bureau of Water Supply
BWRM = Bureau of Water Resources Management
BWRZ = Bureau of Water Regulation and Zoning

SELECTION OF REPOSITORY SITE FOR THE

GREAT LAKES REGIONAL WATER-USE DATA BASE

The success and development of the regional data base will depend on both the participating agencies and ministries and the agency, ministry, or group housing the data base. The repository site will need to be able to do the following:

1. Write the computer software for the data base, including testing and support programs for data entry.

2. Write a standard set of retrieval programs.

3. Document computer programs and specify what is required of the participating agencies and ministries.

4. Accept and enter data by coding form, cards, nine-track tape, or direct electronic communication.

5. Make standardized retrievals routinely and customized retrievals by request on a per-job basis.

6. Adjust the computer program as data elements in the data base change.

7. Assist in production of data reports.

8. Assist in program development, such as suggesting data-collection techniques or procedures, and see the data base through the refinement stages; document the data-collection programs in the States and Provinces, and attend periodic meetings to discuss developments.

To determine which agencies might serve as repository sites, a questionnaire was sent to many agencies, ministries, and institutions requesting a positive response if interested. A copy of this questionnaire is available from the Geological Survey office in Albany, N.Y., with the list of addressees to which it was sent. The following agencies indicated an interest in being the repository site:

1. Great Lakes Environmental Research Laboratory, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Ann Arbor, Mich.

2. Center for Great Lakes Studies, University of Wisconsin at Milwaukee, Milwaukee, Wisc.

3. Great Lakes Commission, Ann Arbor, Mich.

4. Great Lakes and Marine Waters Center, Great Lakes Research Division, Michigan Sea Grant Program, University of Michigan, Ann Arbor, Mich.

5. The Great Lakes Institute, University of Windsor, Windsor, Ontario.

6. Environment Canada, Water Planning and Management Branch, Inland Waters Directorate, Ontario Region, Burlington, Ontario.

7. Large Lakes Research Station, U.S. Environmental Protection Agency, Environmental Research Laboratory, Duluth, Minn.

8. St. Lawrence Seaway Corporation, U.S. Department of Transportation, Massena, N.Y.

9. Department of Civil and Environmental Engineering, Clarkson University, Potsdam, N.Y.

10. Department of Civil Engineering, University at Buffalo, State University of New York, Buffalo, N.Y.

11. U.S. Geological Survey, Water Resources Division, Northeastern Region, Reston, Va.

These agencies and groups compiled cost estimates for writing, storing, and maintaining the regional data base and submitted them to the Chairman of the Water Resources Management Committee of the Council of Great Lakes Governors for review. After analysis of cost estimates and proposals, the Water Resources Management Committee decided to recommend to the governors and premiers of the Great Lakes region that the Great Lakes Commission be the repository site.

POSSIBLE APPLICATION OF THE GREAT LAKES REGIONAL WATER-USE DATA BASE TO HYDROLOGIC-RESPONSE MODELS

Once the regional data base has been established and data entered, it may find applications to hydrologic response models now being used in the Great Lakes-St. Lawrence region. To obtain an inventory of these models, a questionnaire (the same one used to locate possible data-base repository sites) was mailed to many agencies, groups, and universities. The questionnaire contained a section asking information on whether the group maintained such a model. The following models were identified:

1a. The Great Lakes Regulation Model.--This model is stored jointly at the offices of the Detroit District, U.S. Army Corps of Engineers in Detroit, Mich., and in Canada at the offices of the Inland Waters Directorate, Federal Department of the Environment, Ottawa, Canada. One use of this model is described in the "Great Lakes Diversions and Consumptive Uses" report to the International Joint Commission:

> On May 3, 1977, the International Joint Commission (IJC), at the request of the governments of the United States and Canada, established the International Great Lakes Diversions and Consumptive Uses Study Board to investigate the effect on the water levels and outflows of the Great Lakes of: existing and proposed new or changed diversions into,

out of and within the Great Lakes basin; and existing and reasonable foreseeable patterns of consumptive water use. This Appendix contains supporting data to that presented in the Board's main report.

. . . The Great Lakes Regulation Model was used to develop diversion scenarios, producing the levels and outflows which would have occurred on the Great Lakes had a particular set of diversion rates been in effect on the lakes throughout the period of record (1900 - 1976).

A further use of the model for the same study is given (in Synopsis):

. . . Water supplies adjusted to reflect the consumptive use projections were used with the Great Lakes Regulation Model to determine the effect on levels and outflows of the projected consumptive use.

1b. Great Lakes Hydrologic Response Model for microcomputers.--Professors Erhard Joeres and Eric Loucks, Department of Civil and Environmental Engineering, University of Wisconsin, Madison, modified the U.S. Army Corps of Engineers model and adapted it for use on a personal computer.

2. Hydrologic Response Model.--This model, developed by Dr. Quinn of the Great Lakes Environmental Research Laboratory (GLERL), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, predicts lake levels and monthly flow in the connecting channels between Lakes Michigan, Huron, St. Clair, and Erie. The model does not deal with the inflows, diversions, and outflows from Lake Superior and Ontario but rather treats the outflows as an input item. It does not address levels and outflows of Lake Ontario.

3. Great Lakes Hydrologic Response model.--This model, developed by Environment Canada, Water Planning and Management Branch, Inland Waters Directorate, Ontario Region, Burlington, Ontario, routes water supplies through the Great Lakes by simulating the regulation of Lake Superior and Lake Ontario and the unregulated outlet conditions on Lakes Michigan, Huron, St. Clair, and Erie.

The three models referred to above are similar in structure and use. They can use diversion and consumptive-use information and can use aggregate data without requiring site-specific, point-source information. For example, the GLERL model (no. 2) uses as input precipitation, monthly runoff, evapotranspiration, diversions, and discharge of a few connecting channels. This diversion information can be used as a subbasin value and can be calculated from the data in the regional data base. The GLERL model also treats consumptive use as a fixed, constant value for the whole basin, another value obtainable in the regional data base.

Input into the Environment Canada model (no. 3) includes net basin supplies and starting water levels, and output consists of water-level and outflow hydrographs of the Great Lakes. The model requires major diversion values as input and can be modified to compute the effect of these diversions on lake levels and outflow. It treats consumptive use as a reduction in inflow at the subbasin level. The regional data base will have both the diversion data and consumptive-use values.

The U.S. Army Corps of Engineers Great Lakes Regulation Model treats consumptive use as a reduction in inflow at the subbasin level. It is an adjustment to the supply of each basin. The value would be obtainable from the regional data base. The "Great Lakes Diversions and Consumptive Uses" (1985) report strongly emphasizes the importance of consumptive use as a net withdrawal from basin supplies. In the report to the International Joint Commission, seven sectors of consumptive use were examined -- municipal, rural domestic, manufacturing, stock watering, irrigation, and the thermoelectric. Of these, 78 to 91 percent of the consumptive uses were projected to be in the three sectors of municipal, manufacturing, and thermoelectric power generation. The report concludes that consumptive use should be periodically monitored and that consumptive use and not just withdrawals be determined in any water-monitoring scheme. It is encouraging that the regional data base coincides both with the data elements and with the philosphy of the Great Lakes Models and the people using them.

Two areas of potential problems are that the models:

1. may treat the St. Clair subbasin as a separate area, which the regional data base does not do at present, although that adjustment would not be difficult.

2. use annual, quarterly, and monthly data, which implies the desirability of eventually shortening the data-collection interval for the regional data base.

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storage procedures, trigger levels (minimum withdrawals above which data collection is legally mandated), and data-processing-time requirements. The analysis was made by water-use category and agency or ministry for each State and Province. The information was acquired through questionaires, site visits, and published material.

The most complete data-collection records are in the category of public-water supply; the least complete are for hydroelectric power generation and mining. Most States and Provinces estimate withdrawals in the categories of domestic self-supplied and agricultural, and few have data-collection programs that document consumptive use. The degree of data aggregation ranges from estimates by county or drainage basin at 5-year intervals to site-specific data collection yielding daily values. The data-collection procedures vary widely in all categories. Many States and Provinces use some of the same category definitions; some lack definitions for certain categories.

Most methods of estimation for a given category entail multiplying a withdrawal figure by a known value such as number of people (for domestic), acres (for irrigation), or animals (for agricultural). The withdrawal figures may be obtained from results of previous studies or surveys and may or may not be updated. The numerical factors used by each State and Provinces are given with description of the computational procedures.

The U.S. Geological Surveys' National Water-Use Information Program has been in operation since 1978 and has a cooperative program in each of the eight participating States. Water-use data aggregated by county and by drainage basin are stored in the National Water-Use data System on the mainframe computer in Reston, Va. Many States now store within-State water-use data at the Geological Survey's offices within each State, which is particularly beneficial where State agencies do not maintain their own computerized water-use data bases.

Environment Canada is a Canadian federal department designed to preserve and enhance the quality of the environment. One of its five service components, the Inland Water Directorate (IWD), participates in national and international water-management programs. The water-use program in the Directorate (IWD) began with a water-use survey in 1973-74 of manufacturers, followed by a survey of industrial water use in 1976 and 1981. The IWD also acquires municipal water-supply data through letter surveys.

The IWD is studying the econometrics of water use through construction of an environmental/economic model that gages how water withdrawals, supply, and discharges affect the economy. Since 1976, the IWD has had a concentrated research effort that focuses on modeling and forecasting water demand at each node of an areal grid, this model can be used in the context of projected future demand to predict availability. The simulations are especially useful in categories and areas for which data are insufficient. Both the United States' and Canada's vast and growing economic dependence on the Great Lakes-St. Lawrence River water resources has caused an urgent need for documentation of water use and for a regionwide data base that represents withdrawals, diversions, and consumptive use in each water-use category and by each Great Lakes State and Province.

SUMMARY

The Great Lakes and the St. Lawrence River are shared natural water resources between the United States and Canada. The drainage area of the basin, including the St. Lawrence River upstream from Trois-Rivieres, Quebec, is nearly 400,000 mi2. The basin includes parts of eight States and two Provinces. Approximately 60 percent of Canada's population and 15 percent of the United States population live near the lakes.

In 1980, 36 Bgal/d of surface water and 2 Bgal/d of ground water were withdrawn from the Great Lakes basin in the United States. The Great LakesSt. Lawrence Waterway is navigable for 2,400 mi and is maintained by both the United States and Canada. This vast resource requires careful management by the States and Provinces of the basin, as well as the federal governments of both countries, to ensure adequate lake levels and outflows. The ability to do this will depend increasingly on the availability of up-to-date records of withdrawals and diversions by the major users.

Both countries have formed organizations and require agencies to monitor withdrawals and promote the exchange of information; one such group is the Council of Great Lakes Governors, designed to develop, administer, and coordinate programs and projects to stimulate economic and environmental development in the region. In May 1983, the Council of Great Lakes Governors adopted a resolution authorizing an interstate staff committee to make recommendations for improving the structure of organizations in the region. In response, this committee drafted a broad protection and management strategy in a document titled the "Great Lakes Charter," which the governors and premiers of the Great Lakes region signed in February 1985.

The Great Lakes Charter outlines a water-resources-management strategy that calls for cooperation among the individual States and Provinces for the benefit of the region as a whole. Each State and Province's participation requires the ability to provide accurate information on water withdrawals that average more than 100,000 gal/d in any 30-day period and the authority to manage water withdrawals involving a total diversion or consumptive use of Great Lakes basin water in excess of 2 Mgal/d in any 30-day period. The Charter also established a temporary Water Resources Management Committee, composed of representatives appointed by the governors and premiers of each of the Great Lakes States and Provinces, to (1) document the water-use data-collection programs of each State and Province, including similarities and differences among programs, (2) design a regional water-use data base with withdrawal, diversion and consumptive-use data, and (3) describe each State and Provinces' ability to transmit the required data to the data base and acquire missing values through institutional arrangements. The Council of Great Lakes Governors entered into a cooperative agreement with the U.S. Geological Survey in 1985 to provide this documentation. This report documents the findings.

The first major section describes in detail the current water-use data-collection programs in the eight States (New York, Pennsylvania, Ohio, Illinois, Michigan, Indiana, Wisconsin, Minnesota) and two Provinces (Ontario and Quebec) and methods of data estimation used by each for categories for which no records are available. Among the category elements compared among participating States and Provinces are frequency of collection, computer-

The Great Lakes Regional Water-Use Data Base is designed to store withdrawal, diversion, and consumptive-use data for the following categories; by drainage basin and State or Province:

(a). public supply
- domestic self-supplied
- irrigation
- thermoelectric powerplant cooling
- hydroelectric power generation
- industrial self-supplied
- agricultural
- commercial self-supplied
- mining

Data are to be updated annually and stored as average daily amount for each category for the year, in Mgal/d. Other data to be submitted are

(b). type of withdrawal source
- drainage basin
- annual amount of withdrawal
- amount diverted from Great Lakes basin
- amount of diversion into Great Lakes basin
- level of data accuracy
- level of data aggregation
- number of facilities withdrawing 100,000 gal/d or more
- total amount withdrawn by such facilities

No State or Province has a complete data set in the correct format for all categories at present (1986), although some nearly do. States and Provinces that do not have all required data are initiating programs or legislation to provide for acquisition of such data. This report includes some suggestions for ways to fill in gaps and inconsistencies in required data and how to strengthen the data that are collected; it also suggests institutional arrangements to acquire data that are not currently available.

The usefulness of the data base is enhanced if all characteristics (such as category definitions and trigger levels) of the data-collection programs are documented to help the users interpret the regional aggregated data.

Some proposed future refinements of the regional data base would be to develop improved estimation techniques, obtain records rather than estimates of water withdrawals, and establish standard data-collection and estimation methods to ensure uniformity of procedures. A further recommendation would be to make data collection mandatory at the 100,000-gal/d trigger level in accordance with the Great Lakes Charter, which requires accurate and comparable information on water withdrawals in excess of 100,000 gal/d in any 30-day period. Documentation of diversions and consumptive use data at that level would also be desirable. Other proposed refinements include aggregating data by smaller drainage basins within each State and Province; increasing the frequency of reporting to monthly, especially in the irrigation category; documenting public-water-supply deliveries to residential, industrial, and commercial users; lowering data-collection trigger levels to decrease the amount of estimated data; and improving and standardizing estimation techniques and methods of data collection and processing.

Refinement of the data base would be a joint effort between the data-base repository organization and the participating States and Provinces. Each agency and ministry supplying data has several options for transmittal of data to the data-base repository. All participants will be permitted to fill out

and mail coding forms or submit punch cards, 5 ¼-inch diskettes, nine-track tapes, or use the interactive or batch method of direct entry. Some deciding factors are the amount of data to be transferred and the computer capabilities of the participants. A "lead agency" appointed within each State and Province would receive data from the individual agencies and would transmit the data to the data-base repository. (In Canada, only one ministry is involved in each Province.) The eight States have already designated lead agencies and have begun to establish the procedures of data transmittal.

More than 30 agencies and ministries were polled by letter questionaire to determine interest in writing, storing, and maintaining the regional data base. Eleven groups indicated interest and furnished cost estimates and work proposals. After review of the proposals, the Water Resources Management Committee recommend to the governors and premiers of the Great Lakes region that the Great Lakes Commission (Ann Arbor, Mich.) be the repository site.

The regional water-use data base is designed to provide accurate and timely data on withdrawals, diversions, and consumptive uses in the Great Lakes-St. Lawrence River basin. It may also be used, if the participants so choose, to predict the effects of proposed withdrawals, diversions, and consumptive use on lake levels. Hydrologic models currently operated by the U.S. Army Corps of Engineers, Environment Canada, the Great Lakes Environmental Research Laboratory, and the University of Wisconsin could incorporate the data from the regional data base for other predictive studies. If the participants choose to develop the regional data base into a site-specific program, more options will be available for using the data base as a water-resources-management tool.

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Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin.

	ILLINOIS[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	n.a.	No	Yes	Yes	n.a.	Yes	n.a.	n.a.	n.a.
2--If so, by whom?	IDOT-L.Mich. ISWS	--	--	ISWS	ISWS	--	IDOT-L.Mich. ISWS	--	--	--
3--If so, how often are data recorded (ie. what is the time interval)?	IDOT--Monthly or annually ISWS--Annually	--	--	Annually	Annually	--	IDOT--Monthly or annually ISWS--Annually	--	--	--
4--What is the trigger level (minimum value) for data collection?	IDOT--all diverters of. L.Mich. ISWS-None	--	--	None	None	--	IDOT--all diverters of L.Mich. ISWS-None	--	--	--
5--Are the data computerized?	Yes	--	--	Yes	Yes	--	Yes	--	--	--
6--If yes, by whom?	IDOT-L.Mich. ISWS	--	--	ISWS	ISWS	ISWS	IDOT-L.Mich. ISWS	--	--	--
7--Are water-use data estimated?[2]	--	Yes	Yes	--	--	--	--	Yes	--	--
8--If so, by whom?	--	ISWS	ISWS	--	--	--	--	ISWS	--	--
9--If so, how often?	--	Annually	Annually	--	--	--	--	Annually	--	--
10--Are the data computerized?	--	Yes	Yes	--	--	--	--	Yes	--	--
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes L. Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]	Yes L.Mich. only[3]

[1] IDOT = Illinois Department of Transportation, Division of Water Resources
ISWS = Illinois Department of Energy and Natural Resources, Illinois State Water Survey
L.Mich. = Lake Michigan

[2] Method of estimation described on p. 13.

[3] Yes for all diverters of Lake Michigan water or new consumptive uses greater than 2 Mgal/d, administered through IDOT.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	INDIANA[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
2--If so, by whom?	IDNR	IDNR	IDNR	IDNR	IDNR	--	IDNR	IDNR	IDNR	IDNR
3--If so, how often are data recorded (ie. what is the time interval)?	Annually	Annually	Annually	Annually	Annually	--	Annually	Annually	Annually	Annually
4--What is the trigger level (minimum value) for data collection?	100,000 gal/d	100,000 gal/d	100,000 gal/d	100,000 gal/d	100,000 gal/d	--	100,000 gal/d	100,000 gal/d	100,000 gal/d	100,000 gal/d
5--Are the data computerized?	Yes	Yes	Yes	Yes	Yes	--	Yes	Yes	Yes	Yes
6--If yes, by whom?	IDNR	IDNR	IDNR	IDNR	IDNR	--	IDNR	IDNR	IDNR	IDNR
7--Are water-use data estimated?[2]	--	Yes	--	--	--	Yes	--	Yes	--	--
8--If so, by whom?	--	IDNR	--	--	--	Consultant	--	IDNR	--	--
9--If so, how often?	--	Annual	--	--	--	Annual	--	Annual	--	--
10--Are the data computerized?	--	No	--	--	--	No	--	No	--	--
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

[1] IDNR = Indiana Department of Natural Resources, Division of Water

[2] Method of estimation described on p. 14.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	MICHIGAN[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	No	No Variable	No Variable	No Variable	No	No	No	No	No
2--If so, by whom?	MDPH	--	MDNR	MDNR	MDNR	--	--	--	--	--
3--If so, how often are data recorded (ie. what is the time interval)?	Monthly	--	Variable	Variable	Variable	--	--	--	--	--
4--What is the trigger level (minimum value) for data collection?	All users	--	None	None	None	--	--	--	--	--
5--Are the data computerized?	Yes	--	No	No	No	--	--	--	--	--
6--If yes, by whom?	MDPH	--	--	--	--	--	--	--	--	--
7--Are water-use data estimated?[2]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8--If so, by whom?	USGS / MDNR	USGS / MDNR	USGS	USGS	USGS	USGS / MDNR	USGS / MDNR	USGS / MDNR	USGS / MDNR	USGS / MDNR
9--If so, how often?	Every 5 years	Every 5 years	Every 5 years	Every 5 years	Every 5 years	Every 5 years	Every 5 years	Every 5 years	Every 5 years	Every 5 years
10--Are the data computerized?	Yes	No	Yes	Yes	Yes	No	No	No	No	No
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes	No	No	No	No	No	No	No	No	No

[1] MDPH = Michigan Department of Public Health
MDNR = Michigan Department of Natural Resources
USGS = United States Geological Survey

[2] Method of estimation described on p. 17.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	MINNESOTA[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes
2--If so, by whom?	MNDNR	--	MNDNR	MNDNR	MNDNR	--	MNDNR	--	MNDNR	MNDNR
3--If so, how often are data recorded (ie. what is the time interval)?	Monthly and annually	--	Monthly and annually	Monthly and annually	Monthly and annually	--	Monthly and annually	--	Monthly and annually	Monthly and annually
4--What is the trigger level (minimum value) for data collection?	10,000 gal/d or 1 Mgal/yr	--	10,000 gal/d or 1 Mgal/yr	10,000 gal/d or 1 Mgal/yr	10,000 gal/d or 1 Mgal/yr	--	10,000 gal/d or 1 Mgal/yr	10,000 gal/d/or 1 Mgal/yr	10,000 gal/d/or 1 Mgal/yr	10,000 gal/d or 1 Mgal/yr
5--Are the data computerized?	Yes	--	Yes	Yes	Yes	--	Yes	--	Yes	Yes
6--If yes, by whom?	MNDNR	--	MNDNR	MNDNR	MNDNR	--	MNDNR	--	MNDNR	MNDNR
7--Are water-use data estimated?[2]	Yes	Yes	--	--	--	Yes	Yes	Yes	Yes	--
8--If so, by whom?	MNDNR	USGS	--	--	--	USGS	MNDNR	USGS	MNDNR	--
9--If so, how often?	Annually	Annually	--	--	--	Annually	Annually	Annually	Annually	--
10--Are the data computerized?	Yes	Yes	--	--	--	Yes	Yes	Yes	Yes	--
11--Does state/provincial/ federal legislation mandate water-use-data collection?	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

[1] MNDNR = Minnesota Department of Natural Resources, Division of Waters

[2] Method of estimation described on p. 20.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	NEW YORK[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	No	No	No	No	No	No	No	Yes	No
2--If so, by whom?	NYSDOH	--	--	--	--	--	--	--	NYSDOH	--
3--If so, how often are data recorded (ie. what is the time interval)?	Monthly and annually	--	--	--	--	--	--	--	Monthly and annually	--
4--What is the trigger level (minimum value) for data collection?	25 people or 5 service connections	--	--	--	--	--	--	--	25 people or 5 service connections	--
5--Are the data computerized?	Yes	--	--	--	--	--	--	--	Yes	--
6--If yes, by whom?	NYSDOH	--	--	--	--	--	--	--	NYSDOH	--
7--Are water-use data estimated? [2]	--	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8--If so, by whom?	--	USGS	USGS	NYSDEC USGS	NYSDEC USGS	NYSDEC USGS	NYSDEC USGS	USGS	USGS	USGS
9--If so, how often?	--	Every 5 years	Every 5 years	Variable Every 5 years	Variable Every 5 years	Variable Every 5 years	Variable Every 5 years	Every 5 years	Every 5 years	Every 5 years
10--Are the data computerized?	--	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes	No	No	No	No	No	No	No	Yes	No

[1] NYSDOH = New York State Department of Health
NYSDEC = New York State Department of Environmental Conservation

[2] Method of estimation described on p. 22.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	OHIO[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	No	No	No	No	No	No	No	Yes	No
2--If so, by whom?	OEPA	--	--	--	--	--	--	--	OEPA	--
3--If so, how often are data recorded (ie. what is the time interval)?	Monthly systems ≥10,000 people; otherwise annual or tri-annually	--	--	--	--	--	--	--	Monthly systems ≥10,000 people; otherwise annual or tri-annually	--
4--What is the trigger level (minimum value) for data collection?	25 people or 15 connections ≥ 60 days yearly	--	--	--	--	--	--	--	25 people or 15 connections ≥ 60 days yearly	--
5--Are the data computerized?	Yes	--	--	--	--	--	--	--	Yes	--
6--If yes, by whom?	OEPA	--	--	--	--	--	--	--	OEPA	--
7--Are water-use data estimated? [2]	--	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	No
8--If so, by whom?	--	ODNR / USGS	ODNR / USGS	USGS	USGS	USGS	ODNR / USGS	USGS	--	--
9--If so, how often?	--	Variable / Every 5 years	Variable / Every 5 years	Every 5 years	Every 5 years	Every 5 years	Variable / Every 5 years	Every 5 years	--	--
10--Are the data computerized?	--	Yes	No	Yes	Yes	Yes	Yes	No	--	--
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes	No	No	No	No	No	No	No	Yes	No

[1] OEPA = Ohio Environmental Protection Agency
ODNR = Ohio Department of Natural Resources, Division of Water

[2] Method of estimation described on p. 26.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	ONTARIO[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	No, Variable	No	No, Variable	No, Variable	No, Variable	No, Variable	No, Variable	No	No, Variable	No, variable
2--If so, by whom?	OMOE	--	OMOE	OMOE	OMOE	OMOE	OMOE	--	OMOE	OMOE
3--If so, how often are data recorded (ie. what is the time interval)?	Annually or variable	--	Annually or variable	Annually or variable	Annually or variable	Annually or variable	Annually or variable	--	Annually or variable	Annually or variat
4--What is the trigger level (minimum value) for data collection?	≥50,000 liters per day (12,500 gal/d)	--	>50,000 liters per day (12,500 gal/d)	≥50,000 liters per day (12,500 gal/d)	>50,000 liters per day (12,500 gal/d)	≥50,000 liters per day (12,500 gal/d)	≥50,000 liters per day (12,500 gal/d)	--	≥50,000 liters per day (12,500 gal/d)	>50,000 liters per day (12,500 gal/d)
5--Are the data computerized?	Yes	--	Yes	Yes	Yes	Yes	Yes	--	Yes	Yes
6--If yes, by whom?	OMOE	--	OMOE	OMOE	OMOE	OMOE	OMOE	--	OMOE	OMOE
7--Are water-use data estimated?[2]	No	No	No	No	No	No	No	No	No	No
8--If so, by whom?	--	--	--	--	--	--	--	--	--	--
9--If so, how often?	--	--	--	--	--	--	--	--	--	--
10--Are the data computerized?	--	--	--	--	--	--	--	--	--	--
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

[1] OMOE = Ontario Ministry of the Environment
[2] Method of estimation described on p. 31.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	PENNSYLVANIA[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	No	No	Yes	Yes	No	Yes	No	No	Yes
2--If so, by whom?	PaDER	--	--	PaDER	PaDER	--	PaDER	--	--	PaDER
3--If so, how often are data recorded (ie. what is the time interval)?	Annually	--	--	Annually	Annually	--	Every 5 years	--	--	Every 5 years
4--What is the trigger level (minimum value) for data collection?	$\geq$ 15 service connections, $\geq$ 25 people at least 60 days each year	--	--	All plants	All plants	--	All industries	--	--	All mines
5--Are the data computerized?	Yes	--	--	Yes	Yes	--	Yes	--	--	Yes
6--If yes, by whom?	PaDER	--	--	PaDER	PaDER	--	PaDER	--	--	PaDER
7--Are water-use data estimated?[2]	--	Yes	Yes	--	--	--	--	Yes	Yes	--
8--If so, by whom?	--	PaDER	PaDER / USGS	--	--	--	--	USGS	USGS	--
9--If so, how often?	--	Variable	Variable / Every 5 years	--	--	--	--	Every 5 years	Every 5 years	--
10--Are the data computerized?	--	Yes	Yes / Yes	--	--	--	--	No	No	--
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes	No	No	No	No	No	No	No	No	No

[1] PaDER = Pennsylvania Department of Environmental Resources, Bureau of Water Resources Management, State Water Plan Division
USGS = United States Geological Survey

[2] Method of estimation described on p. 33.

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	QUEBEC[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
2--If so, by whom?	EQ	--	--	EQ	EQ	EQ	EQ	--	EQ	EQ
3--If so, how often are data recorded (ie. what is the time interval)?	Annually or variable	--	--	Annually or variable	Annually or variable	Annually or variable	Annually or variable	--	Annually or variable	Variabl
4--What is the trigger level (minimum value) for data collection?	All municipalities	--	--	$\geq$ 5,000 kwh	$\geq$ 5,000 kwh	$\geq$ 5,000 kwh	$\geq$ 50,000 gal/d	--	$\geq$ 50,000 gal/d	All mines
5--Are the data computerized?	Yes	--	--	Yes	Yes	Yes	Yes	--	Yes	Yes
6--If yes, by whom?	EQ	--	--	EQ	EQ	EQ	EQ	--	EQ	EQ
7--Are water-use data estimated?[2]	Yes, partially	Yes	Yes	--	--	--	--	Yes	--	--
8--If so, by whom?	EQ	EQ	EQ	--	--	--	--	EQ	--	--
9--If so, how often?	Variable	Variable	Variable	--	--	--	--	Variable	--	--
10--Are the data computerized?	Yes	No	No	--	--	--	--	No	--	--
11--Does state/provincial/federal legislation mandate water-use-data collection?	No	No	No	No	No	No	No	No	No	No

[1] EQ = Environment Quebec

[2] Method of estimation described on p. 35

Table 1. Water-use data-collection programs in each State and Province in the Great Lakes-St. Lawrence River basin (continued)

	WISCONSIN[1]									
	Public-water supply	Domestic self-supplied	Irrigation	Fossil fuel power	Nuclear power	Hydro-electric power	Industrial self-supplied	Agricultural (live stock)	Commercial	Mining
1--Is water-use data collected on a recurring basis (ie., at scheduled intervals)?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
2--If so, by whom?	WDNR: BWS	WDNR: BWRM	WDNR: BWRZ-Surface water BWS-Ground water	WDNR: BWRM-Surface water BWS-Ground water	WDNR: BWRM-Surface water BWS-Ground water	--	WDNR: BWRM-Surface water BWS-Ground water	WDNR: BWRZ-Surface water BWS-Ground water	WDNR: BWRM-Surface water BWS-Ground water	WDNR: BWRM-Surface water BWS-Ground water
3--If so, how often are data recorded (ie. what is the time interval)?	Monthly	Monthly* Annually	Monthly	Monthly	Monthly	--	Monthly	Monthly* Annually	Monthly	Monthly* Annually
4--What is the trigger level (minimum value) for data collection?	Serving $\geq$ 25 people	All SW & GW > 70 gpm or 100,000 gal/d	All SW & GW > 70 gpm or 100,000 gal/d	All SW & GW > 70 gpm or 100,000 gal/d	All SW & GW > 70 gpm or 100,000 gal/d	--	All SW & GW > 70 gpm or 100,000 gal/d	All SW & GW > 70 gpm or 100,000 gal/d	All SW & GW > 70 gpm or 100,000 gal/d	All SW & GW > 70 gpm or 100,000 gal/d
5--Are the data computerized?	Yes	Yes	Yes	Yes	Yes	--	Yes	Yes	Yes	Yes
6--If yes, by whom?	WDNR	WDNR	WDNR	WDNR	WDNR	--	WDNR	WDNR	WDNR	WDNR
7--Are water-use data estimated?[2]	--	Yes**	--	--	--	Yes**	--	Yes**	--	Yes**
8--If so, by whom?	--	WDNR: BWRM	--	--	--	WDNR: BWRM	--	WDNR: BWRM	--	WDNR: BWRM
9--If so, how often?	--	Annually	--	--	--	Annually	--	Annually	--	Annually
10--Are the data computerized?	--	Yes	--	--	--	Yes	--	Yes	--	Yes
11--Does state/provincial/federal legislation mandate water-use-data collection?	Yes*	Yes*	Yes*	Yes*	Yes*	No	Yes*	Yes*	Yes*	Yes*

[1] WDNR = Wisconsin Department of Natural Resources
BWRZ = Bureau of Water Regulation and Zoning
BWS = Bureau of Water Supply
SW = Surface Water
GW = Ground Water

[2] Method of estimation described on p. 37.

TABLE 2

Summary of water-use data-collection programs in each State and Province, by water-use category

ABBREVIATIONS

Illinois	IDOT	Department of Transportation, Division of Water Resources
	ISWS	Department of Energy and Natural Resources, State Water Survey
Indiana	IDNR	Department of Natural Resources, Division of Water
Michigan	MDPH	Department of Public Health
	MDNR	Department of Natural Resources
Minnesota	MNDNR	Department of Natural Resources, Division of Water
New York	NYSDOH	Department of Health
	NYSDEC	Department of Environmental Conservation
Ohio	OEPA	Environmental Protection Agency
	ODNR	Department of Natural Resources, Division of Water
Ontario	OMOE	Ministry of the Environment
Pennsylvania	PaDER	Department of Environmental Resources, Bureau of Water Resources Management, State Water Plan Division
Quebec	EQ	Environment Quebec
Wisconsin	WDNR	Department of Natural Resources
	BWRZ	Bureau of Water Regulation and Zoning
	BWRM	Bureau of Water Resources Management
	BWS	Bureau of Water Supply
	USGS	U.S. Geological Survey

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category.

PUBLIC WATER SUPPLY

	A. Data Collection						B. Data Recording					
State and Agency	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Illinois IDOT (only Lake Michigan water use)	Mgal/d	Withdrawal, conveyance loss, consumptive use	Required metering	Allocation permit	Monthly or annually	196	Day or year	Yes	March 1 (for data Oct. 1-Sept. 30)	Yes	Yes	Address
Illinois ISWS	gal	Withdrawal	Voluntary measurement	Survey	Annually	196	Year	No	Sept. 30	Yes	Yes	Address,10-acre plot, county, USGS hydrologic unit
Indiana IDNR	gal	Withdrawal	Required reporting	Registration	Annually	600	Month and year	Yes	March 31	Yes	Yes	Owner, address, (source-county, township, range and section)
Michigan MDPH	gal	Withdrawal	Required metering	Legislative mandate	Monthly	750	Day	Yes	Feb. 15	Yes	Yes	Address, county
Michigan USGS/MDNR	Mgal/d	Withdrawal	Estimate	Cooperative program	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Minnesota MNDNR	gal	Withdrawal	Required measurement and estimate	Allocation permit	Monthly and annually	41	Month and year	Yes	Nov. 30	Yes	Yes	Address, township and range, MNDNR watershed, village, city, county, USGS hydrologic unit, 40-acre plot
New York NYSDOH	gal/d	Withdrawal, conveyance loss	Required measurement and metering since 1975	Legislative mandate	Monthly and annually	Not provided	Day	Yes	June 1	Yes	Yes	Address, county, basin, city, town, village

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Illinois IDOT (only Lake Michigan water use)	IBM-AT PC	Symphony	Paper file	Easy	Difficult	Yes	Individual user	6 months	Only at collection agency	IBM-AT PC Only at collection agency	--
Illinois ISWS	Agency mainframe agency mini-computer	UNIX Utility, ICE, Cyber Utilities	Paper file, disk	Difficult	Easy	Yes	Survey section, village, county, USGS hydrologic unit	6 months to 1 year	Only at collection agency	At collection agency and USGS mainframe	Different format (USGS is aggregated)
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan MDPH	Agency mini-computer	Specific program	Paper file, disk	Easy	Easy	Yes	Individual user, county	1 month	Only at collection agency	At collection agency and USGS mainframe	Different format (USGS is aggregated)
Michigan USGS/MDNR	Agency mainframe (USGS)	NWUDS-System 2000	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	At collection agencies	USGS mainframe	--
Minnesota MNDNR	State mini-computer; agency personal computers	INFO for Prime mini-computer and for the PC	Disk, tape	Easy	Easy	Yes	Township/range, county, MNDNR watershed, individual user, USGS hydrologic unit	1 year	Only at collection agency	At state agency and USGS mainframe	Different format (USGS is aggregated)
New York NYSDOH	Agency mainframe	SAFWATER (specific program)	Paper file, disk, tape	Easy	Easy	No (available with programming)	Township, village, county, river basin (for sources), individual user	6 months	Only at collection agency	At collection agency, local USGS Prime (some years), USGS mainframe	Different format (USGS mainframe data is aggregated)

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

PUBLIC WATER SUPPLY (continued)

State and Agency	A. Data Collection: Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	B. Data Recording: Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Ohio OEPA	gal/d	Withdrawal, consumptive use	Required measurement; required metering >10,000 people served	Legislative mandate	Monthly >10,000 people served; otherwise annually or triennially	Not provided	Day	Yes	Feb. 15	Yes	Yes	Location address, latitude and longitude, basin, county
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occasional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Day	Yes occasionally	Variable	Yes	Yes	Address, UTM coordinates, Latitude and longitude, basin, village, town, city, county
Penn. PaDER	gal/d	Withdrawal, consumptive use	Required measurement	Allocation permit (surface water only) Survey (all)	Annually (Half of the public-water suppliers are updated each year)	<50	Year	Yes	Dec. 31 (of following year)	Yes	Yes	UTM coordinates, latitude and longitude, river mile, basin, village, town, city, county
Quebec EQ	Cubic meter per hour	Withdrawal	Voluntary measurement and estimate	Survey	Annually or variable	780	Year	Yes	Variable	Yes	Yes	Address, UTM coordinates, latitude and longitude of source, village, town, city, county, basin
Wisconsin WDNR-BWS	Mgal/d	Withdrawal	Required measurement	Allocation permit	Monthly	550	Day	Yes	March 15	Yes	Yes	Latitude and longitude, address, village, town, city, basin, county

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Dis-aggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Ohio OEPA	Agency mainframe	Model State Information System	Paper file, microfiche, tape	Difficult	Difficult	No	County, basin	45 days	At collection agency and at USGS (on microfiche)	At collection agency, USGS mainframe and USGS minicomputer	Different format (USGS minicomputer is by individual user)
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy, otherwise easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM) only	n.a.
Penn. PaDER	Agency mainframe	Cobol program	Paper file, disk, tape, microfiche	Easy	Easy	Yes	Township, county, basin, individual user	1 year	Only at collection agency	Only at collection agency	--
Quebec EQ	Agency mainframe	Cobol program (Extracto)	Paper file, disk (municipal only), tape	Easy	Easy	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	EQ mainframe only	n.a.
Wisconsin WDNR-BWS	Agency mainframe/minicomputer	Cobol program	Disk	Easy	Easy	Yes	Individual user, basin, county, village, city	4 months	Only at collection agency	Agency mainframe/minicomputer	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

DOMESTIC SELF-SUPPLIED

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Illinois ISWS	gal	Withdrawal	Estimate (and cooperative program with USGS)	Survey	Annually	Not provided	Year	n.a.	Sept. 30	Yes	No	County, USGS hydrologic unit
Indiana IDNR	gal	Withdrawal	Required reporting and estimate	Registration	Annually	Not provided	Month and year	n.a.	March 31	Yes	Yes	Owner, address, (Source-county, township, range, and section)
Michigan USGS/MDNR	Mgal/d	Withdrawal	Estimate	Cooperative program	Every 5 years	Not provided	Year	n.a.	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Minnesota USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MNDNR	Annually	27,673	Year	n.a.	Sept. 30	Yes	No	County, USGS hydrologic unit
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	Not provided	Year	n.a.	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Ohio ODNR	Mgal/d	Withdrawal	Estimate	Cooperative program with USGS	Variable	Not provided	Year	n.a.	Variable	Yes	No	County, basin
Ohio USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with ODNR	Every 5 years	Not provided	Year	n.a.	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit

DOMESTIC SELF-SUPPLIED (continued)

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Illinois ISWS	Agency mainframe, agency minicomputer	Unix Utility, ICE, Cyber Utilities	Paper file, disk	Difficult	Easy	Yes	County, USGS hydrologic unit	6 months to 1 year	Only at collection agency	At collection agency and USGS mainframe	Different format
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan USGS/MDNR	None	--	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	--	--
Minnesota USGS	Agency mainframe	NWUDS-System 2000	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS mainframe	--
New York USGS	Agency minicomputer	SWUDS	Paper file, disk	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS minicomputer	--
Ohio ODNR	None	--	Paper file	Impossible	County--easy basin--impossible	No	County	Variable	Only at collection agency	--	--
Ohio USGS	Agency mainframe	NWUDS-System 2000	Paper file, published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS mainframe	--

Ontario (nothing)

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

DOMESTIC SELF-SUPPLIED (continued)

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Penn.-PaDER	Mgal/d	Withdrawal	Estimate	Cooperative program with USGS	Variable	Not provided	Year	n.a.	Variable	Yes	No	County, USGS hydrologic unit municipality
Quebec EQ	Cubic meter per hour	Withdrawal	Estimate	Estimate for Great Lakes data base	Variable	Not provided	Year	n.a.	Variable	Yes	No	Municipality, county, basin
Wisconsin WDNR-BWRM	Mgal/d	Withdrawal	Estimate (primarily)	Cooperative program with USGS	Monthly[2] or annually	Not provided	Year	n.a.	March 15	Yes[1]	Yes[2]	County, USGS hydrologic unit, latitude and longitude[2], basin[2], individual user[2]

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Penn.-PaDER	Agency mainframe	Cobol program	Paper file, published report, disk	Impossible	Easy	Yes	County, USGS hydrologic unit, municipality	Variable	Only at collection agency	Only at collection agency	--
Quebec EQ	None	--	Paper file	Impossible	Easy	Yes	County, basin	Variable	Only at collection agency	--	n.a.
Wisconsin WDNR-BWRM	Agency mainframe/minicomputer	System specific	Paper file, published report, disk	Easy[2]	Easy	Yes	County, USGS hydrologic unit, latitude and longitude*, basin*, individual user*	4 months	Only at collection agency	Agency mainframe/minicomputer	--

* If withdrawal >100,000 gal/d

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

IRRIGATION

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Illinois ISWS	gal	Withdrawal	Estimate	Survey	Annually	Not provided	Year	No	Sept. 30	Yes	No	County, USGS hydrologic unit
Indiana IDNR	gal	Withdrawal	Required reporting	Registration	Annually	1200	Month and year	Yes	March 31	Yes	Yes	Owner, address, (source-county, township, range and section)
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	3000	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Michigan MDNR	gal	Withdrawal	Estimate, voluntary measurement	Survey	Variable	3000	Month	No	Variable	Yes	Yes	Address, town, range and section
Minnesota MNDNR	gal	Withdrawal	Required measurement	Allocation permit	Monthly and annually	17	Month and year	Yes	Nov. 30	Yes	Yes	Address, township and range, MNDNR watershed, village, city, county, USGS hydrologic unit, 40-acre plot
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Ohio ODNR	Mgal/d	Withdrawal	Estimate, voluntary measurement	Survey Contract	Variable Every 5 years	Not provided	Year or season	No	Agricul.- Dec. 31, golf course- Sept. 30	Yes	No	Agricultural- address and basin, golf course- county

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Illinois ISWS	Agency mainframe agency minicomputer	Unix Utility, ICE, Cyber Utilities	Paper file and disk	Difficult	Easy	Yes	County, USGS hydrologic unit	6 months to 1 year	Only at collection agency	At collection agency and USGS mainframe	Different format
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan USGS	Agency mainframe	NWUDS-System 2000	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	6 months	Only at collection agency	USGS mainframe	--
Michigan MDNR	None	--	Paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	--	Only at collection agency	USGS mainframe	--
Minnesota MNDNR	State minicomputer; agency personal computers	INFO for Prime minicomputers and for the PC	Disk and tape	Easy	Easy	Yes	Township/range, county, MNDNR watershed, individual user, USGS hydrologic unit	1 year	Only at collection agency	At state agency and USGS mainframe	Different format (USGS is aggregated)
New York USGS	Agency minicomputer	SWUDS	Paper file, disk	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS minicomputer	--
Ohio ODNR	None	--	--	Impossible	County-easy, basin-agricultural, difficult golf course-impossible	Agricultural-Yes golf course-No	Agricultural-county and basin golf course-county	9-12 months	Only at collection agency	--	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

IRRIGATION (continued)

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Ohio USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with ODNR	Every five years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occasional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Day	Yes occassionally	Variable	Yes	Yes	Address, UTM coordinates, latitude and longitude, basin, village, city, county
Penn. PaDER	gal/d	Withdrawal	Voluntary measurement (rarely); estimate	Survey	Variable	Not provided	Month	No	Variable	Yes	Yes	UTM coordinates, latitude and longitude, river mile. basin, village, city, county
Penn. USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with PaDER	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Quebec EQ	Cubic meter per hour	Withdrawal	Estimate	Estimate for Great Lakes data base	Variable	Not provided	Year	No	Variable	Yes	No	County, basin
Wisconsin WDNR BWRZ BWS	Mgal/d	Withdrawal	Required measurement	Permit	Monthly	2794	Month	Yes	April 1	Yes	Yes	Latitude and longitude, address, village, town, city, county, basin, USGS hydrologic unit

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Dis-aggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Ohio USGS	None	--	Paper file, and published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	--	--
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy, otherwise easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM)	n.a.
Penn. PaDER	Agency mainframe	Cobol program	Paper file, disk, tape, microfiche	Easy	Easy	Yes	Township, county, basin, individual user	1 year	Only at collection agency	At collection agency and USGS mainframe	Different format (USGS is aggregated)
Penn. USGS	Agency mainframe	NWUDS-System 2000	Paper file and published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS mainframe	Different format
Quebec EQ	None	--	Paper file	Impossible	Easy	Yes	County, basin	Variable	Only at collection agency	--	n.a.
Wisconsin WDNR BWRZ BWS	Agency mainframe/ minicomputer	System specific	Tape, disk	Easy	Easy	Yes	County, township, individual user, latitude and longitude, basin	4 months	Only at collection agency	At collection agency and USGS minicomputer (GW only)	Different format

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

THERMOELECTRIC FOSSIL-FUEL POWER

	A. Data Collection						B. Data Recording					
State and Agency	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	For how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Illinois ISWS	gal	Withdrawal	Voluntary measurement	Survey	Annually	Not provided	Year	No	Sept. 30	Yes	Yes	Address, 10-acre plot, county, USGS hydrologic unit
Indiana IDNR	gal	Withdrawal	Required reporting	Registration	Annually	65	Month and year	Yes	March 31	Yes	Yes	Owner, address, (source-county, township, range and section)
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	87	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Michigan MDNR	Mgal/d	Withdrawal	Estimate and voluntary measurement	Survey	Variable	87	Year	No	--	Yes	Yes	Address, USGS hydrologic unit
Minnesota MNDNR	gal	Withdrawal	Required measurement	Allocation permit	Monthly and annually	1	Month and year	Yes	Nov. 30	Yes	Yes	Address, township and range, MNDNR watershed, village, city, county, USGS hydrologic unit, 40-acre plot

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Illinois ISWS	Agency mainframe agency mini-computer	Unix Utility, ICE, Cyber Utilities	Paper file and disk	Difficult	Easy	Yes	Survey section, village, county, USGS hydrologic unit	6 months to 1 year	Only at collection agency	At collection agency and USGS mainframe	Different format
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	At collection agency and USGS mainframe	Different format (USGS is aggregated)
Michigan USGS	Agency mainframe	NWUDS-System 2000	Published report, paper file	Easy	Easy	Yes	County, USGS hydrologic unit	6 months	Only at collection agency	USGS mainframe	--
Michigan MDNR	None	--	Paper file	Not possible	Easy	Yes	County, USGS hydrologic unit	--	Only at collection agency	USGS mainframe	--
Minnesota MNDNR	Agency mini-computer; agency personal computers	INFO for Prime mini-computer and for the PC	Disk and tape	Easy	Easy	Yes	Township/range, county, MNDNR watershed, individual user, USGS hydrologic unit	1 year	Only at collection agency	At collection agency and USGS main frame	Different format (USGS is aggregated)

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

THERMOELECTRIC FOSSIL-FUEL POWER (continued)

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	For how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	Not provided	Month	No	Sept. 30 after year of estimate	Yes	Yes	County, USGS hydrologic unit, latitude and longitude, owner address
New York NYSDEC	Mgal/d	Withdrawal	Estimate	Cooperative program with USGS	Variable	Not provided	Year	No	--	Yes	No	Address, county
Ohio USGS	Mgal/d	Withdrawal	Voluntary measurement, estimate	Cooperative program with ODNR, survey	Every 5 years (minimum)	32 (total including nuclear)	Year	No	June 30 after year of survey	Yes	Yes	County, village, city (FIPS code), USGS hydrologic unit
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occasional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Month	Yes occasionally	Variable	Yes	Yes	Address, UTM coordinates, latitude and longitude, basin, village, town, city, county
Penn. PaDER	Mgal/d	Withdrawal, consumptive use	Voluntary measurement	Survey	Annually	Not provided	Year	Yes	Dec. 31 after year of data	Yes	Yes	UTM coordinates, latitude and longitude, river mile, basin, village, city, county
Quebec EQ	Cubic meter per hour	Withdrawal	Voluntary measurement	Survey	Annually	6	Year	Yes	Variable	Yes	Yes	Address, UTM coordinates, latitude-longitude of source, village, town, city, county, basin
Wisconsin WDNR BWRM BWS	gal	Withdrawal	Required measurement	Permit	Annually-SW, monthly-GW	72	Month	Yes	March 15	Yes	Yes	Latitude and longitude, address, village, town, city, county, basin

State and Agency	C. Data Storage: Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
New York USGS	Agency minicomputer	SWUDS	Paper file, disk	Easy	Easy	Yes	County, USGS hydrologic unit, latitude and longitude, individual user	9 months	Only at collection agency	USGS minicomputer	--
New York NYSDEC	None	--	Paper file	Easy	With difficulty	No	Individual user	--	At collection agency and at USGS	USGS minicomputer	Different format
Ohio USGS	Agency mainframe agency minicomputer	NWUDS, SWUDS	Paper file, published report, disk	Easy	Easy	Yes	Individual user, county, USGS hydrologic unit	3 months	Only at collection agency	USGS mainframe USGS minicomputer	--
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy, otherwise easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM)	n.a.
Penn. PaDER	Agency mainframe	Cobol program	Paper file, disk, tape, microfiche	Easy	Easy	Yes	Township, county, basin, individual user	1 year	Only at collection agency	Agency mainframe and USGS mainframe	Different format (USGS is aggregated)
Quebec EQ	Agency mainframe	Cobol program	Paper file, tape	Easy	Easy	Yes	Township, village, county, basin, Individual user	Variable	Only at collection agency	EQ mainframe (IBM)	n.a.
Wisconsin WDNR BWRM BWS	Agency mainframe/ minicomputer	System specific	Disk, tape	Easy	Easy	Yes	Latitude and longitude, township, individual user, basin, county	4 months	Only at collection agency	Agency mainframe and minicomputer	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

THERMOELECTRIC NUCLEAR POWER

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	For how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Illinois ISWS	gal	Withdrawal	Voluntary measurement	Survey	Annually	Not provided	Year	No	Sept. 30	Yes	Yes	Address, 10-acre plot, county, USGS hydrologic unit
Indiana IDNR	gal	Withdrawal	Required reporting	Registration	Annually	0	Month and year	Yes	March 31	Yes	Yes	Owner, address, (source-county, township, range and section)
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	4	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Michigan MDNR	Mgal/d	Withdrawal	Estimate and voluntary measurement	Survey	Variable	4	Year	No	--	Yes	Yes	Address, USGS hydrologic unit
Minnesota MNDNR	gal	Withdrawal	Required measurement	Allocation permit	Monthly and annually	0	Month and year	Yes	Nov. 30	Yes	Yes	Address, township and range, MNDNR watershed, village, city, county, USGS hydrologic unit, 40-acre plot

C. Data Storage

State and agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Illinois ISWS	Agency mainframe agency mini-computer	Unix Utility, ICE, Cyber Utilities	Paper file and disk	Difficult	Easy	Yes	Survey section, village, county, USGS hydrologic unit	6 months to 1 year	Only at collection agency	At collection agency and USGS mainframe	Different format
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan USGS	Agency mainframe	NWUDS-System 2000	Published report, paper file	Easy	Easy	Yes	County. USGS hydrologic unit	6 months	Only at collection agency	USGS mainframe	--
Michigan MDNR	None	--	Paper file	Not possible	Easy	Yes	County, USGS hydrologic unit	--	Only at collection agency	USGS mainframe	--
Minnesota MNDNR	State mini-computer; agency personal computers	INFO for Prime mini-computer and for the PC	Disk and tape	Easy	Easy	Yes	Township/ range, county, MNDNR watershed, individual user, USGS hydrologic unit	1 year	Only at collection agency	At state agency and USGS mainframe	Different format (USGS is aggregated)

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

THERMOELECTRIC NUCLEAR POWER (continued)

State and Agency	A. Data Collection: Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	For how many users are data collected? (in Project area)	B. Data Recording: Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	3	Month	No	Sept. 30 after year of estimate	Yes	Yes	County, USGS hydrologic unit, latitude and longitude, owner's address
New York NYSDEC	Mgal/d	Withdrawal	Estimate	Cooperative program with USGS	Variable	3	Year	No	--	Yes	No	Address, county
Ohio USGS	Mgal/d	Withdrawal	Voluntary measurement, estimate	Cooperative program with ODNR, survey	Every 5 years (minimum)	1	Year	No	June 30 after year of estimate	Yes	Yes	County, village, city (FIPS code), USGS hydrologic unit
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occasional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Month	Yes, occasionally	Variable	Yes	Yes	Address, UTM coordinates, latitude and longitude, basin, village, town, city, county
Penn. PaDER	Mgal/d	Withdrawal, consumptive use	Voluntary measurement	Survey	Annually	Not provided	Year	Yes	Dec. 31 after year of data	Yes	Yes	UTM coordinates, latitude and longitude, river mile, basin, village, city, county
Quebec EQ	Cubic meter per hour	Withdrawal	Voluntary measurement	Survey	Annually	1	Year	Yes	Variable	Yes	Yes	Address, UTM coordinates, latitude-longitude of source, village, town, city, county, basin
Wisconsin WDNR BWRZ BWS	Mgal/d	Withdrawal	Required measurement	Permit	Monthly	3	Month	Yes	March 15	Yes	Yes	Latitude and longitude, address, village, town, city, county, basin

C. Data Storage

State and agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
New York USGS	Agency minicomputer	SWUDS	Paper file and disk	Easy	Easy	Yes	County, USGS hydrologic unit, latitude and longitude, individual user	9 months	Only at collection agency	USGS minicomputer	--
New York NYSDEC	None	--	Paper file	Easy	With difficulty	Yes	Individual user	--	At collection agency and at USGS	USGS minicomputer	Different format
Ohio USGS	Agency mainframe, agency minicomputer	NWUDS, SWUDS	Paper file, published report, disk	Easy	Easy	Yes	Individual user, county USGS hydrologic unit	3 months	Only at collection agency	USGS mainframe, USGS minicomputer	--
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy, otherwise easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM)	n.a.
Penn. PaDER	Agency mainframe	Cobol program (Extracto)	Paper file, disk, tape, microfiche	Easy	Easy	Yes	Township, county, basin, individual user	1 year	Only at collection agency	Agency mainframe and USGS mainframe	Different format (USGS is aggregated)
Quebec EQ	Agency mainframe	Cobol program	Paper file, tape	Easy	Easy	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	EQ mainframe	n.a.
Wisconsin WDNR BWRZ BWS	Agency mainframe/ minicomputer	System specific	Disk, tape	Easy	Easy	Yes	Latitude and longitude, individual user, township, county, basin	4 months	Only at collection agency	Agency mainframe and minicomputer	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

HYDROELECTRIC POWER

	A. Data Collection						B. Data Recording					
State and Agency	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	n.a.	No	County, USGS hydrologic unit
Minnesota USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MNDNR	Annually	5	Year	No	Sept. 30	n.a.	No	County, USGS hydrologic unit
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	83	Month	No	Sept. 30 after year of estimate	n.a.	Yes	County, USGS hydrologic unit, latitude and longitude, owner's address
New York NYSDEC	Mgal/d	Withdrawal	Estimate	Cooperative program with USGS	Variable	83	Year	No	Variable	n.a.	No	Address, county

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Michigan USGS	None	--	Published report, paper file	Easy	Easy	Yes	County, USGS hydrologic unit	6 months	Only at collection agency	--	--
Minnesota USGS	Agency mainframe	NWUDS	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS mainframe	--
New York USGS	Agency minicomputer	SWUDS	Paper file and disk	Easy	Easy	Yes	County, USGS hydrologic unit, latitude and longitude, individual user	9 months	Only at collection	USGS minicomputer	--
New York NYSDEC	None	--	Paper file	Easy	With difficulty	No	Individual user	--	At collection agency and at USGS	USGS minicomputer	Different format

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

HYDROELECTRIC POWER (continued)

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Ohio USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with ODNR	Every 5 years	0	Year	No	Sept. 30 after year of estimate	n.a.	No	County, USGS hydrologic unit
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occasional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Month	Yes, occassionally	Variable	n.a.	Yes	Address UTM coordinates, latitude and longitude, basin, village, town, city, county
Quebec EQ	Cubic meter per hour	Withdrawal	Voluntary measurement	Survey	Annually	Not provided	Year	Yes	Variable	n.a.	Yes	Address, UTM coordinates, latitude-longitude, village, town, city, county, basin
Wisconsin WDNR BWRM	Mgal/d	Withdrawal	Estimate	Cooperative program with USGS	Annually	73	Year	No	March 15	n.a.	Yes	County, USGS hydrologic unit

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Ohio USGS	None	--	Paper file and published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	--	--
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy, otherwise easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM)	n.a.
Quebec EQ	Agency mainframe	Cobol program (Extracto)	Paper file and tape	Easy	Easy	Yes	County, village, basin, individual user	Variable	Only at collection agency	EQ mainframe	n.a.
Wisconsin WDNR BWRM	Agency mainframe/ minicomputer	System specific	Paper file and published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	Agency mainframe and minicomputer	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category.

INDUSTRIAL SELF-SUPPLIED

	A. Data Collection						B. Data Recording					
State and Agency	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Illinois IDOT (only Lake Michigan water use)	Mgal/d	Withdrawal, conveyance loss, consumptive use	Required meter.	Allocation permit	Monthly or annually	2	Day or year	Yes	March 1 (for data Oct. 1-Sept. 30)	Yes	Yes	Address
Illinois ISWS	gal	Withdrawal	Voluntary measurement	Survey	Annually	Not provided	Year	No	Sept. 30	Yes	Yes	Address, 10-acre plot, county, USGS hydrologic unit
Indiana IDNR	gal	Withdrawal	Required reporting	Registration	Annually	400	Month and year	Yes	March 31	Yes	Yes	Owner, address, (source-county, township, range and section)
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Minnesota MNDNR	gal	Withdrawal	Required measurement and estimate	Allocation permit	Monthly and annually	5	Month and year	Yes	Nov. 30	Yes	Yes	Address, township and range, MNDNR watershed, village, city, county, USGS hydrologic unit, 40-acre plot
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Illinois IDOT (only Lake Michigan water use)	IBM-AT	Symphony	Paper file	Easy	Easy	Yes	Individual user	6 months	Only at collection agency	IBM-AT PC only at collection agency	--
Illinois ISWS	Agency mainframe agency mini-computer	UNIX Utility, ICE, Cyber Utilities	Paper file and disk	Difficult	Easy	Yes	Survey section, village, county, USGS hydrologic unit	6 months to 1 year	Only at collection agency	At collection agency and USGS mainframe	Different format
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan USGS	None	--	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	6 months	Only at collection agency	--	--
Minnesota MNDNR	State mini-computer; agency personal computers	INFO for Prime mini-computer and for the PC	Disk and tape	Easy	Easy	Yes	Township/range, county, MNDNR watershed, individual user, USGS hydrologic unit	1 year	Only at collection agency	At state agency and USGS mainframe	Different format (USGS is aggregated)
New York USGS	Agency mini-computer	SWUDS	Paper file, disk	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS minicomputer	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category.

INDUSTRIAL SELF-SUPPLIED (continued)

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
New York NYSDEC	Mgal/d	Withdrawal	Estimate	Cooperative program with USGS	Variable	Not provided	Year	No	Variable	Yes	No	Address, county
Ohio ODNR	Mgal/d	Withdrawal	Estimate, voluntary measurement	Survey	Variable	6762	Year	No	Variable	Yes	No	County, basin
Ohio USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with ODNR	Every 5 years	6762	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occassional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Month	Yes, occassionally	Variable	Yes	Yes	Address, UTM coordinates, latitude and longitude, basin, village, town, city, county
Penn. PaDER	gal/d	Withdrawal, consumptive use	Voluntary measure-	Survey	Every 5 years	Not provided	Year	Yes	Dec. 31 after year of survey	Yes	Yes	UTM coordinates, latitude and longitude, river mile, basin, village, city, county
Quebec EQ	Cubic meter per hour	Withdrawal	Voluntary measurement	Survey	Annually or variable	86	Year	Yes	Variable	Yes	Yes	Village, town, city, county, basin
Wisconsin WDNR BWRZ BWS BWRM	gal, Mgal/d	Withdrawal	Required measurement	Registration	Monthly	92	Month	Yes	March 15	Yes	Yes	Address, Village, town, city

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
New York NYSDEC	Agency mainframe	ASCII file	Paper file, tape	Easy	County-easy, Basin-with difficulty	No	County, Individual user	--	At collection agency and at USGS	At collection agency and at USGS	Different format-USGS is aggregated
Ohio ODNR	None	--	Paper file	Impossible because of privacy	Easy	Yes	County, basin	1 year	Only at collection agency	Not computerized	--
Ohio USGS	Agency mainframe	NWUDS-System 2000	Paper file and published report	Impossible because of privacy	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS mainframe	--
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy, otherwise easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM)	n.a.
Penn. PaDER	Agency mainframe	Cobol program	Paper file, disk, tape, microfiche	Easy	Easy	Yes	Township, county, basin, individual user	1 year	Only at collection agency	PaDER mainframe and USGS mainframe	Different format-USGS is aaggregated
Quebec EQ	Agency mainframe	Cobol program	Paper file, tape	Impossible because of privacy, otherwise easy	Easy	Yes	County, basin, township, village	Variable	Only at collection agency	EQ mainframe (IBM)	n.a.
Wisconsin WDNR BWRZ BWS BWRM	Agency mainframe and minicomputer	System specific	Disk, tape	Easy	Easy	Yes	Latitude and longitude, township, individual user, county, basin	4 months	Only at collection agency	Agency mainframe and minicomputer	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

(AG) LIVESTOCK

	A. Data Collection						B. Data Recording					
State and Agency	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Illinois ISWS	gal	Withdrawal	Estimate	Survey	Annually	0	Year	No	Sept. 30	Yes	No	County, USGS hydrologic unit
Indiana IDNR	gal	Withdrawal	Required reporting and estimate	Registration	Annually	20	Month and year	Yes	March 31	Yes	Yes	Owner, address, (source-county, township, range and section)
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Minnesota USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MNDNR	Annually	782,757	Year	No	Sept. 30	Yes	No	County, USGS hydrologic unit
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Ohio USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with ODNR	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Penn. USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with PaDER	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Quebec EQ	Cubic meter per hour	Withdrawal	Estimate	Estimate for Great Lakes data base	Variable	Not provided	Year	No	Variable	Yes	No	County, basin
Wisconsin WDNR-BWRZ BWS	Mgal/d	Withdrawal	Estimate (primarily)	Cooperative program with USGS	Monthly or annually	Not provided	Year	Yes	March 15	Yes*	Yes*	County*, USGS hydrologic unit, basin*, latitude and longitude*, individual user

* If withdrawal >100,000 gpd.

State and Agency	C. Data Storage: Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Illinois ISWS	Agency mainframe, agency minicomputer	UNIX Utility ICE, Cyber Utilities	Paper file and disk	Difficult	Easy	Yes	County, USGS hydrologic unit	6 months to 1 year	Only at collection agency	At collection agency and USGS mainframe	Different format
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan USGS	None	--	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	6 months	Only at collection agency	--	--
Minnesota USGS	Agency mainframe	NWUDS-System 2000	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS mainframe	--
New York USGS	Agency minicomputer	SWUDS	Paper file, disk	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS minicomputer	--
Ohio USGS	None	--	Paper file and published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	--	--
Penn. USGS	None	--	Paper file and published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	--	--
Quebec EQ	None	--	Paper file	Impossible	Easy	Yes	County, basin	Variable	Only at collection agency	--	n.a.
Wisconsin WDNR-BWRZ BWS	Agency minicomputer	Mainframe/ system specific	Disk	Easy*/ Impossible	Easy	Yes	Latitude and longitude*, county*, USGS hydrologic unit, basin*, individual user*	4 months	Only at collection agency	WDNR mainframe and minicomputer	--

* If withdrawal >100,000 gal/d

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category.

COMMERCIAL SELF-SUPPLIED

	A. Data Collection						B. Data Recording					
State and Agency	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Indiana IDNR	gal	Withdrawal	Required reporting	Registration	Annually	Not provided	Month and year	Yes	March 31	Yes	Yes	Owner, address, (source-county, township, range and section)
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Minnesota MNDNR	gal	Withdrawal	Required measurement and estimate	Allocation permit	Monthly	2	Month and year	Yes	Nov. 30	Yes	Yes	Address, township and range, MNDNR watershed, village, city, county, USGS hydrologic unit, 40-acre plot
New York NYSDOH	gal/d	Withdrawal, conveyance	Required measurement and metering since 1975	Legislative mandate	Monthly and annually	Not provided	Day	Yes	June 1	Yes	Yes	Address, county, basin, city, town, village
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Ohio OEPA	gal/d	Withdrawal, consumptive use	Required measurement and required metering >10,000 people served	Legislative mandate	Monthly >10,000 people served; otherwise, annually or triennially	Not provided	Day	Yes	Feb. 15	Yes	Yes	Location address, latitude and longitude, river basin, county

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan USGS	None	--	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	6 months	Only at collection agency	--	--
Minnesota MNDNR	State minicomputer; agency personal computers	INFO for Prime minicomputer and for the PC	Disk and tape	Easy	Easy	Yes	Township/range, county, MNDNR watershed, individual user, USGS hydrologic unit	1 year	Only at collection agency	At state agency and USGS mainframe	Different format (USGS IS aggregated)
New York NYSDOH	Agency mainframe	SAFWATER (system specific)	Paper file, disk, tape	Easy	Easy	No (available with programming)	Township, village, county, river basin (for sources), individual users	6 months	Only at collection agency	At collection agency, local USGS Prime (some years), USGS mainframe	Different format (USGS mainframe data is aggregated)
New York USGS	Agency minicomputer	SWUDS	Paper file, disk	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS minicomputer	--
Ohio OEPA	Agency mainframe	Model State Information System	Paper file, microfiche, tape	Difficult	Difficult	No	County, river basin	45 days	At collection agency and at USGS (on microfiche)	At collection agency and USGS minicomputer	Different format (USGS minicomputer is by individual user)

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

COMMERCIAL SELF-SUPPLIED (continued)

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occassional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Month	Yes, occassionally	Variable	Yes	Yes	Address, UTM coordinates, latitude and longitude, basin, village, town, city, county
Penn. USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with PaDER	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Quebec EQ	Cubic meters per hour	Withdrawal	Voluntary measurement	Survey	Annually or variable	Not provided	Year	Yes	Variable	Yes	Yes	UTM coordinates, latitude and longitude (of source), village, town, city, county, basin
Wisconsin WDNR BWRM BWS	gal, Mgal/d	Withdrawal	Required measurement	Permit	Monthly	37	Month	Yes	March 15	Yes	Yes	Latitude and longitude, address, village, town, city, basin, county

	C. Data Storage										
State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy, otherwise easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM)	n.a.
Penn. USGS	None	--	Paper file and published report	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	--	--
Quebec (nothing)	Agency mainframe	Cobol program (Extracto)	Paper file, disk, tape	Impossible because of privacy, otherwise easy	Easy	Yes	Township, county, village, basin	Variable	Only at collection agency	EQ mainframe (IBM)	n.a.
Wisconsin WDNR BWRM BWS	Agency mainframe/ minicomputer	System specific	Disk, tape	Easy	Easy	Yes	Latitude and longitude, township, individual user, county, basin	4 months	Only at collection agency	Agency mainframe and minicomputer	Different format

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

MINING

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Indiana IDNR	gal	Withdrawal	Required reporting	Registration	Annually	Not provided	Month and year	Yes	March 31	Yes	Yes	Owner, address (source-county, township, range, and section)
Michigan USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with MDNR	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit
Minnesota MNDNR	gal	Withdrawal	Required measurement	Allocation permit	Monthly and annually	28	Month and year	Yes	Nov. 30	Yes	Yes	Address, township and range, MNDNR watershed, village, city, county, USGS hydrologic unit 40-acre plot
New York USGS	Mgal/d	Withdrawal	Estimate	Cooperative program with NYSDEC	Every 5 years	Not provided	Year	No	Sept. 30 after year of estimate	Yes	No	County, USGS hydrologic unit

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Dis-aggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Indiana IDNR	Agency mainframe	Statistical Analysis System (SAS)	Disk	Easy	Easy	Yes	County, basin	1 week	Only at collection agency	Only at collection agency	--
Michigan USGS	None	--	Published report, paper file	Impossible	Easy	Yes	County, USGS hydrologic unit	6 months	Only at collection agency	--	--
Minnesota MNDNR	State mini-computer; agency personal computers	INFO for Prime mini-computer and for the PC	Disk and tape	Easy	Easy	Yes	Township/ range, county, MNDNR watershed, individual users, USGS hydro-logic unit	1 year	Only at collection agency	At state agency and USGS main-frame	Different format (USGS is aggregated)
New York USGS	Agency mini-computer	SWUDS	Paper file, disk	Impossible	Easy	Yes	County, USGS hydrologic unit	9 months	Only at collection agency	USGS minicomputer	--

Table 2.--Summary of the water-use data-collection programs in each State and Province by water-use category (continued)

MINING (continued)

State and Agency	A. Data Collection						B. Data Recording					
	Unit of meas.	Type of data collected	Degree of accuracy	Collection program	How often are data recorded?	From how many users are data collected? (in Project area)	Time period for which data are tallied	Are data collected from users >100,000 gal/d (30-day avg)	Average date by which data are processed	Is source specified by type?	Is source specified by name?	How is user location identified?
Ontario OMOE	Liter per day, gal/d or Imperial gal/d	Withdrawal	Occassional required measurement	Allocation permit	When required, annually; otherwise variable	Not provided	Month	Yes, occassional	Variable	Yes	Yes	Address, UTM coordinates, latitude and longitude, basin, village, town, city, county
Penn. PaDER	gal/d	Withdrawal, consumptive use	Voluntary measurement	Survey	Every 5 years	Not provided	Year	Yes	Dec. 31 after year of survey	Yes	Yes	UTM coordinates, latitude and longitude, river mile, basin, village, city, county
Quebec EQ	Cubic meters per hour	Withdrawal	Voluntary measurement	Survey	Variable	Not provided	Year	Yes	Variable	Yes	Yes	Village, town, city, county, basin
Wisconsin WDNR-BWRM BWS	Mgal/d	Withdrawal	Estimate (primarily)	Cooperative program with USGS	Monthly or annually	Not provided	Year	Yes	March 15	Yes*	Yes*	Latitude and longitude, county, USGS hydrologic unit, basin

C. Data Storage

State and Agency	Computer-storage-collection agency	Computer software used	Data access	Disaggregate data to individual users?	Aggregate by county, province, or river basin?	Are data available specifically for Great Lakes basin?	By what divisions are data stored?	Process time. (How long from collection to storage?)	Storage site: Data not computerized	Storage site: Data computerized	Data stored at collection agency and at USGS: how stored?
Ontario OMOE	Agency mainframe	Cobol program	Paper file (primarily)	Impossible because of privacy otherwise; easy	Difficult	Yes	Township, village, county, basin, individual user	Variable	Only at collection agency	Ontario mainframe (IBM)	n.a.
Penn. PaDER	Agency mainframe	Cobol program	Paper file, disk, tape, microfiche	Easy	Easy	Yes	Township, county, basin, individual user	1 year	Only at collection agency	PaDER mainframe and USGS mainframe	Different format-USGS is aggregated
Quebec EQ	Agency mainframe	Cobol program (Extracto)	Paper file, tape	Impossible because of privacy otherwise; easy	Easy	Yes	Township, county, village, basin	Variable	Only at collection agency	EQ mainframe (IBM)	n.a.
Wisconsin WDNR-BWRM BWS	Agency mini-computer	--	Paper file and published report	Easy*	Easy	Yes	Latitude and longitude*, County*, USGS hydrologic unit, basin*, individual user	4 months	Only at collection agency	Agency mini-computer	--

* If withdrawal >100,000 gal/d

Table 3.--Water-use data-collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category.

1. PUBLIC WATER SUPPLY

Data-collection and storage information	Number of State/Provinces or agencies
Data collected by	
State/Province	10
Agency or ministry	12
Collection method	
Allocation permit (Pa. surface water only)	5
Registration	1
Survey	2
Legislative mandate	3
Cooperative program	1
Reporting method[1]	
Required metering (Ohio >10,000 people)	4
Required reporting	4
Occasional required reporting	1
Voluntary reporting	2
Estimate	1
Frequency of data collection	
Daily	5
Annually	4
Daily or annually	1
Monthly or annually	2
Withdrawal unit	
gallon (gal)	4
gal/d	4
Mgal/d	3
m^3/h	1
Trigger level	
All users	2
All diverters of L. Mich.	1
10,000 gal/d	1
12,500 gal/d	1
100,000 gal/d	1
10 people	1
25 people	1
25 people or 5 connections	1
25 people or 15 connections	2
None	2
Frequency of recording[2]	
Monthly	2
Monthly or annually	3
Annually	3
Annually or variable	2
Monthly, annually, or triennially	1
Every five years	1
Data processed by	
February	2
March	3
June	1
September	2
November	1
December	1
Variable	2
Method of data storage	
Site specific	8
Aggregated	4
Data available by drainage basin	
Easy	9
Difficult	3
Data specified as ground water or surface water	
Yes	12
No	0
Data available by surface-water name	
Yes	11
No	1
Data computerized	
Yes	12
No	0
Data collected from users exceeding 100,000 gal/d	
Yes	9
Occasionally	1
No	2

[1] The most accurate method is tabulated.
[2] Includes reporting and computer storage.

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

2. DOMESTIC, SELF SUPPLIED

Data-collection and storage information	Number of State/Provinces or agencies
Data collected by	
State/Province	9
Agency or ministry	10
Collection method	
Registration	1
Survey	1
Cooperative program	7
Estimate for Great Lakes	1
Reporting method[1]	
Required reporting, estimate	1
Estimate	9
Data-collection interval	
Monthly and annually	1
Annually	9
Withdrawal unit	
gallon (gal)	2
Mgal/d	7
m^3/h	1
Trigger level	
100,000 gal/d	1
100,000 gal/d ground water and all surface water	1
None	8
Frequency of recording[2]	
Monthly or annually	1
Annually	3
Every five years	3
Variable	3
Data processed by	
March	2
September	5
Variable	3
Method of data storage	
Site specific	1
Aggregated	9
Data available by drainage basin	
Easy	9
By county, easy; by basin, impossible	1
Data specified as ground water or surface water	
Yes	10
No	0
Data available by surface-water name	
Yes	1
No	9
Data computerized	
Yes	7
No	3
Data collected from users exceeding 100,000 gal/d	
n.a.	

1 The most accurate method is tabulated
2 Includes reporting and computer storage

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

3. IRRIGATION

Data-collection and storage information	Number of State/Provinces or agencies
Data collected by	
State/Province	10
Agency or ministry	13
Collection method	
Allocation permit	2
Permit	1
Registration	1
Survey	4
Cooperative program	4
Estimate for Great Lakes	1
Reporting method[1]	
Required reporting	3
Occasional required reporting	1
Voluntary	3
Estimate	6
Data-collection interval	
Daily	1
Monthly	3
Monthly or annually	2
Annually	7
Withdrawal unit	
gallon (gal)	4
gal/d	2
Mgal/d	6
m^3/h	1
Trigger level	
10,000 gal/d	1
12,500 gal/d	1
100,000 gal/d	1
100,000 gal/d ground water and all surface water	1
None	9

Data-collection and storage information	Number of State/Provinces or agencies
Frequency of recording[2]	
Monthly	1
Monthly or annually	1
Annually	2
Annually or variable	1
Every 5 years	5
Variable	3
Data processed by	
March	1
April	1
September	5
November	1
December	1
Variable	4
Method of data storage	
Site specific	4
Aggregate	9
Data available by drainage basin	
Easy	11
Difficult	2
Data specified as ground water or surface water	
Yes	13
No	0
Data available by surface-water name	
Yes	6
No	7
Data computerized	
Yes	9
No	4
Data collected from users exceeding 100,000 gal/d	
Yes	3
Occasionally	1
No	9

[1] The most accurate method is tabulated
[2] Includes reporting and computer storage

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

4. THERMOELECTRIC, FOSSIL-FUEL POWER

Data-collection and storage information	Number of State/Provinces or agencies
Data collected by	
State/Province	10
Agency or ministry	12
Collection method	
Allocation permit	2
Permit	1
Registration	1
Survey	4
Cooperative program	4
Reporting method[1]	
Required reporting	3
Occasional required reporting	1
Voluntary	5
Estimate	3
Data-collection interval	
Monthly	3
Monthly and annually	2
Annually	7
Withdrawal unit	
gallon (gal)	3
gal/d	1
Mgal/d	7
m^3/h	1
Trigger level	
All plants	1
10,000 gal/d	1
12,500 gal/d	1
100,000 gal/d	1
100,000 gal/d ground water and all surface water	1
5,000 kwh	1
None	6

Data-collection and storage information	Number of State/Provinces or agencies
Frequency of recording[2]	
Monthly	1
Monthly or annually	1
Annually	4
Annually when required, otherwise variable	1
Every five years	3
Variable	2
Data processed by	
March	2
June	1
September	3
November	1
December	1
Variable	4
Method of data storage	
Site specific	9
Aggregate	3
Data available by drainage basin	
Yes	10
No	2
Data specified as ground water or surface water	
Yes	12
No	0
Data available by surface-water name	
Yes	10
No	2
Data computerized	
Yes	10
No	2
Data collected from users exceeding 100,000 gal/d	
Yes	5
Occasionally	1
No	6

[1] The most accurate method is tabulated
[2] Includes reporting and computer storage.

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

5. THERMOELECTRIC POWER, NUCLEAR

Data-collection and storage information	Number of State/Provinces or agencies
Data collected by	
State/Province	10
Agency or ministry	12
Collection method	
Allocation permit	2
Permit	1
Registration	1
Survey	4
Cooperative program	4
Reporting method[1]	
Required reporting	3
Occasional required reporting	1
Voluntary	5
Estimate	3
Data-collection interval	
Monthly	3
Monthly and annually	2
Annually	7
Withdrawal unit	
gallon (gal)	4
gal/d	1
Mgal/d	6
m^3/h	1
Trigger level	
All plants	1
10,000 gal/d	1
12,500 gal/d	1
100,000 gal/d	1
100,000 gal/d ground water, all surface water	1
5,000 kwh	1
None	6
Frequency of recording[2]	
Monthly	1
Monthly or annually	1
Annually	4
Annually when required, otherwise variable	1
Every five years	3
Variable	2
Data processed by	
March	2
June	1
September	3
November	1
December	1
Variable	4
Method of data storage	
Site specific	9
Aggregate	3
Data available by drainage basin	
Yes	10
No	2
Data specified as ground water or surface water	
Yes	12
No	0
Data available by surface-water name	
Yes	10
No	2
Data computerized	
Yes	10
No	2
Data collected from users exceeding 100,000 gal/d	
Yes	5
Occasionally	1
No	6

[1] The most accurate method is tabulated.
[2] Includes reporting and computer storage.

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

6. HYDROELECTRIC POWER

Data-collection and storage information	Number of State/Provinces or agencies	Data-collection and storage information	Number of State/Provinces or agencies
Data collected by		Frequency of recording[2]	
State/Province	7	Annually	3
Agency or ministry	8	Every five years	3
		Annually when required, otherwise variable	1
Collection method		Variable	1
Allocation permit	1		
Survey	1		
Cooperative program	6	Data processed by	
		March	1
Reporting method[1]		September	4
Occasional required reporting	1	Variable	3
Voluntary	1		
Estimate	6	Method of data storage	
		Site specific	4
Data-collection interval		Aggregate	4
Monthly	2		
Annually	6	Data available by drainage basin	
		Easy	6
Withdrawal unit		Difficult	2
gal/d	1		
Mgal/d	6	Data specified as ground water or surface water	
m^3/h	1	n.a.	
Trigger level		Data available by surface-water name	
12,500 gal/d	1	Yes	4
$\geq$ 5,000 kwh	1	No	4
None	6		
		Data computerized	
		Yes	5
		No	3
		Data collected from users exceeding 100,000 gal/d	
		Yes	1
		Occasionally	1
		No	6

[1] The most accurate method is tabulated.
[2] Includes reporting and computer storage.

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

7. INDUSTRIAL, SELF SUPPLIED

Data-collection and storage information	Number of State/Provinces or agencies
Data collected by	
State/Province	10
Agency or ministry	13
Collection method	
Allocation permit	3
Registration	2
Survey	4
Cooperative program	4
Reporting method[1]	
Required metering	1
Occasional required metering	1
Required reporting	4
Voluntary	3
Estimate	4
Data-collection interval	
Monthly	2
Annually	8
Daily or annually	1
Monthly or annually	2
Withdrawal unit	
gallon (gal)	3
gal/d	2
Mgal/d	7
m^3/h	1
Trigger level	
Lake Michigan diverters	1
All industries	1
10,000 gal/d	1
12,500 gal/d	1
50,000 gal/d	1
100,000 gal/d ground water, all surface water	1
100,000 gal/d	1
None	6
Frequency of recording[2]	
Monthly	1
Annually	2
Monthly or annually	2
Annually or variable	1
Every five years	4
Variable	3
Data processed by	
March	3
September	4
November	1
December	1
Variable	4
Method of data storage	
Site specific	6
Aggregate	7
Data available by drainage basin	
Easy	11
Difficult	2
Data specified as ground water or surface water	
Yes	13
No	0
Data available by surface-water name	
Yes	8
No	5
Data computerized	
Yes	11
No	2
Data collected from users exceeding 100,000 gal/d	
Yes	6
Occasionally	1
No	6

[1] The most accurate method is tabulated.
[2] Includes reporting and computer storage.

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

8. AGRICULTURAL

Data-collection and storage information	Number of State/Provinces or agencies	Data-collection and storage information	Number of State/Provinces or agencies
Data collected by		Frequency of recording [2]	
State/Province	9	Monthly or annually	1
Agency or ministry	9	Annually	3
		Every five years	4
Collection method		Variable	1
Registration	1		
Survey	1	Data processed by	
Cooperative program	6	March	2
Estimate for Great Lakes	1	September	6
		Variable	1
Reporting method [1]			
Required reporting	1	Method of data storage	
Estimate	8	Site specific	1
		Aggregate	8
Data-collection interval			
Monthly and annually	1	Data available by drainage basin	
Annually	8	Yes	9
		No	0
Withdrawal unit			
gallon (gal)	2	Data specified as ground water or surface water	
Mgal/d	6	Yes	9
m^3/h	1	No	0
Trigger level			
100,000 gal/d	1	Data available by surface-water name	
100,000 gal/d ground water, all surface water	1	Yes	2
		No	7
None	7		
		Data computerized	
		Yes	5
		No	4
		Data collected from users exceeding 100,000 gal/d	
		Yes	2
		No	7

1 The most accurate method is tabulated.
2 Includes reporting and computer storage.

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

9. COMMERCIAL, SELF SUPPLIED

Data-collection and storage information	Number of State/Provinces or agencies
Data collected by	
State/Province	9
Agency or ministry	10
Collection method	
Allocation permit	2
Permit	1
Registration	1
Legislative mandate	2
Cooperative program	4
Reporting method[1]	
Required metering	1
Required metering and required reporting, >10,000 people served	1
Required reporting	2
Occasional required reporting	1
Required reporting, estimate	1
Estimate	4
Data-collection interval	
Daily	2
Monthly	2
Monthly or annually	2
Annually	4
Withdrawal unit	
gallon (gal)	2
gal/d	3
Mgal/d	4
m^3/h	1
Trigger level	
10,000 gal/d	1
12,500 gal/d	1
100,000 gal/d	1
100,000 gal/d ground water and all surface water	1
25 people or 5 connections	1
25 people or 15 connections	1
None	4
Frequency of recording[2]	
Monthly	1
Monthly and annually	2
Annually	1
Every five years	3
Annual when required, otherwise variable	2
Monthly, annually, or triennially	1
Data processed by	
February	1
March	2
June	1
September	3
November	1
Variable	2
Method of data storage	
Site specific	4
Aggregate	6
Data available by drainage basin	
Easy	8
Difficult	2
Data specified as ground water or surface water	
Yes	10
Data available by surface-water name	
Yes	7
No	3
Data computerized	
Yes	8
No	2
Data collected from users exceeding 100,000 gal/d	
Yes	6
Occassionally	3
No	1

[1] The most accurate method is tabulated.
[2] Includes reporting and computer storage.

Table 3.--Water-use data collection and storage methods in Great Lakes-St. Lawrence River basin, by water-use category--continued.

10. MINING

Data-collection and storage information	Number of State/Provinces or agencies	Data-collection and storage information	Number of State/Provinces or agencies
Data collected by		Frequency of recording [2]	
State/Province	8	Monthly or annually	2
Agency or ministry	8	Annually	1
		Every five years	3
Collection method		Variable	2
Allocation permit	2		
Registration	1	Data processed by	
Survey	2	March	2
Cooperative program	3	September	2
		November	1
Reporting method [1]		December	1
Required reporting	2	Variable	2
Occasional required reporting	1		
		Method of data storage	
Voluntary	2	Site specific	4
Estimates	3	Aggregate	4
Data-collection interval		Data available by drainage basin	
Monthly	1	Easy	7
Monthly and annually	2	Difficult	1
Annually	5		
		Data specified as ground water or surface water	
Withdrawal unit		Yes	8
gallon (gal)	2	No	0
gal/d	2		
Mgal/d	3		
m^3/h	1	Data available by surface-water name	
		Yes	6
Trigger level		No	2
All users	2		
10,000 gal/d	1		
12,500 gal/d	1	Data computerized	
100,000 gal/d	1	Yes	7
100,000 gal/d ground water, all surface water	1	No	1
		Data collected from users exceeding 100,000 gal/d	
None	2	Yes	5
		Occasionally	1
		No	2

[1] The most accurate method is tabulated.
[2] Includes reporting and computer storage.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin.

	PUBLIC WATER SUPPLY	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	Systems or wells that furnish water for drinking or general domestic use in incorporated municipalities, and incorporated communities where 15 or more separate lots or properties, or 25 persons, are being served, or are intended to be served, at least 60 days per year.
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	Either a municipally owned, investor-owned, privately owned, state-owned, federally owned, nonprofit, or conservancy district utility company producing and(or) distributing water for sale through a pipeline distribution system to its customers.
Michigan	- Michigan Department of Public Health (MDPH)	Water withdrawn for all uses of public and private water suppliers and delivered to users that do not supply their own water.
	- Michigan Department of Natural Resources (MDNR)	
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	The various supplies of water used primarily for domestic-supply purposes and obtained from a source or sources by a municipality, a water district, a person, or corporation where water is delivered through a common distribution system.
New York	- New York State Department of Health (NYSDOH), Bureau of Public Water Supply Protection	"Community water system" means a public water system that serves at least five service connections used by year-round residents, or regularly serves at least 25 year-round residents.
	- New York State Department of Environmental Conservation (NYSDEC)	"Public water system" means either a community or noncommunity system that provides piped water to the public for human consumption, if such system has at least five service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Such term includes: (1) collection, treatment, storage, and distribution facilities under control of the supplier of water of such system and used in connection wih such system, and (2) collection or pretreatment storage facilities not under such control that are used in connection with such system.
Ohio	- Ohio Environmental Protection Agency (OEPA)	"Public Water System" means a system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves at least 25 individuals.
	- Ohio Department of Natural Resources (ODNR), Division of Water	Same as OEPA.
Ontario	- Ministry of the Environment (OMOE)	Public supply - schools, hospitals, churches, public washrooms, campgrounds, picnic grounds, conservation areas, defense installations.
		Municipal - water pumped and distributed to industrial, commercial, and residential areas.
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	Water that is sold to the public by water-supply companies, water authorities, or municipalities.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	PUBLIC WATER SUPPLY	
	State Agency or Province-ministry	Definition
Quebec	- Environmental Quebec (EQ)	Municipal water suppliers. Public and private suppliers - suppliers serving 10 or more people, commercial establishments, government buildings, schools, fire control, flood control, housing developments.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	Community system - A public water system that has at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Public system - A water system belonging to, or operated by, the people as a whole or the community at large. Municipal system - A community water system owned and operated by an incorporated city or village. Nonmunicipal system - A water system not owned or operated by an incorporated city or village. Other community system - A nonmunicipal water system operated by a town, sanitary district, subdivision, or mobile home park. Other use - Water uses not specifically categorized, such as use in parks, schools, and public buildings, fire control, water-main flushing and leakage.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	DOMESTIC SELF-SUPPLIED	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	The water is "self supplied" if a public supply is either unavailable or not used. Individual families and small communities not served by a public water supply system are categorized as "rural" with respect to water use. (Rural = domestic self-supplied.)
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	Users who obtain their water from sources other than municipal water systems.
Michigan	- Michigan Department of Natural Resources (MDNR)	None.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	Water used for normal household purposes such as drinking, food preparation, and bathing.
New York	- New York State Department of Environmental Conservation (NYSDEC)	Water used for normal household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens.
Ohio	- Ohio Department of Natural Resources (ODNR), Division of Water	Called "rural water use" - Withdrawals by households or farmsteads. Both domestic and livestock uses are grouped in this category.
Ontario	- Ministry of the Environment (OMOE)	Taking of water for ordinary household purposes.
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	Water withdrawn from privately owned sources (mostly wells) for domestic use in private residences.
Quebec	- Environmental Quebec (EQ)	Users not supplied from municipal, public, or privately owned systems.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	Residential use - Water used for personal services in housing units of not more than two families.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	IRRIGATION	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	None.
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	Includes agricultural and golf courses.
Michigan	- Michigan Department of Natural Resources (MDNR)	Individuals or institutions applying water by artificial means to crops, recreational areas, or commercial grounds, on an area larger than one-half acre.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	Artificial application of water to assist in the growing of crops and pastures or to maintain turf on public or private lands such as parks, golf courses, cemetaries, or building grounds.
New York	- New York State Department of Environmental Conservation (NYSDEC)	Artificial application of water on land to assist in the growing of crops and pastures or maintaining recreational lands such as parks and golf courses.
Ohio	- Ohio Department of Natural Resources (ODNR), Division of Water	Includes crop and golf-course turf irrigation.
Ontario	- Ministry of the Environment (OMOE)	The watering of crops grown for sale, such as, tobacco, market vegetables, nursery stock, orchards, sod, irrigation of golf courses, pasture, greenhouses, public parks, institutional grounds.
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	Water withdrawn by agricultural enterprises from privately owned sources or intakes and used for irrigation (does not include domestic uses on farms). See "Commercial".
Quebec	- Environmental Quebec (EQ)	None.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	Water applied to crops, golf courses, parks, or commercial grounds, but not domestic lawns.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	THERMOELECTRIC POWER GENERATION	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	None.
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	Energy production.
Michigan	- Michigan Department of Natural Resources (MDNR)	Electrical power generated from fossil-fuel (coal, oil, or natural gas), geothermal, or nuclear energy.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	Electrical power generated from fossil-fuel (coal, oil, or natural gas), geothermal, or nuclear energy.
New York	- New York State Department of Environmental Conservation (NYSDEC)	Electrical power generated from fossil-fuel (coal, oil, or natural gas), geothermal, or nuclear energy.
Ohio	- Ohio Department of Natural Resources (ODNR), Division of Water	None.
Ontario	- Ministry of the Environment (OMOE)	See "Industrial".
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	Rated capacity cooling water requirements by electric generating facilities from their privately owned sources or intakes.
Quebec	- Environmental Quebec (EQ)	None.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	Electrical power generated from fossil-fuel (coal, oil, or natural gas), geothermal, or nuclear energy.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	HYDROELECTRIC POWER GENERATION	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	None.
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	None.
Michigan	- Michigan Department of Natural Resources (MDNR)	The use of water to drive turbines and generate electric power.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	The use of water to drive turbines and generate electric power.
New York	- New York State Department of Environmental Conservation (NYSDEC)	The use of water to drive turbines and generate electric power.
Ohio	- Ohio Department of Natural Resources (ODNR), Division of Water	None
Ontario	- Ministry of the Environment (OMOE)	See "Industrial".
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	None.
Quebec	- Environmental Quebec (EQ)	None.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	The use of water to drive turbines and generate electric power.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	INDUSTRIAL	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	Industries and commercial establishments that use their own water source facilities are classified as "self-supplied industry."
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	None.
Michigan	- Michigan Department of Natural Resources (MDNR)	Water withdrawn for industrial, manufacturing, or processing facilities.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	That part of industrial use from sources other than public supplies.
New York	- New York State Department of Environmental Conservation (NYSDEC)	Water used for industrial uses such as steel, chemical and allied products, paper and allied products, mining, and petroleum refining.
Ohio	- Ohio Department of Natural Resources (ODNR), Division of Water	That part of industrial use from sources other than public supplies.
Ontario	- Ministry of the Environment (OMOE)	Thermo and hydroelectric power generation, cheese factories, milk or food-processing plants, factories, industrial cooling, air conditioning, steam boilers, hydrostatic testing of pipelines, mining and ore-milling operations, gravel and crushed-stone washing, dewatering of gravel pits, mines, quarries, construction excavations, road cuts, sewer and water-main excavations.
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	Water withdrawn by manufacturing industries from their privately owned sources or intakes.
Quebec	- Environmental Quebec (EQ)	Manufacturing operations.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	Water used by industries, such as paper mills, canneries, and manufacturing plants. Private system - A water system belonging to a particular person or group of persons.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	AGRICULTURAL	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	None.
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	Water used by livestock. Livestock as used here includes cattle, sheep, goats, hogs, and poultry. Also included are animal specialities such as horses, rabbits, bees, pets, fur-bearing animals in captivity, and fish in captivity. Water used for stock watering, feed lots, dairy operations, and other farm needs.
Michigan	- Michigan Department of Natural Resources (MDNR)	None.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	Water used by livestock. Livestock as used here includes cattle, sheep, goats, hogs, and poultry. Also included are animal specialities such as horses, rabbits, bees, pets, fur-bearing animals in captivity, and fish in captivity. Water used for stock watering, feed lots, dairy operations, and other farm needs.
New York	- New York State Department of Environmental Conservation (NYSDEC)	Water used by livestock. Livestock as used here includes cattle, sheep, goats, hogs, and poultry. Also included are animal specialities such as horses, rabbits, bees, pets, fur-bearing animals in captivity, and fish in captivity. Water used for stock watering, feed lots, dairy operations, and other farm needs.
Ohio	- Ohio Department of Natural Resources (ODNR), Division of Water	See "Domestic self-supplied".
Ontario	- Ministry of the Environment (OMOE)	Taking of water for livestock or poultry.
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	Water withdrawn by agricultural enterprises from privately owned sources or intakes and used for livestock operations (does not include domestic uses on farms).
Quebec	- Environmental Quebec (EQ)	None.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	Stock use - Water consumed by domestic farm animals.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	COMMERCIAL	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	See "Industrial".
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	None.
Michigan	- Michigan Department of Natural Resources (MDNR)	None.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	Self-supplied water used by non-manufacturing business such as wholesale or retail trade, office buildings, or motels, or by institutions such as schools or hospitals, for cooling and heating and for domestic (sanitary) purposes.
New York	- New York State Department of Environmental Conservation (NYSDEC)	Water used by motels, hotels, restaurants, office buildings, commercial facilities, and institutions, both civilian and military.
Ohio	- Ohio Department of Natural Resources (ODNR), Division of Water	Withdrawal by gas stations, restaurants, and retailers that are self-supplied.
Ontario	- Ministry of the Environment (OMOE)	Service stations, motels, snow making, car washes, arenas, shopping plazas, laundromats, restaurants, cold-storage sheds, and fish hatcheries.
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	Self-supplied institutional - Water withdrawn from privately owned sources or intakes for use by institutions including schools, hospitals, correctional institutions, and golf courses.
Quebec	- Environmental Quebec (EQ)	Establishments selling a product or services.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	Water used for commercial purposes, such as use by motels, retail outlets, restaurants, and resorts.

Table 4.--Water-use-category definitions recognized by States and Provinces in the Great Lakes - St. Lawrence River basin (continued).

	MINING	
	State Agency or Province-ministry	Definition
Illinois	- Illinois Department of Energy and Natural Resources (ISWS), State Water Survey Division	None.
Indiana	- Indiana Department of Natural Resources (IDNR), Division of Water	None.
Michigan	- Michigan Department of Natural Resources (MDNR)	None.
Minnesota	- Minnesota Department of Natural Resources (MNDNR)	Water withdrawn by mineral industries from their privately-owned sources or intakes.
New York	- New York State Department of Environmental Conservation (NYSDEC)	Water used in the extraction of minerals occurring naturally such as coal and ores, crude petroleum, and gases, such as natural gas. Also includes quarrying, well operation, milling (crushing, screening, washing, flotation, etc.) and other preparations customarily done at the mine site, or as part of a mining activity. Does not include the processing of raw materials, such as smelting ores, refining petroleum, and slurry pipeline operations.
Ohio (ODNR)	- Ohio Department of Natural Resources (ODNR), Division of Water	Nonmanufacturing industrial includes sand and gravel quarrying, coal mining, coal cleaning, mining and mineral-related activities, and railroad activities.
Ontario	- Ministry of the Environment (OMOE)	See "Industrial".
Pennsylvania	- Pennsylvania Department of Environmental Resources (PaDER)	See "ndustrial".
Quebec	- Environmental Quebec (EQ)	None.
Wisconsin	- Wisconsin Department of Natural Resources (WDNR)	None.

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC).

[SIC data from U.S. Office of Management and Budget, 1972.]

PUBLIC WATER SUPPLY

Water withdrawn for all uses by public and private suppliers and delivered to users that do not supply their own water. Water suppliers provide for a variety of uses such as domestic, commercial, industrial, and water use.

4941. Water Supply.--Establishments primarily engaged in distributing water for sale to domestic, commercial, and industrial use.

Users in the following categories are self supplied; that is, they are not provided water by a public supplier.

DOMESTIC, SELF SUPPLIED

Water used for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Also called residential water use.

8811. Domestic.--Private households, residences, apartments, farms, residential (noncommercial), subdivisions, condominiums, residential trailer parks.

IRRIGATION

Artificial application of water on lands to assist in the growing of crops and pastures or maintaining recreational lands such as parks and golf courses.

0111-0191. Agricultural Production--Crops.--Establishments (farms, orchards, greenhouses, nurseries) primarily engaged in the production of crops, plants, vines, trees (excluding forestry operations). Also includes sod farms, mushroom cellars, cranberry bogs, and the production of bulbs, flower seeds, and vegetable seeds.

0111-0119. Establishments primarily engaged in the production of cash grains.

0131-0139. Establishments primarily engaged in the production of field crops (except cash grains).

0161. Establishments primarily engaged in the production of vegetables and melons.

0171-0175. Establishments primarily engaged in the production of fruits and tree nuts.

0171-0172. Berry farms.

0173. Tree nuts.

0174. Citrus fruits.

0175. Deciduous tree fruits.

0181-0189. Horticultural specialities.--Establishments primarily engaged in the production of ornamental plants and nursery products, such as bulbs, florists' greens, flowers, shrubbery, flower and vegetable seeds and plants, and sod. These products can be grown under cover, or outdoors.

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

IRRIGATION (continued)

0191. General farms, primarily crops.--Establishments deriving 50 percent or more of their total value of sales of agricultural products from crops, but less than 50 percent from products of any single 3-digit industry group.

4971. Irrigation systems.--Establishments primarily engaged in operating water supply systems for the purpose of irrigation.

7992. Public golf courses.--The operation of golf courses open to the general public on a fee basis. Membership golf and country clubs are classified in 7997. Miniature golf courses and golf driving ranges in 7999.

INDUSTRIAL, SELF SUPPLIED

Water used in the manufacture of metals, chemicals, paper, and allied products.

1521-3999. Industrial.

1521-1542. Building construction, general contractors.--Houses, apartments, condomimiums, motels, hotels, commercial buildings, farm buildings, churches, hospitals.

1611. Construction other than building construction.--Streets and highways, except elevated highways.

1622. Heavy construction.--Bridges, viaducts, elevated highways, tunnels.

1623. Heavy construction.--Construction of pipelines, communciation and power lines, sewer and water mains.

1629. Heavy construction, not elsewhere classified.--Blasting, breakwater construction, caesson drilling, channel construction, dike construction, chemical complex construction, dam construction, water power project construction, and wharf construction.

1711-1789. Construction, special trades.--Specialized activities, such as plumbing, painting, plastering, carpentering, electrical work, masonary, water-well drilling.

2011-2099. Manufacturing, food and beverage processing.--Meat, poultry, dairy products, canned and preserved fruits and vegetables, grain mill products, bakery products, sugar and confectionary products, fats and oils, nonalcoholic beverages, alcoholic beverages.

2111-2141. Tobacco manufacturers.

2211-2299. Textile mill products.

2311-2399. Apparel-products from fabrics.

2411-2499. Lumber and wood products, except furniture.--Timber cutting and pulpwood operations, sawmills, planning mills, millwork, veneer and structural wood members.

2511-2599. Furniture and fixtures.--The manufacture of funiture (household, office, and restaurant), partitions, shelving, and beds.

2611-2661. Paper and allied products.--The manufacture of pulps, paper and paperboard, coated paper and tape, sanitary products, boxes, tubes, and drums.

2711-2795. Printing, publishing, and allied industries.--Letterpress, lithography, gravure, screen processing, bookbinding, typesetting, engraving, photoengraving, and electrotyping.

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

INDUSTRIAL, SELF SUPPLIED (continued)

2812-2899. Chemical and allied products.--The production of basic chemicals, and the manufacture of products by predominantly chemical processes. Establishments manufacture three general classes of products: 1. Basic chemicals (acids, alkalies, salts, organic chemicals); 2. Chemical products to be used in further manufacture (synthetic fibers, plastics, dry colors, pigments); 3. finished chemical products to be used for ultimate consumption (drugs, cosmetics, soaps) or used as supplies in other industries (paints, fertilizers, explosives).

2911-2999. Petroleum refining and related products.--Including the manufacture of paving mixtures and blocks, asphalt felts and coatings, lubricating oils and greases.

3011-3079. Rubber and miscellaneous plastics products.--Manufacturing from natural, synthetic or reclaimed rubber, gutta percha, balata, or gutta siak. Products include tires, footwear, flooring and rubber sundries and toys, molded plastics building and packing materials, sundries and toys.

3111-3199. Leather and leather products.--Establishments engaged in tanning, currying and finishing hides and skins, manufacturing finished leather and artificial leather products.

3211-3275. Stone, clay, glass, and concrete products.--Establishments engaged in the manufacture of products made from materials taken from the earth in the form of stone, clay, and sand.

3281. Cut stone and stone products.--Establishmennts engaged in cutting, shaping, and finishing stone for building and miscellaneous uses.

3291-3299. Abrasive, asbestos, and miscellaneous nonmetallic products.--Establishments manufacturing abrasive, asbestos, and mineral products.

3312-3399. Primary metals industries.--Establishments engaged in smelting, and refining of ferrous and nonferrous metals from ore, pig, or scrap; rolling, drawing, and alloying; the manufacture of castings and other basic products of ferrous and nonferrous metals, including the production of coke. Operations include blast furnaces, steel works, rolling and finishing mills, foundries, smelting, and extruding.

3411-3499. Fabricated metal products, except machinery and transportation equipment.--Products include cans, tinware, hand tools, cutlery, general hardware, nonelectric heating apparatus, fabricated structural metals, forguigs, stampings, ordnance (except vehicles and guided missiles), enameled iron and metal, transmission and television towers, boiler works products, sheet metal, metal buildings components, electroplating, plating, polishing and engraving operations.

3511-3599. Machinery, except electrical.--Establishments engaged in the manufacture of engines, turbines, farm and garden machinery, heavy construction machinery and equipment, elevators, escalators, conveyors, hoists, cranes; industrial trucks, tractors, trailers, and stackers; heavy machine tools, tool and die works, rolling and milling machinery, food products machinery, textile, woodworking, printing, and paper industry machinery, special industry machinery, pumps, roller bearings, compressors, fans, speed changers and transmissions, furnaces, typewriters, electronic computing equipment, calculating equipment, scales and balances, office machines, refrigeration and service industry machinery, commercial laundry, dry cleaning, and pressing machines, and service industry machinery.

3612-2699. Electrical and electronic machinery, equipment and supplies.--Establishments engaged in manufacturing machinery, apparatus and supplies for the generation, storage, transmission, transformation, and utilization of electrical energy. Includes manufacture of household appliances, but excludes industrial machinery and equipment powered by built-in or detachable electric motors. Establishments manufacture power, electric transmission and distribution equipment, household appliances, electric lighting and wiring equipment, radio and television receiving equipment, communication equipment, and electronic components and accessories.

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

INDUSTRIAL, SELF SUPPLIED (continued)

3711-3799. Transportation equipment.--Establishments engaged in the manufacturing of equipment for transportation of passengers and cargo by land, sea, and air. Important products produced include motor vehicles, aircraft, ships, boats, railroad equipment, guided missiles, and space vehicles.

3811-3873. Measuring, analyzing, and controlling instruments.--Photographic, medical, and optical goods; watches and clocks. The manufacture of instruments for measuring, testing, analyzing, and controlling, and their associated sensors and accessories. Engineering, laboratory, scientific, and research instruments, surgical, medical, and dental instruments and supplies, and ophthalmic goods.

3911-3999. Miscellaneous manufacturing industries.--Establishments primarily engaged in manufacturing jewelry, silverware, and plated ware, musical instruments, toys, sporting goods, pens, pencils, and other office and artists' goods, buttons, costume novelties, miscellaneous notions, brooms and brushes, caskets, and other miscellaneous manufacturing industries.

COMMERCIAL, SELF SUPPLIED

Water used by motels, hotels, restaurants, office buildings, and institutions, both civilian and military.

4011-4041. Railroad transportation.--Line-haul operations, including switching and terminal establishments.

4111-4172. Local and suburban transit and interurban highway passenger transportation.--Establishments providing passenger transportation within a single municipality, contiguous municipalities, r a municipality and its suburban areas by rail, bus, subway, or taxi. Includes charter services and school bus transportation.

4212-4231. Motor freight transportation and warehousing.--Includes terminal maintenance facilities.

4311. U.S. Postal Service.--This industry includes only the U.S. Postal Service.

4511-4583. Transportation by air.--Establishments engaged in furnishing domestic and foreign transportation by air, operating airports, and furnishing terminal services.

4612-4619. Pipelines, except natural gas.--Pipeline transportation of crude petroleum and other commoditiess, except natural gas.

4712-4789. Transportation services.--Establishments furnishing services incidental to transportation, such as forwarding and packing services, scheduling freight and passenger transportation, railroad car rental, inspection and weighting services, and fixed facilities to operate toll roads and toll bridges.

4811-4899. Communications.--Establishments that furnish point-to-point communication services, whether by wire or radio, and radio and television broadcasting (telephone, radio, television, cablevision, missile tracking, etc.).

4922-4939. Gas production and distributions.--Combination electric and gas services.

5012-5099. Wholesale trade-durable goods.--The wholesale distribution or marketing of durable goods. Icludes establishments primarily engaged the distribution of motor vehicles, parts, and supplies; tires and tubes; furniture and home furnishings; lumber, plywood, and millwork; construction materials (brick, stone, cement, gravel, lime, plaster, sand, glass, tile, roofing material, etc.); sporting and recreational goods and supplies; toys and hobbies; photographic equipment and supplies; metals and minerals, except petroleum (aluminum,

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

COMMERCIAL, SELF SUPPLIED (continued)

iron, steel, copper, mercury, tin, lead, zinc, forms, forgings, ingots, plates, sheets, rods, etc.); coal, coke; electrical goods, apparatus, equipment, wiring supplies, and appliances; electronic parts and equipment; hardware, plumbing and heating equipment and supplies; warm air and air conditioning equipment and supplies; commercial machines and equipment; construction and mining machinery and equipment; industrial, professional, transportation, and service establishment equipment and supplies.

5111-5199. Wholesale trade-nondurable goods.--The wholesale distribution or marketing of nondurable goods. Includes establishments primarily engaged in paper and paper products, drugs and druggists sundries, apparel and other dry goods, clothing and accessories, footwear, groceries, dairy products, poultry, fish and seafood, meats, fruits and vegetables, farm-product raw materials (cotton, grain, livestock, furs, hides, sugar, wool, vegetable oils, etc.); chemicals and allied products, petroleum and petroleum products sold through bulk stations, beer, wine, and liquor, farm supplies, tobacco products, paints and varnishes.

5211-5271. Building materials, hardware, garden supply, and mobile home dealers.--Retail establishments engaged primarily in selling lumber, building supplies, paint, glass, wallpaper, hardware, nursery stock, garden supplies, and mobile homes.

5311-5399. General merchandise stores.--Retail stores which sell a variety of lines of merchandise through department stores, variety stores, and general merchandise stores.

5411-5499. Food stores.--Retail stores selling food for home consumption. Includes grocery stores, supermarkets, delicatessen stores, seafood markets, freezer and locker meat provisioners, fruit stores, vegetable markets, candy, nut, and confectionary stores, dairy products stores, and retail bakeries.

5511-5599. Automotive dealers and gasoline service stations.--Retail dealers selling new and used automobiles, boats, recreational and utility trailers, and motorcycles; those selling new automobile parts and accessories; and gasoline service stations.

5611-5699. Apparel and accessory stores.--Retail stores selling new clothing, shoes, hats, underwear, and related articles for personal wear and adornment. Includes furriers and custom tailors carrying bulk stock.

5712-5733. Furniture, home furnishings and equipment.--Retail stores selling goods for furnishing the home, including floor coverings, draperies, glass and chinaware, stoves, refrigerators, and appliances.

5812-5813. Eating and drinking places.--Retail establishments selling prepared foods and drinks (alcohloic and nonalcoholic) for consumption on premises.

5912-5999. Miscellaneous retail.--Retail establishments not elsewhere classified. They include drug stores, liquor stores, used merchandise stores, florists, cigar stores, bicycle shops, sporting goods stores, book and stationery stores, jewelry stores, hobby, toy, and game shops, camera and photographic supply stores, luggage and leather goods stores, gift, novelty and souvenir shops, mail-order houses, and sewing, needlework and piece goods stores.

6011-6059. Banking.--Institutions engaged in deposit banking or closely related functions, including fiduciary activities. These include federal reserve banks, commercial and stock banks, state banks, national banks, private banks, mutual savings banks and trust companies.

6112-6163. Credit agenices other than banks.--Establishments engaged in extending credit in the form of loans but not engaged in deposit banking. These include rediscount and financing institutions (GNMA, FNMA, FHA), savings and loan associations, federal savings and loan associations, state savings and loan associations, agricultural credit institutions, federal credit unions, state credit unions, business credit institutions, and mortgage bankers and brokers.

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

COMMERCIAL, SELF SUPPLIED (continued)

6212-6281. Security and commodity brokers, dealers, exchanges, and services.--Establishments engaged in the underwriting, purchase, sale, or brokerage of securities and other financial contracts.

6311-6411. Insurance.--Establishments acting as insurance carriers of all types, including agents and brokers dealing in insurance and organizations rendering services to insurance carriers or policy holders.

6512-6612. Real estate.--Includes real estate operators, and owners and leasors of real property, as well as buyers, sellers, developers, agents, and brokers.

6711-6799. Holding and other investment offices.--This group includes investment trusts, investment companies, holding companies, and commodity trading companies.

7011. Hotels, motels, and tourist courts.--Includes commercial and institutional establishments engaged in furnishig lodging, or lodging and meals, and camping facilities, on a fee basis.

7021. Rooming and boarding houses.--Establishments renting rooms, with or without board, on a fee basis to permanent or transient guests.

7032-7033. Camps and trailering parks.--Commercially operated sporting and recreational camps, such as boys' and girls' camps, fishing and hunting camps, and overnight or short-term sites for trailers, campers, or tents.

7041. Organization hotels and lodging houses, on membership basis.--Lodging houses and hotels operated by membership organizations for the benefit of their constituents, and not open to the general public.

7211-7219. Personal services.--Establishments primarily engaged in providing services generally involving the care of the person or his apparel. Includes laundries (family or commercial), garment pressing, dry cleaning, linen supply, diaper service, carpet and upholstery cleaning, industrial laundries, photographic studios, beauty shops, barber shops, shoe repair and hat cleaning shops, and funeral service establishments.

7311-7399. Business services.--Establishments engaged in rendering services to business establishments on a fee or contract basis.

7311-7319. Advertising.--Establishments engaged in preparing advertising (writing copy, art work, graphics) and placing such in periodicals, newspapers, radio, and television or other media, for clients on a commission or fee basis.

7321. Consumer credit and collecting.--Mercantile and consumer credit reporting or the collection or adjustment of claims via credit bureaus and clearinghouses and collection agencies.

7331-7339. Mailing, reproduction, commercial art and photography and stenographic services.--Establishments engaged in rendering the following services: direct mail advertizing, blueprinting and photocopying, commercial photography (art and graphics), and stenographic services.

7341-7349. Services to dwellings and other buildings.--Establishments engaged in window cleaning, disinfectiong and exterminating, and cleaning and maintenance.

7351. News syndicates.--Establishments engaged in furnishing news, pictures, features, etc., and in supplying news reporting services to the media. Includes both nonprofit (membership) and commercial (nonmembership) news syndicates.

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

COMMERCIAL, SELF SUPPLIED (continued)

7361-7369. Personnel supply services.--Establishments engaged in providing employment service for employers and those seeking employment, except theatrical and motion picture casting bureaus.

7372-7379. Computer and data processing services.--Establishments engaged in providing services in computer programming, systems design, data processing, and rental, leasing, repair, and maintenance of computer equipment.

7391-7399. Miscellaneous business services.--Establishments engaged in providing services on a contract or fee basis. Includes research and development laboratories, management, consulting, and public relations firms, detective agencies and protective services, equipment rental and leasing, photofinishing laboratories, trading stamp services, and commercial testing laboratories.

7512-7549. Automotive repair, services, garages.--Establishments engaged in furnishing automotive repair, rental, leasing and parking services to the general public. Includes tire retreading and repair shops, paint shops, body and upholstery shops, muffler, glass, and brake shops, and car washes.

7622-7699. Miscellaneous repair services.--Establishments primarily engaged in miscellaneous repair services, except automotive, clothing, and shoe repair services. Includes establishments that repair radio, television, sterophonic equipment, refrigeration and air conditioning equipment, electrical and electronic components, watches, clocks, jewelry, furniture, leather goods, bicycles, guns, musical instruments, scientific instruments, harness equipment, etc.

7813-7833. Motion pictures.--Establishments producing and distributing motion pictures (television and other media), exhibiting motion pictures in commercially operated theaters, and furnishing services to the motion picture industry.

7911-7999. Amusement and recreation service, except motion pictures.--Establishments include dance halls, studios, and schools, bands and orchestras, entertainers and actors, bowling alleys and pool halls, arenas and athletic fields, race tracks, public golf courses, coin-operated amusement devices, amusement parks, membership sports and recreation clubs, etc.

8011-8049. Health services (offices).--Establishments or practitioners furnishing medical, surgical, and other health services to people. Includes physicians, dentists, chiropractors and optometrists.

8051-8059. Nursing and personal care facilities.--Establishments providing nursing and health related personal care with inpatient beds. Includes extended care facilities, nursing homes, convalescent homes, and rest homes.

8062-8069. Hospitals.--General medical and surgical hospitals, psychiatric hospitals, and specialty hospitals (childrens, geriatric, tuberculosis, maternity, etc.).

8071-8072. Medical and dental laboratories.--Establishments providing professional analytical or diagnostic services to the medical profession.

8081. Outpatient care facilities.--Establishments engaged in outpatient care with permanent facilities and medical staff to provide diagnosis and treatment. Includes clinics, dispensaries, group health associations, health maintenance organizations and rehabilitation centers.

8091. Health and allied services, not elsewhere classified.--Includes blood banks and blood donor stations, oxygen tent service, and visiting nurse associations.

8111. Legal services.--Attorneys, law offices, legal aid services, patent solicitors' offices and referees in bankruptcy.

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

COMMERCIAL, SELF SUPPLIED (continued)

8211-8299. Educational services.--Establishments furnishing academic or technical courses. Includes elementary and secondary schools, preparatory and vocational schools, colleges, universities, junior colleges, technical institutes, correspondence schools, business schools, and libraries.

8321-8399. Social services.--Establishments providing social services and rehabilitation services to persons with personal or social problems, and to the handicapped and disadvantaged. Includes individual and family social services, job training and vocational rehabitational services, child day care, residential care, etc.

8411-8421. Museums, art galleries, botanical and zoological gardens, which are not operated commercially.--Funding of these establishments is not primarily from admission charges. They are of historical, educational, or cultural interest.

8611-8699. Membership organizations.--Organizations operating for the promotion of interests of the members. Included are trade and professional organizations, labor organizations, political and religious organizations, and business, civic, social, and fraternal associations.

8911-8999. Miscellaneous services.--Establishments engaged in performing services not elsewhere classified. Includes services rendered by engineers, architects, accountants, artists, lecturers, and writers.

9111-9311. Executive, legislative, general government, public order and safety, and finance.--Offices of city, town, county, state, and federal government.

9411-9451. Administration of human resources programs.--Government administration of educational and public health programs, social manpower, and income maintenance programs, and veterans affairs (except health and insurance).

9531-9721. Administration of housing programs, urban planning, economic programs, national security, and international affairs.--Government establishments engaged in administering these broad programs.

MINING, SELF SUPPLIED

Water used in the extraction of minerals occurring naturally: solids, such as coal and ores; liqids, such as crude petroleum, and natural gas. Also includes quarrying and milling.

1011-1099. Metal mining.--Establishments primarily engaged in mining, developing mines, or exploring for metallic minerals (ores). Includes all ore dressing and beneficiating operations, whether performed at mills operated in conjunction with the mines served, or at custom mills operated separately. These include mills which crush, grind, wash, dry, sinter, or leach ore, or perform gravity separation or floatation operations.

1111-1112. Anthracite mining.--Hard coal mining, including dredging operations, and preparation plants (cleaner, breaker, and washery plants), underground mining, and strip mining.

1211-1213. Bituminous coal and liquite mining.--Mining operations and preparation plants. The industry includes underground mining, auger mining, strip mining, culm bank mining, and coal cleaning, crushing, screening, and sizing plants, whether or not operated in conjunction with the mines served.

1311-1389. Oil and gas extraction.--Establishments primarily engaged in: 1. producing crude petroleum and natural gas; 2. recovering oil from oil shale and oil sand; and 3. producing natural gasoline and cycle condensate. Types of activities included are exploration,

Table 5.--Definitions of categories used in Great Lakes Regional Water-Use Data Base and of activities within each as described by Standard Industrial Classification Code (SIC)--continued.

MINING, SELF SUPPLIED (continued)

drilling, oil and gas well operation and maintenance, the operation of natural gasoline and cycle plants, and the mining and extraction of oil from oil shale and oil sand.

1411-1499. Mining and quarrying of nonmetallic minerals, except fuels.--Includes exploration and primary preparation plants (crushing, grinding, washing).

AGRICULTURAL, NONIRRIGATION WATER USES--Agricultural (livestock)

Water used by cattle, sheep, goats, hogs, and poultry.

0211-0279. Farms, ranches, dairies, feedlots, egg production facilities, broiler facilities, poultry hatcheries, and apiaries primarily engaged in the keeping, grazing, or feeding of livestock for sale or for livestock products, for livestock increase, or value increase. Also included are animal specialties (horses, rabbits, bees, pets, fish in captivity, and fur-bearing animals in captivity).

0291. General farms, primarily livestock.--Establishments deriving 50 percent or more of their total value of sales from livestock and livestock products.

0711-0729. Agricultural services.--Establishments primarily engaged in performing associated services such as soil preparation, crop planting, crop cultivating and protection, farm labor and management, landscape, horticultural, and miscellaneous services on a fee or contractural basis.

0741-0742. Veterinary services.--Establishments of licensed practioners engaged in the practice of veterinary medicine, dentistry, or surgery for farm animals and animal specialities.

0761-0762. Farm labor and management services.--Establishments that provide labor for agricultural production or harvesting, or management or complete maintenance of citrus groves, orchards, or vineyards.

0781-0783. Landscape and horticultural services.--Establishments performing landscape planning, architectural, and counceling services, lawn and garden services, and ornamental shrub and tree services.

0811-0851. Forestry.--Establishments primarily engaged in the generation of timber tracts, tree farms, forest nurseries, and related activities such as reforestation services, and the gathering forest products (gums, barks, balsam needles, maple sap, spanish moss, etc.).

ELECTRIC POWER GENERATION

Thermoelectric power:

Fossil fuel--Water used for electrical power generation by plants using coal, oil, or natural gas.

Nuclear--Water used by generating plants fueled by nuclear energy.

Hydroelectric power--The use of water to drive turbines to generate electric power.

Instream use--Once-through plants.

Offstream use--Pumped-storage (recycled) systems.

4911. Electric services.--Establishments engaged in the generation, transmission and/or distribution of electric energy for sale.

TABLE 6

AVAILABILITY OF INFORMATION REQUIRED BY THE INITIAL

GREAT LAKES REGIONAL WATER-USE DATA BASE, BY STATE AND PROVINCE

1. Amount withdrawn and responsible agency
2. Amount of withdrawal diverted
3. Amount of withdrawal consumed
4. Number of facilities withdrawing ≥100,000 gal/d
5. Withdrawals by facilities ≥ 100,000 gal/d
6. Amount diverted into [basin]

Explanation

"Yes" indicates that data are available for transmittal to data base

"Yes" for "Number of facilities ≥ 100,000 gal/d" and "Withdrawals by facilities ≥ 100,000 gal/d" in left column indicates a trigger level less than or equal to 100,000 gal/d and at least annual reporting

"No" indicates that data are not being collected, estimated, or determined.

A, B, C, D, or E following "No" indicates the reason for unavailability of data:

A = not all data collected or estimated annually
B = data not stored or readily available by drainage subbasin
C = data not identified as surface water or ground water
D = Name of surface-water source not given
E = Data not stored as divisions smaller than county, basinwide, municipality, or watershed aggregates.

n.a. = not applicable.

"Est" = estimated.

It is assumed if data are not site-specific as to origin, "amount diverted" and "amount consumed" will be unknown, unless the juristiction has other legislation or programs to provide this information independent of the withdrawal-data collection program.

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base.

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
ILLINOIS[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	IDOT Data yes	n.a.	n.a.	ISWS Data yes	n.a.	IDOT Data yes	n.a.	n.a.	n.a.
Amount diverted	Yes	n.a.	n.a.	Yes (IDOT)	n.a.	Yes	n.a.	n.a.	n.a.
Amount consumed	Yes	n.a.	n.a.	Yes (IDOT)	n.a.	Yes	n.a.	n.a.	n.a.
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	n.a.	No	n.a.	Yes	n.a.	n.a.	n.a.
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	n.a.	No	n.a.	Yes	n.a.	n.a.	n.a.
Amount diverted into	Yes	n.a.	n.a.	n.a.	n.a.	Yes	n.a.	n.a.	n.a.
B. Other Surface Water -- Tributaries									
Amount withdrawn	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Amount diverted	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Amount consumed	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Number of facilities > 100,000 gal/d	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Withdrawals by facilities ≥ 100,000 gal/d	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Amount diverted into	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

C. Ground Water -- Wells or Springs Tapping an Aquifer

	ISWS Data	ISWS Est	ISWS Est	ISWS Data		ISWS Data	ISWS Est		
Amount withdrawn	yes	yes	yes	yes	n.a.	yes	yes	n.a.	n.a.
Amount diverted	No-E	n.a.	No-E	No-E	n.a.	No-E	No-E	n.a.	n.a.
Amount consumed	No-E	No-E	No-E	No-E	n.a.	No-E	No-E	n.a.	n.a.
Number of facilities ≥ 100,000 gal/d	No	n.a.	No	No	n.a.	No	No	n.a.	n.a.
Withdrawals by facilities ≥ 100,000 gal/d	No	n.a.	No	No	n.a.	No	No	n.a.	n.a.
Amount diverted into	No	n.a.	No	No	n.a.	No	No	n.a.	n.a.

[1] ISWS = Illinois State Water Survey
IDOT = Illinois Department of Transportation

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
INDIANA[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	ISBH IDNR Data yes	IDNR Data-yes Est-No-D	IDNR Data yes	IDNR Data yes	IDNR Est yes	IDNR Data yes	IDNR Data-yes Est-No-D	IDNR Data yes	IDNR Data yes
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	Data-yes Est-No	Yes	Yes
Amount consumed	Yes	No	Yes	No	n.a.	Yes	No	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	No	Yes	Yes	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	No	Yes	Yes	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	Yes	Yes	No	Yes	Yes
B. Other Surface Water -- Tributaries									
Amount withdrawn	ISBH IDNR Data yes	IDNR Data-yes Est-No-D	IDNR Data yes	IDNR Data yes	IDNR Est yes	IDNR Data yes	IDNR Data-yes Est-No-D	IDNR Data yes	IDNR Data yes
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	Data-yes Est-No	Yes	Yes

Amount consumed	Yes	No	Yes	No	n.a.	Yes	No	Yes	Yes
Number of facilities ≥ 100,000 gal/d	n.a.	n.a.	Yes	Yes	No	Yes	Yes	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	No	Yes	Yes	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes

C. Ground Water -- Wells or Springs Tapping an Aquifer

	ISBH IDNR	IDNR	IDNR	IDNR		IDNR	IDNR	IDNR	IDNR
Amount withdrawn	Data yes	Data-yes Est-yes	Data yes	Data yes	n.a.	Data yes	Data-yes Est-yes	Data yes	Data yes
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	Data-yes Est-No	Yes	Yes
Amount consumed	Yes	No	Yes	No	n.a.	Yes	No	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	n.a.	No	No	No	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes

[1] IDNR = Indiana Department of Natural Resources
ISBH = Indiana State Board of Health

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
MICHIGAN[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	MDPH Data yes	MDNR USGS Est No-A,D	MDNR Data-No Est-No-A	MDNR Data-No Est-No-A	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D
Amount diverted	Yes	n.a.	No-E	No-E	n.a.	No-E	No-E	No-E	No-E
Amount consumed	No	No-E	No-E	No-E	n.a.	No-E	No-E	No-E	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	No	No
B. Other Surface Water -- Tributaries									
Amount withdrawn	MDPH Data yes	MDNR USGS Est No-A,D	MDNR Data-No Est-No-A	MDNR Data-No Est-No-A	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D	MDNR USGS Est No-A,D
Amount diverted	Yes	n.a.	No-E	No-E	n.a.	No-E	No-E	No-E	No-E

Amount consumed	No	No-E	No-E	No-E	n.a.	No-E	No-E	No-E	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	No	No

C. Ground Water -- Wells or Springs Tapping an Aquifer

	MDPH Data	MDNR USGS Est	MDNR Data-No	MDNR Data-No		MDNR USGS Est	MDNR USGS Est	MDNR USGS Est	MDNR USGS Est
Amount withdrawn	yes	No-A	Est-No-A	Est-No-A	n.a.	No-A	No-A	No-A	No-A
Amount diverted	Yes	n.a.	No-E	No-E	n.a.	No-E	No-E	No-E	No-E
Amount consumed	No	No-E	No-E	No-E	n.a.	No-E	No-E	No-E	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	n.a.	No	No	No	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	n.a.	No	No	No	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	No	No

[1] MDNR = Michigan Department of Natural Resources
MDPH = Michigan Department of Public Health
USGS = U.S. Geological Survey

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
MINNESOTA[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	MNDNR Data-yes Est-yes	USGS Est No-D	MNDNR Data yes	MNDNR Data yes	USGS Est No-D	MNDNR Data-yes Est-yes	USGS Est No-D	MNDNR Data-yes Est-yes	MNDNR Data yes
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	No-E	Yes	Yes
Amount consumed	No	No-E	No	No	n.a.	No	No-E	No	No
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	No	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	No	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes
B. Other Surface Water -- Tributaries									
Amount withdrawn	MNDNR Data-yes Est-yes	USGS Est No-D	MNDNR Data yes	MNDNR Data yes	USGS Est No-D	MNDNR Data-yes Est-yes	USGS Est No-D	MNDNR Data-yes Est-yes	MNDNR Data yes
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	No-E	Yes	Yes

Amount consumed	No	No-E	No	No	n.a.	No	No-E	No	No
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	No	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	No	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes

C. Ground Water -- Wells or Springs Tapping an Aquifer

	MNDNR	USGS	MNDNR	MNDNR		MNDNR	USGS	MNDNR	MNDNR
Amount withdrawn	Data-yes Est-yes	Est yes	Data yes	Data yes	n.a.	Data-yes Est-yes	Est yes	Data-yes Est-yes	Data yes
Amount diverted	Yes	No-E	Yes	Yes	n.a.	Yes	No-E	Yes	Yes
Amount consumed	No	No-E	No	No	n.a.	No	No-E	No	No
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes

[1] MNDNR = Minnesota Department of Natural Resources
USGS = U.S. Geological Survey

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
NEW YORK[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	NYSDOH Data yes	USGS Est No-A,D	USGS Est No-A,D	NYSDEC USGS Est-No-A USGS	NYSDEC USGS Est-No-A USGS	NYSDEC USGS Est-No-A,D USGS	USGS Est No-A,D	USGS Est No-A,D	USGS Est No-A,D
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	No	No-E	No-E	No-E
Amount consumed	No	No-E	No-E	No	n.a.	No	No-E	No-E	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	No	No
B. Other Surface Water -- Tributaries									
Amount withdrawn	NYSDOH Data yes	USGS Est No-A,D	USGS Est No-A,D	NYSDEC USGS Est-No-A USGS	NYSDEC USGS Est-No-A USGS	NYSDEC USGS Est-No-A,D USGS	USGS Est No-A,D	USGS Est No-A,D	USGS Est No-A,D
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	No	No-E	No-E	No-E

Amount consumed	No	No-E	No-E	No	n.a.	No	No-E	No-E	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	No	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	No	No

C. Ground Water -- Wells or Springs Tapping an Aquifer

	NYSDOH Data	USGS Est	USGS Est	NYSDEC USGS Est-No-A		NYSDEC USGS Est-No-A	USGS Est	USGS Est	USGS Est
Amount withdrawn	yes	No-A	No-A	USGS	n.a.	USGS	No-A	No-A	No-A
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	No	No-E	No-E	No-E
Amount consumed	No	No-E	No-E	No	n.a.	No	No-E	No-E	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	n.a.	No	No	No	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	n.a.	No	No	No	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	No	No

[1] NYSDOH = New York State Department of Health
NYSDEC = New York State Department of Environmental Conservation
USGS = U.S. Geological Survey

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
OHIO[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	OEPA Data No-D	USGS ODNR Est-No-A,D	USGS ODNR Data No-A,B,D Est-No-A,D	USGS Data-No Est-No-A	USGS Est-No-A,D	USGS ODNR Data Est-No-A,D	USGS Est No-A,D	OEPA Data No-A,D	USGS Est No-A,D
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Amount consumed	No	No-E	No-E	No	n.a.	No-E	No-E	No	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	Yes	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	Yes	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	Yes	No
B. Other Surface Water -- Tributaries									
Amount withdrawn	OEPA Data No-D	USGS ODNR Est-No-A,D	USGS ODNR Data No-A,B,D Est-No-A,D	USGS Data-No Est-No-A	USGS Est-No-A,D	USGS ODNR Data Est-No-A,D	USGS Est No-A,D	OEPA Data No-A,D	USGS Est No-A,D
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes

Amount consumed	No	No-E	No-E	No	n.a.	No-E	No-E	No	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	Yes	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	No	No	No	Yes	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	Yes	No
			C. Ground Water -- Wells or Springs Tapping an Aquifer						
Amount withdrawn	OEPA Data yes	USGS ODNR Est-No-A	USGS ODNR Data No-A,B Est-No-A	USGS Data-No Est-No-A	n.a.	USGS ODNR Data Est-No-A	USGS Est No-A	OEPA Data yes	USGS Est No-A
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Amount consumed	No	No-E	No-E	No	n.a.	No-E	No-E	No	No-E
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	n.a.	No	No	Yes	No
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	No	n.a.	No	No	Yes	No
Amount diverted into	Yes	n.a.	No	No	n.a.	No	No	Yes	No

[1] OEPA = Ohio Environmental Protection Agency
ODNR = Ohio Department of Natural Resources
USGS = U.S. Geological Survey

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
ONTARIO[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	OMOE Data No-A,B	No	OMOE Data No-A,B	OMOE Data No-A,B	OMOE Data No-A,B	OMOE Data No-A,B	No	OMOE Data No-A,B	OMOE Data No-A,B
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes
Amount consumed	Yes	No	Yes	Yes	n.a.	Yes	No	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	Yes	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	Yes	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.		Yes	n.a.	Yes	No	Yes	Yes
B. Other Surface Water -- Tributaries									
Amount withdrawn	OMOE Data No-A,B	No	OMOE Data No-A,B	OMOE Data No-A,B	OMOE Data No-A,B	OMOE Data No-A,B	No	OMOE Data No-A,B	OMOE Data No-A,B
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes

Amount consumed	Yes	No	Yes	Yes	n.a.	Yes	No	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	Yes	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a	Yes	Yes	Yes	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes

C. Ground Water -- Wells or Springs Tapping an Aquifer

Amount withdrawn	OMOE Data No-A,B	No	OMOE Data No-A,B	OMOE Data No-A,B	n.a.	OMOE Data No-A,B	No	OMOE Data No-A,B	OMOE Data No-A,B
Amount diverted	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes
Amount consumed	Yes	No	Yes	Yes	n.a.	Yes	No	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	Yes	Yes	n.a.	Yes	No	Yes	Yes

[1] OMOE = Ontario Ministry of the Environment

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
PENNSYLVANIA[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	PaDER Data No-A	PaDER Est No-A,D	PaDER USGS Est No-A,D	PaDER Data yes	No	PaDER Data No-A	USGS Est No-A,D	USGS Est No-A,D	PaDER Data No-A
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	Yes	No-E	No-E	Yes
Amount consumed	Yes	No-E	No-E	Yes	n.a.	Yes	No-E	No-E	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	No	Yes	No	No	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	No	Yes	No	No	Yes
Amount diverted into	Yes	n.a.	No	Yes	n.a.	Yes	No	No	Yes
B. Other Surface Water -- Tributaries									
Amount withdrawn	PaDER Data No-A	PaDER Est No-A,D	PaDER USGS Est No-A,D	PaDER Data yes	No	PaDER Data No-A	USGS Est No-A,D	USGS Est No-A,D	PaDER Data No-A
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	Yes	No-E	No-E	Yes

Amount consumed	Yes	No-E	No-E	Yes	n.a.	Yes	No-E	No-E	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	No	Yes	No	No	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	No	Yes	No	No	Yes
Amount diverted into	Yes	n.a.	No	Yes	n.a.	Yes	No	No	Yes

C. GROUND WATER -- Wells or Springs Tapping an Aquifer

	PaDER Data	PaDER Est	PaDER USGS Est	PaDER Data		PaDER Data	USGS Est	USGS Est	PaDER Data
Amount withdrawn	No-A	No-A	No-A,D	yes	No	No-A	No-A,D	No-A,D	No-A
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	Yes	No-E	No-E	Yes
Amount consumed	Yes	No-E	No-E	Yes	n.a.	Yes	No-E	No-E	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	n.a.	Yes	No	No	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	n.a.	Yes	No	No	Yes
Amount diverted into	Yes	n.a.	No	Yes	n.a.	Yes	No	No	Yes

[1] PaDER = Pennsylvania Department of Environmental Resources
USGS = U.S. Geological Survey

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
				QUEBEC[1]					
				A. Surface Water -- The Great Lakes and the St. Lawrence River					
Amount withdrawn	EQ Data No-A	EQ Est No-A,D	EQ Est No-A,D	EQ Data No-A	EQ Data No-A	EQ Data No-A	EQ Est No-A,D	EQ Data NO-A	EQ Data No-A
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	Yes	No-E	Yes	Yes
Amount consumed	Yes	No-E	No-E	Yes	n.a.	Yes	No-E	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	Yes	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	Yes	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	No	Yes	n.a.	Yes	No	Yes	Yes
				B. Other Surface Water -- Tributaries					
Amount withdrawn	EQ Data No-A	EQ Est No-A,D	EQ Est No-A,D	EQ Data No-A	EQ Data No-A	EQ Data No-A	EQ Est No-A,D	EQ Data No-A	EQ Data No-A
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	Yes	No-E	Yes	Yes

Amount consumed	Yes	No-E	No-E	Yes	n.a.	Yes	No-E	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	Yes	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	Yes	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	No	Yes	n.a.	Yes	No	Yes	Yes
			C. Ground Water -- Wells or Springs Tapping an Aquifer						
Amount withdrawn	EQ Data No-A	EQ Est No-A	EQ Est No-A	EQ Data No-A	n.a.	EQ Data No-A	EQ Est No-A	EQ Data No-A	EQ Data No-A
Amount diverted	Yes	n.a.	No-E	Yes	n.a.	Yes	No-E	Yes	Yes
Amount consumed	Yes	No-E	No-E	Yes	n.a.	Yes	No-E	YesE	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	n.a.	Yes	No	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	No	Yes	n.a.	Yes	No	Yes	Yes
Amount diverted into	Yes	n.a.	No	Yes	n.a.	Yes	No	Yes	Yes

[1] EQ = Environment Quebec

Table 6.--Availability of information required by the initial Great Lakes Regional Water Use Data Base (continued)

	Category and compiling agency								
	Public-water supply	Domestic, self-supplied	Irrigation	Thermo-electric power	Hydro-electric power	Industrial, self-supplied	Agricultural (livestock)	Commercial self-supplied	Mining self-supplied
WISCONSIN[1]									
A. Surface Water -- The Great Lakes and the St. Lawrence River									
Amount withdrawn	WDNR Data Yes	WDNR Est Yes	WDNR Data Yes	WDNR Data Yes	n.a.	WDNR Data Yes	WDNR Est Yes	WDNR Data Yes	WDNR Est Yes
Amount diverted	Yes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Amount consumed	Yes	Yes	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Number of facilities $\geq$ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Withdrawals by facilities $\geq$ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Amount diverted into	Yes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
B. Other Surface Water -- Tributaries									
Amount withdrawn	WDNR Data Yes	WDNR Est Yes	WDNR Data Yes	WDNR Data Yes	WDNR Est Yes	WDNR Data Yes	WDNR Est Yes	WDNR Data Yes	WDNR Est Yes
Amount diverted	Yes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Amount consumed	Yes	Yes	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Number of facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Amount diverted into	Yes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
			C. Ground Water -- Wells or Springs Tapping an Aquifer						
	WDNR Data	WDNR Est-No-E	WDNR Data	WDNR Data		WDNR Data	WDNR Est-No-E	WDNR Data	WDNR Est-No-E
Amount withdrawn	Yes	Data-Yes	Yes	Yes	n.a.	Yes	Data-Yes	Yes	Data-Yes
Amount diverted	Yes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Amount consumed	Yes	Yes[2] No-E	Yes	Yes	n.a.	Yes	Yes[2] No-E	Yes	Yes[2] No-E
facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Withdrawals by facilities ≥ 100,000 gal/d	Yes	n.a.	Yes	Yes	n.a.	Yes	Yes	Yes	Yes
Amount diverted into	Yes	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

[1] WDNR = Wisconsin Department of Natural Resources
[2] For users ≥ 100,000 gal/d

Table 7A.--Estimated withdrawals for water uses within agricultural, domestic, commercial, industrial, and thermoelectric categories.

Type of water use	SIC code[1]	Withdrawal	Source of data[2]
AGRICULTURAL (Livestock)			
		gal/d per animal	
Horse, work	0272	12.0	1
Horse, drinking	0272	12.0	2
Mule	0272	12.0	1
Mule, drinking	0272	12.0	2
Goat	0214	2.0	1
Sheep, on range or dry pasture	0214	.6-1.6	1
Sheep, on range, salty feeds	0214	2.0	1
Sheep, on rations of hay and grain or hay, roots and grain	0214	.0-.07	1
Sheep, on good pasture	0214	.0	1
Sheep, drinking	0214	2.0	2
Sheep	0214	1.0-1.5	3
Sheep	0214	1.5	4
Sheep	0214	2.0	5
Sheep	0214	2.0	6
Sheep	0214	.7	7
Sheep	0214	2.0	8
Sheep	0214	2.0	9
Cattle, Holstein calves;			
4 weeks of age liquid	0212	1.2-1.4	1
8 weeks of age milk,	0212	1.6	1
12 weeks of age or dried	0212	2.2-2.4	1
16 weeks of age milk and	0212	3.0-3.4	1
20 weeks of age water	0212	3.8-4.3	1
26 weeks of age supplied	0212	4.0-5.8	1
Steers, maintenance ration	0212	4.2	1
Steers, fattening ration	0211	8.4	1
Range cattle	0212	4.2-8.4	1
Steer, drinking	0212	12.0	2
Cattle, drinking	0212	12.0	2
Beef cows	0212	14.0	4
Beef cows	0212	12.0	6
Beef cows	0212	6.9	7
Beef cows	0212	10.0	8
Beef cows	0212	12.0-15.0	9
Dairy heifers, pregnant	0241	7.2-8.4	1
Jersey cows, milk production 5-30 lb/d	0241	7.2-12.0	1

[1] SIC = Standard Industrial Classification, U.S. Office of Management and Budget, 1972.

[2] References are cited at end of this table, p. 187.

Table 7A.--Estimated withdrawals for water uses within agricultural, domestic, commercial, industrial, and thermoelectric categories--continued.

Type of water use	SIC code	Withdrawal	Source of data
AGRICULTURAL (Livestock)--continued			
		gal/d per animal	
Holstein cows, milk production			
20-50 lb/d	0241	7.8-22.0	1
80 lb/d	0241	23.0	1
dry	0241	11.0	1
Dairy, drinking and servicing	0241	35.0	2
Milk cows	0241	7.0-17.0	3
Milk cows	0241	14.0	4
Milk cows	0241	12.5	5
Milk cows	0241	35.0	6
Milk cows	0241	21.2	7
Milk cows	0241	20.0	8
Milk cows	0241	35.0	9
Milk cows	0241	25.0	9
Pigs, body weight 30 lb	0213	.6-1.2	1
Pigs, body weight 60-80 lb	0213	.8	1
Pigs, body weight 75-125 lb	0213	1.9	1
Pigs, body weight 200-380 lb	0213	1.4-3.6	1
Sows, pregnant	0213	3.6-4.6	1
Sows, lactating	0213	4.8-6.0	1
Hog, drinking	0213	4.0	2
Pigs	0213	1.2-2.5	3
Pigs	0213	2.0	4
Pigs	0213	5.0	5
Pigs	0213	4.0	6
Pigs	0213	2.6	7
Pigs	0213	3.0	8
Pigs	0213	7.0	9
Sows	0213	4.0	4
Sows, lactating	0213	1.9-3.6	9
		gal/d per 100 birds	
Chickens, 1-3 weeks of age	0251	0.4-2.0	1
Chickens, 3-6 weeks of age	0251	1.4-3.0	1
Chickens, 6-10 weeks of age	0251	3.0-4.0	1
Chickens, 9-13 weeks of age	0251	4.0-5.0	1
Pullets	0251	3.0-4.0	1
Nonlaying hens	0251	5.0	1
Laying hens (moderate temp)	0251	5.0-7.5	1
Laying hens (warm temp)	0251	9.0	1

Table 7A.--Estimated withdrawals for water uses within agricultural, domestic, commercial, industrial, and thermoelectric categories--continued.

Type of water use	SIC code	Withdrawal	Source of data
AGRICULTURAL (Livestock)--continued			
		gal/d per 100 birds	
Chickens	0251	5.0-10.0	2
Lay flock	0252	5.0-6.0	3
Lay flock	0252	6.0	4
Lay flock	0252	6.0	6
Lay flock	0252	5.0	7
Lay flock	0252	5.0	8
Lay flock	0252	4.8-15.6	9
Turkeys 1-3 weeks of age	0253	1.1-2.6	1
Turkeys 4-7 weeks of age	0253	3.7-6.4	1
Turkeys 9-13 weeks of age	0253	9.0-14.0	1
Turkeys 15-19 weeks of age	0253	17.0	1
Turkeys 21-26 weeks of age	0253	14.0-15.0	1
Turkeys	0253	10.0-18.0	2
Turkeys	0253	12.0-30.0	3
Turkeys	0253	10.0	4
Turkeys	0253	5.0	6
Turkeys	0253	10.0	8
Turkeys	0253	2.7-26.2	9
DOMESTIC			
		gal/d per person	
Private homes	8811	40.0	1
Toilet	8811	30.0	1
Bath/shower	8811	30.0-60.0	1
Household use, avg. daily use	8811	60.0	10, 11
Toilet	8811	24.0	10, 11
Bath/shower	8811	19.0	10, 11
Laundry	8811	8.0	10, 11
Kitchen	8811	6.0	10, 11
Household use, avg. daily use	8811	63.75	11, 12
Toilet	8811	25.0	11, 12
Bathing	8811	20.0	11, 12
Laundry	8811	8.75	11, 12
Dishwashing/cooking	8811	6.75	11, 12
Single family (per resident)	8811	50.0-75.0	2
Apartment, multiple	6513	60.0	2
Boarding house	7033	50.0	2
Rooming house	6514	60.0	2
Luxury dwelling	8811	100.0-150.0	2

Table 7A.--Estimated withdrawals for water uses within agricultural, domestic, commercial, industrial, and thermoelectric categories--continued.

Type of water use	SIC code	Withdrawal	Source of data
	COMMERCIAL		
Hotel	7011	50.0 gal/h per fixture	1
Hotel	7011	50.0-60.0 gal per person/d	2
Motel	7011	40.0-50.0 gal per person/d	2
Tourist court	7011	35.0-50.0 gal per person/d	2
Trailer parks	7033	25.0-50.0 gal per person/d	2
Apartment house	6513	20.0 gal/h per fixture	1
Apartments, multiple family	6513	40.0-60.0 gal per person/d	2
Hospital	8062	25.0 gal/h per fixture	1
Institutions	8071	75.0-125.0 gal per person/d	2
Office buildings	6512	40.0 gal/h per fixture	1
Mercantile buildings	6512	35.0 gal/h per fixture	1
Day school	8211	50.0 gal/h per fixture	1
Airports	4583	3.0-5.0 gal/h per fixture	2

Table 7A.--Estimated withdrawals for water uses within agricultural, domestic, commercial, industrial, and thermoelectric categories--continued.

Type of water use	SIC code	Withdrawal	Source of data
		INDUSTRIAL	
Petroleum, per barrel crude	2911	1,741 gal	12
Petroleum, per barrel oil field	1311	468 gal	13
Petroleum, per ton crude	2911	2,600 gal	1
Petroleum, per barrel oil field	1311	168 gal	1
Automobile manufacture	3711	10,000 gal/vehicle	1
Automobile manufacture	3711	10,000 gal/vehicle	12
Distilling, per gal spirits	2085	3-76 gal	1
Distilling, per gal spirits	2085	125-167 gal	12
Pulp & paper, per ton	2621	60,720 gal	1
Pulp & paper, per ton	2621	57,000 gal	12
Pulp & paper, per ton			
Groundwood	2621	10,000 gal	13
Bleached sulfite	2621	75,000 gal	13
Paperbrand	2621	13,000 gal	13
Lag paper	2621	80,000 gal	13
Soap & detergent, per case	2841	253-554 gal	1
Soap & detergent, per case	2841	3-100 gal	12
Steel, per ton	3312	34,000 gal	13
Steel, per ton			
Fully integrated mill	3312	22,700 gal	1
Fully integrated mill	3312	20,800 gal	12
Rolling & drawing mill	3312	3,900 gal	1
Rolling & drawing mill	3312	3,550 gal	12
Blast furnace smelting	3312	27,200 gal	1
Blast furnace smelting	3312	25,000 gal	12
Electrometal ferro alloys	3313	19,000 gal	1
Electrometal ferro alloys	3313	17,400 gal	12
Leather tanning, per ft2 hide	3111	12.5 gal avg	1
Leather tanning, per ft2 hide	3111	10.0 gal avg	12
Aluminum, per pound	3361	1 gal	13
Gauxite, per ton of ore	1051	80 gal	1
Cooper reduction, per ton	3331	30,000 gal	13
Styrene, per pound	2821	2-123 gal	13
Butadine, per pound	2911	5-22 gal	13
Butadine, per pound	2911	11-363 gal	1
Rayon, per pound			
Process	2823	32 gal	1
Cooling	2823	78 gal	12
		THERMOELECTRIC	
Electric power, fossil fuel	4911	48-83 gal/kwh	14
Electric power, fossil fuel	4911	53 gal/kwh	1

Table 7A.--Sources of estimated withdrawals for water uses within agricultural, domestic, commercial, industrial, and thermoelectric categories.

1. Todd, David Keith, ed., 1970, The water encyclopedia: Huntington, N.Y., Water Information Center, pp. 275-281.

2. U.S. Environmental Protection Agency, 1974, Manual of individual water systems, EPA-430/9-74-007, p. 15.

3. American Society of Agricultural Engineers, 1981-1982 Agricultural engineers yearbook, design values for livestock fallout shelters: p. 399.

4. Great Lakes Basin Commission, 1975, Great Lakes Basin Commission's framework study, Appendix 6, water supply--municipal, industrial, and rural: tables 6 to 10, p. 24.

5. Kemodle, J. M. and Wilson, J. M., 1970, Water use in Tennessee: Tennessee Department of Conservation, table 18, p. 26.

6. Herring, J. R. and Miler, K. M., 19 , Maryland water use report, January-December 1979: Water Resources Administration, table 2, p. 6.

7. Upper Mississippi River Basin Commission, 1979, Water Resources Subregion Plan Reference Handbook, Final Draft, February 1979: table 17, p. 133.

8. Wirst, W. G., Planert, Michael, and Arihood, L. D., 1976, Maumee River basin Level B Study, comprehensive water and related land resources planning: Great Lakes Basin Commission Water-Supply Technical Paper, August 1976, section 3.1.3, p. 22.

9. Indiana Department of Natural Resources, 1982, 1980 Survey of domestic self-supplied and livestock water uses in Indiana: p. 2.

10. Cornell Cooperative Extension, U.S. Department of Agriculture, 1985, Hazardous/chemical waste and water quality program: no. 24, p. 2.

11. Great Lakes and Water Resources Planning Commission, 1986, Watermarks, v. 1, no. 5, p. 4.

12. National Association of Manufacturers, 1985, Water in industry: New York, N.Y., p. 81.

13. U.S. Geological Survey, 1955, Water requirements of selected industries: U.S. Geological Survey Water-Supply Paper 1330, p. 394.

14. U.S. Water Resources Council, 1978, Part III, Functional water use, the nation's water resources, the second national water assessment: Washington, D.C., p. 134.

Table 7B.--Water use coefficients, by Standard Industrial Classification (SIC) code and State.
[Data from U.S. Water Resources Council, 1980.]

Values are ratio of water withdrawal to water discharge:

$$\frac{\text{Withdrawal}}{\text{Discharge}} = \frac{\text{Withdrawal}}{\text{Withdrawal - Consumption}}$$

State	Primary metals SIC 33	Chemical and allied products SIC 28	Paper and allied products SIC 26	Food and kindred products SIC 20	Petroleum refining and related industries SIC 29
Illinois	1.15	1.21	1.08	1.13	1.63
Indiana	1.05	1.24	1.20	1.42	1.13
Michigan	1.20	1.02	1.13	1.15	1.21
Minnesota	1.15	2.00	1.15	1.20	2.00
New York	2.14	1.04	1.03	1.24	1.04
Ohio	1.13	1.05	1.12	1.17	1.07
Pennsylvania	1.07	1.05	1.09	1.19	1.18
Wisconsin	1.08	1.34	1.03	1.03	1.05

	Textile mill products SIC 22	Miscellaneous manufacturing --	Commercial --	Mining and quarrying of nonmetallic minerals SIC 14
Illinois	--	1.08	1.09	1.18
Indiana	--	1.20	1.09	1.17
Michigan	--	1.02	1.07	1.18
Minnesota	--	1.15	1.09	1.17
New York	1.00	1.06	1.19	1.17
Ohio	1.00	1.10	1.14	1.17
Pennsylvania	1.09	1.11	1.09	1.18
Wisconsin	--	1.12	1.10	1.18

	Coal mining and oil and gas extraction SIC 11,12,13	Metal mining SIC 10	Domestic --	Electric services SIC 4911
Illinois	1.97	--	1.13	1.01
Indiana	1.89	--	1.46	1.01
Michigan	2.00	1.57	1.23	1.01
Minnesota	--	1.59	1.27	1.02
New York	--	1.57	1.24	1.01
Ohio	2.05	--	1.22	1.01
Pennsylvania	1.93	1.80	1.19	1.02
Wisconsin	--	1.33	1.28	1.01

Table 8.--Sources of water-use data or research information.

ILLINOIS

Public Water Supply

1. Battelle-Northwest, Richland, Wash., Pacific Northwest Laboratory.
2. Illinois State Water Survey, Urbana.
3. Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers.
4. Keifer and Associates Incorporated, Chicago, Water Resources Bulletin v. 15, no. 1, p. 17-29, February 1979
5. Alvord, Burdick and Howson, Chicago.
6. Department of Housing and Urban Development, Washington, D.C.
7. Illinois State Geological Survey, Champaign.
8. Illinois State Water Survey, Urbana, Hydrology Section
9. West Virginia University, Morgantown, Bureau of Business Research.
10. M.B. Corlew and Associates, Inc., Edwardsville.
11. Illinois State Department of Transportation, Springfield, Division of Water Resources.
12. Illinois State Department of Transportation, Chicago, Division of Water Resources.
13. Northwest University, Evanston, Department of Civil Engineering.
14. Harza Engineering Corporation, Chicago.
15. Northeastern Illinois University, Chicago.
16. Chicago Department of Water and Sewers.
17. Illinois State Water Survey, Warrenville, Hydrology Section.
18. Southwestern Illinois Metropolitan Area Planning Commission, Collinsville.
19. Southeastern Illinois Regional Planning and Development Commission, Harrisburg.
20. City-County Planning Commission, Rockford.
21. Champaign County Regional Planning Commission, Urbana.
22. McClean County Regional Planning Commission, Bloomington.
23. Simon Fraser University, Burnaby, British Columbia, Department of Geography.
24. East-West Gateway Coordinating Council, St. Louis, Mo.
25. Illinois University, Urbana, Department of Business Administration.
26. Illinois Technical Adivsory Committee On Water Resources, Springfield.
27. Illinois State Department of Business and Ecomonic Development, Springfield.
28. Illinois State Technical Advisory Committee on Water Resources, Springfield.
29. Hittan Associates, Inc., Columbia, Md.
30. Northeastern Illinois Planning Commission, Chicago.
31. Illinois State Water Survey Division, Champaign.
32. American Society of Civil Engineers, New York, N.Y.
33. Purdue University, Lafayette, Ind., Water Resources Research Center.
34. Illinois University, Urbana, Water Resources Center.
35. Illinois University, Urbana, Department of Civil Engineering.

Domestic

1. Illinois University, Urbana, Department of Business Administration.
2. Illinois State Water Survey, Urbana.
3. Southern Illinois University at Carbondale, Department of Geography.

Table 8.--Sources of water-use data or research information--continued.

Irrigation

1. University of Illinois, Urbana, Cooperative Extension Agricultural Engineer.
2. League of Women Voters, Detroit, Mich., Lake Michigan Inter-League Group.
3. Illinois University at Urbana-Champaign.
4. Illinois State Water Survey, Urbana.
5. Illinois University, Urbana, Water Center.
6. Illinois University at Urbana-Champaign, Department of Agricultural Engineering.

Fossil-Fuel Power (Thermoelectric)

1. Illinois University at Urbana-Champaign, Department of Civil Engineering. (includes consumptive use)
2. League of Women Voters, Detroit, Mich., Lake Michigan Inter-League Group.
3. Illinois University at Urbana-Champaign, Water Resources Center.
4. Lake Michigan Cooling Water Studies Panel, Chicago.
5. Illinois Univesity at Urbana-Champaign, Institute for Environmental Studies.
6. Illinois State Water Survey, Urbana.
7. Massachusetts Institute of Technology, Cambridge Energy Laboratory.
8. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Nuclear Power

1. Battelle-Northwest, Richland, Wash., Pacific Northwest Laboratory.

Hydroelectric Power

1. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Industrial

1. Illinois State Water Survey, Urbana.
2. Illinois State Water Survey, Naperville.
3. Chicago University, Illinois Center For Urban Studies.
4. Argonne National Laboratory, Urbana-Champaign.

Agricultural (Livestock)

1. Illinois State Water Survey, Urbana.

Mining

1. Argonne National Laboratory, Urbana-Champaign.
2. Illinois State Water Survey, Urbana.

Water-Use Data

1. Illinois State Department of Transportation, Springfield, Division of Water Resources.

Table 8.--Sources of water-use data or research information--continued.

2. Illinois State Water Survey, Urbana.
3. Illinois State Department of Business and Economic Development, Springfield.
4. West Virginia University, Morgantown, W.Va., Bureau of Business Research.
5. Illinois State Water Survey Division, Champaign.

INDIANA

Public Water Supply

1. Illinois State Water Survey, Urbana.
2. U.S. Geological Survey, Lansing, Mich.
3. Purdue University, Lafayette, School of Civil Engineering.
4. Purdue University, Lafayette, Water Resources Research Center.
5. Indiana University at Bloomington, Department of Geology.
6. West Virginia University, Morgantown, W.Va., Bureau of Business Research.

Domestic

1. Purdue University, Lafayette, Department of Agricultural Economics.
2. Purdue University, Lafayette, Department of Sociology and Anthropology.

Irrigation

1. Purdue University, West Lafayette, Department of Agronomy.
2. Purdue University, Lafayette, Agricultural Experiment Station.
3. Indiana State Department of Natural Resources, Indianapolis.
4. Purdue University, Lafayette, Water Resources Research Center.

Fossil-Fuel Power (Thermoelectric)

1. Lake Michigan Cooling Water Studies Panel, Chicago, Il.
2. Federal Energy Regulatory Commission, Chicago, Il., Chicago Regional Office.
3. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Hydroelectric Power

1. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Industrial

1. Bethlehem Steel Corportation, Chesterton, Burns Harbor Plant.

Water-Use Data

1. Public Health Service, Charlottesville, Va.
2. U.S. Geological Survey, Columbus, Ohio
3. U.S. Geological Survey, Indianapolis, Ind.
4. West Virginia University, Morgantown, W.Va., Bureau of Business Research.

Table 8.--Sources of water-use data or research information--continued.

MICHIGAN

Public Water Supply

1. U.S. Geological Survey, Lansing.
2. Detroit Metropolitan Water Services.
3. Technology Planning Center Incorporated, Ann Arbor.
4. Tri-County Regional Planning Commission, Lansing.
5. West Virginia University, Morgantown, W.Va., Bureau of Business Research.

Domestic

1. Tri-County Regional Planning Commission, Lansing.

Irrigation

1. Michigan State University, East Lansing, Department of Horticulture.
2. Michigan Agricultural Experiment Station, East Lansing.
3. Michigan State University, East Lansing, Department of Crop and Soil Science.
4. Biocycle, Jan./Feb. 1981, v. 22, no. 1, p. 34-37.
5. U.S. Environmental Protection Agency, Chicago, Ill.
6. Water and Sewage Works, March 1977, v. 124, no. 3, p. 42-44.
7. Michigan Department of Natural Resources, Lansing, Water Resources Commission.
8. Tri-County Regional Planning Commission, Lansing.
9. Michigan State University, East Lansing, Department of Fisheries and Wildlife.
10. Michigan State University, East Lansing, Institute of Water Research.

Fossil-Fuel Power (Thermoelectric)

1. Lake Michigan Cooling Water Studies Panel, Chicago, Il.
2. Federal Energy Regulatory Commission, Chicago, Il., Chicago Regional Office.
3. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Hydroelectric Power

1. Federal Energy Regulatory Commission, Chicago, Il., Chicago Regional Office.
2. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Industrial

1. Corning Glass Works, Corning, N.Y.
2. Tri-County Regional Planning Commission, Lansing.

Table 8.--Sources of water-use data or research information--continued.

Agricultural (Livestock)

1. Tri-County Regional Planning Commission, Lansing.

Commerical

1. Tri-County Regional Planning Commission, Lansing.

Mining

1. U.S. Geological Survey, Lansing.

Water-Use Data

1. U.S. Geological Survey, Lansing.
2. Michigan State Water Resources Commission, Lansing, Department of Conservation.
3. Michigan State Water Resources Commission, Lansing, Department of Natural Resources.
4. Michigan State University, East Lansing, Department of Resource Development.
5. U.S. Geological Survey, Reston, Va., Water Resources Division.
6. U.S. Geological Survey, Indianapolis, Ind.
7. West Virginia University, Morgantown, W.Va., Bureau of Business Research.

MINNESOTA

Public Water Supply

1. U.S. Geological Survey, St. Paul.
2. University of Minnesota, Minneapolis, Department of Agricultural and Applied Economics.
3. U.S. Army Corps of Engineers, St. Paul District.

Domestic

1. University of Minnesota, Minneapolis, Department of Agricultural and Applied Economics.
2. University of Minnesota, Minneapolis, Water Resources Research Center.

Irrigation

1. University of Minnesota, Morris, Cooperative Extension, Agricultural Engineer.
2. Agricultural Research Service, Morris, North-Central Soil Conservation Research Laboratory.
3. University of Minnesota, St. Paul, Department of Soil Science.
5. Science and Education Administration, Morris, North-Central Soil Conservation Research Laboratory.

Table 8.--Sources of water-use data or research information--continued.

Irrigation (continued)

5. University of Minnesota, St. Paul, Department of Agricultural and Applied Economics.
6. U.S. Geological Survey, Reston, Va., Water Resources Division.
7. University of Minnesota, St. Paul, Water Resources Research Center.

Mining

1. U.S. Geological Survey, St. Paul.

Water-Use Data

1. U.S. Geological Survey, St. Paul.
2. Minnesota Department of Natural Resources, St. Paul, Division of Water, Soils and Minerals.

NEW YORK

Public Water Supply

1. New York State Temporary Commission on the water supply needs of Southeastern New York, Albany (includes comsumptive use).
2. Somerset County Planning Board, Somerville, N.J.
3. Parsons, Brinckerhoff, Quade and Douglas, Inc., New York, N.Y.
4. Center For The Environment and Man, Incorporated, Hartford, Conn.
5. Great Lakes Basin Commission, Ann Arbor, Mich.
6. Ulster County Planning Board, Kingston.
7. Columbia University, New York, Department of Geography.
8. University of Vermont, Burlington, Vt., Department of Zoology.
9. Cornell University, Ithaca, Water Resources and Marine Science Center.
10. Battelle-Northwest, Richland, Wash., Pacific Northwest Laboratory.
11. Columbia University-Barnard College, New York, Department of Geography.
12. New York State Department of Environmental Conservation, Albany.
13. U.S. Army Corps of Engineers, Buffalo District.

Domestic

1. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Miss.

Irrigation

1. Cornell University, Ithaca, Cooperative Extension Associate, Agricultural Engineer.
2. Cornell University, Ithaca, New York Water Resources and Marine Sciences Center.
3. Great Lakes Basin Commission, Ann Arbor, Mich.
4. League of Women Voters Education Fund, Washington, D.C.

Table 8.--Sources of water-use data or research information--continued.

Fossil-Fuel Power (Thermoelectric)

1. Delaware University, Newark, N.J., Water Resources Center.
2. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Nuclear Power

1. Battelle-Northwest, Richland, Wash., Pacific Northwest Laboratory.

Hydroelectric Power

1. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Industrial

1. Sanitary Engineering Center, Cincinnati, Ohio
2. Cornell University, Ithaca, Water Resources and Marine Sciences Center.
3. New York State Temporary Commission on The Water Supply Needs of Southeastern New York, Albany.
4. Great Lakes Basin Commission, Ann Arbor, Mich.
5. New York State Department of Environmental Conservation, Albany.
6. League of Women Voters Education Fund, Washington, D.C.
7. Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

Agricultural (Livestock)

1. League of Women Voters Education Fund, Washington, D.C.

Commerical

1. Cornell University, Ithaca, Water Resources and Marine Sciences Center.

Water-Use Data

1. New York State Department of Health, Albany, Bureau of Public Water Supply Protection.

OHIO

Public Water Supply

1. Robert A. Taft Sanitary Engineering Center, Cincinnati.
2. Ohio Department of Natural Resources, Columbus, Division of Water.
3. W.E. Gates and Associates, Incorporated, Batavia.
4. Municipal Environmental Research Laboratory, Cincinnati.

Table 8.--Sources of water-use data or research information--continued.

5. Parsons, Brincherhoff, Quade and Douglas, New York, Advanced Technology Division.
6. Jones and Henry Engineers, Limited, Toledo.
7. Finkbeiner, Pettis and Strout, Limited, Toledo.
8. Public Health Service, Charlottesville, Va., Region III.
9. U.S. Geological Survey, Columbus.
10. West Virginia University, Morgantown, W.Va., Bureau of Business Research.

Domestic

1. Ohio Department of Natural Resources, Columbus, Division of Water.

Irrigation

1. Cooperative Extension Agricultural Engineer, Ohio State University, Columbus.
2. Ohio, Department of Natural Resources, Columbus, Division of Water, Golf Course Irrigation.
3. Ohio Department of Natural Resources, Columbus, Division of Water.

Fossil-Fuel Power (Thermoelectric)

1. Illinois University at Urbana-Champaign, Department of Civil Engineering, (includes consumptive use).
2. Oak Ridge National Laboratory, Tenn., Department of Energy.

Hydroelectric Power

1. Burgess and Niple Limited, Columbus.

Industrial

1. Ohio State University, Columbus, Department of Civil Engineering (includes consumptive use).
2. Argonne National Laboratory, Department of Energy.
3. Robert A. Taft Sanitary Engineering Center, Cincinnati.
4. Ohio Department of Natural Resources, Columbus, Division of Water.

Agricultural (Livestock)

1. U.S. Department of Agriculture, Washington, D.C.
2. Ohio River Basin Commission, Cincinnati.
3. Michigan State University, East Lansing, Mich.

Water-Use Data

1. U.S. Geological Survey, Columbus.
2. Great Lakes Basin Commission, Ann Arbor, Mich.
3. U.S. Geological Survey, Indianapolis, Ind.
4. West Virginia University, Morgantown, W.Va., Bureau of Business Research.

Table 8.--Sources of water-use data or research information--continued.

ONTARIO

Public Water Supply

1. Guelph University, Ontario, Department of Economics.
2. Waterloo University, Ontario, Department of Economics.
3. Ottawa-Carleton Regional Municipality, Ottawa.
4. Toronto Department of Public Works, Ottawa.
5. Ontario Department of Energy, Mines and Resources, Vancouver, B.C., Policy and Planning Branch.

Irrigation

1. Ontario Department of Energy, Mines and Resources, Vancouver, B.C., Policy and Planning Branch.

Hydroelectric Power

1. Ontario Department of Energy, Mines and Resources, Vancouver, B.C., Policy and Planning Branch.

Industrial

1. Ontario Department of Energy, Mines and Resources, Vancouver, B.C., Policy and Planning Branch.

Water-Use Data

1. Ontario Department of Energy, Mines and Resources, Vancouver, B.C., Policy and Planning Branch.

PENNSYLVANIA

Public Water Supply

1. Pennsylvania State University, University Park, Institute For Research on Land and Water Resources.
2. Sanitary Engineering Center, Cincinnati, Ohio.

Domestic

1. Pennsylvania State University, University Park, Institute For Research on Land and Water Resources.

Irrigation

1. Agricultural Engineering Water Specialist, Pennsylvania State Univresity, University Park.

Table 8.--Sources of water-use data or research information--continued.

Fossil-Fuel Power (Thermoelectric)

1. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.
2. Pennsylvania State University, University Park, Institute For Research on Land and Water Resources.
3. Pennsylvania Department of Environmental Resources, Harrisburg, Office of Enforcement (includes consumptive use).

Hydroelectric Power

1. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation
2. Pennsylvania State University, University Park, Institute for Research on Land and Water Resources.

Industrial

1. Sanitary Engineering Center, Cincinnati, Ohio.

Water-Use Data

1. Pennsylvania Department of Environmental Resources, Harrisburg, Office of Resources Management.

QUEBEC

Public Water Supply

1. Magill University, Montreal, Department of Civil Engineering.
2. National Institute of Scientific Research, St. Foy, Quebec.

Domestic

1. Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).

WISCONSIN

Public Water Supply

1. U.S. Geological Survey, Madison.
2. Southeastern Wisconsin Regional Planning Board Commissioner, Madison.
3. Board of Waterworks, Madison.

Domestic

1. U.S. Geological Survey, Madison.

Table 8.--Sources of water-use data or research information--continued.

Irrigation

1. Wisconsin University, Madison, Water Resources Center.
2. U.S. Geological Survey, Madison.

Fossil-Fuel Power (Thermoelectric)

1. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.
2. U.S. Geological Survey, Madison.

Hydroelectric Power

1. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Industrial

1. U.S. Geological Survey, Madison.

Agricultural (Livestock)

1. Wisconsin University, Madison, Water Resources Center.

Water-Use Data

1. Wisconsin University, Madison, Water Resources Center.
2. U.S. Geological Survey, Madison.

GREAT LAKES

Public Water Supply

1. Cornell University, Ithaca, N.Y., Water Resources and Marine Sciences Center.
2. West Virginia University, Morgantown, W.Va., Bureau of Business Research.
3. Environmental Policy Institute, Washington, D.C.

Domestic

1. Environmental Policy Institute, Washington, D.C.

Irrigation

1. Great Lakes Basin Commission, Ann Arbor, Mich.
2. Cornell University, Ithaca, N.Y., Water Resources and Marine Sciences Center.
3. Great Lakes Basin Commission, Ann Arbor, Mich., Public Information Office.
4. Environmental Policy Institute, Washington, D.C.

Table 8.--Sources of water-use data or research information--continued.

Fossil-Fuel Power (Thermoelectric)

1. Oak Ridge National Laboratory, Tenn. (includes consumptive use).
2. Stanford University, Calif., Department of Operations Research.
3. Federal Energy Regulatory Commission, Washington, D.C., Office of Electric Power Regulation.

Industrial

1. Cornell University, Ithaca, N.Y., Water Resources and Marine Sciences Center.
2. Illinois University, Urbana, Water Resources Center.
3. Environmental Policy Institute, Washington, D.C.

Agricultural (Livestock)

1. Environmental Policy Institute, Washington, D.C.

Water-Use Data

1. Water Well Journal, July 1982, v. 36, no. 7, p. 48-52.
2. Great Lakes Basin Commission, Ann Arbor, Mich.
3. U.S. Geological Survey, Indianapolis, Ind.
4. Great Lakes Basin Commission, Ann Arbor, Mich.
5. Argonne National Laboratory, Illinois, Energy and Environmental Systems.
5. West Virginia University, Morgantown, W.Va., Bureau of Business Research.

CONSUMPTIVE USE

1. Susquehanna River Basin Commission, Harrisburg, Pa.
2. Illinois Department of Transportation, Chicago, Division of Water Resources.

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