

**ANNUAL REPORT**  
of the  
*GREAT LAKES REGIONAL WATER USE  
DATABASE REPOSITORY*  
*REPRESENTING 1998 WATER USE DATA IN LITERS*

*Prepared by*  
*The Great Lakes Commission and  
The Water Withdrawal and Use Technical Subcommittee  
Under*  
*Project Element 3 of  
A Great Lakes Water Resources Decision Support System*

*July 2002*

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## ***PREFACE***

The Great Lakes Water Use Database Repository, housed at the Great Lakes Commission, provides a centralized source of information on withdrawals, diversions, and consumptive uses of water in the Great Lakes Basin in both the United States and Canada. The Commission prepares an annual report, based upon the data submitted by the eight Great Lakes states and the two Canadian Great Lakes provinces.

- The introduction provides background on the Water Use Database Repository, describes the database management system, and presents issues associated with data reporting and analysis.
- The Great Lakes Basin Summary provides an overview of Basin water use. After providing Basin-wide statistics, this section gives a detailed graphical representation of water use by jurisdiction.
- The Appendix is comprised of printouts generated by the Water Use Database.
- The Great Lakes Commission welcomes all inquiries concerning the Great Lakes Regional Water Use Database Repository. Please call 734-665-9135, or e-mail Tom Crane at [tcrane@glc.org](mailto:tcrane@glc.org), for further information.

# **TABLE OF CONTENTS**

<i>ACKNOWLEDGEMENTS</i>	<i>I</i>
<i>JURISDICTIONAL CONTACTS</i>	<i>II</i>
<i>PREFACE</i>	<i>III</i>
<i>TABLE OF CONTENTS</i>	<i>IV</i>
<i>I. INTRODUCTION</i>	<i>1</i>
<i>Background on the Great Lakes Regional Water Use Database Repository</i>	<i>1</i>
<i>Database Management System</i>	<i>1</i>
<i>Database Definitions</i>	<i>2</i>
<i>Categories of Use for the Regional Water Use Database</i>	<i>3</i>
<i>Principal Facilities Definition</i>	<i>4</i>
<i>Current State and Provincial Activities Related to the Operation and Use of the Great Lakes Regional Water Use Database</i>	<i>4</i>
<i>II. GREAT LAKES BASIN SUMMARY FOR 1998 WATER WITHDRAWAL AND USE INFORMATION</i>	<i>7</i>
<i>Overview</i>	<i>7</i>
<i>Hydroelectric Power Summary</i>	<i>7</i>
<i>Consumptive Uses of Great Lakes Water</i>	<i>9</i>
<i>Interbasin Diversions of Great Lakes Water</i>	<i>9</i>
<i>III. JURISDICTION REPORT ANALYSES</i>	<i>13</i>
<i>Abbreviations</i>	<i>13</i>
<i>Illinois</i>	<i>14</i>
<i>Indiana</i>	<i>15</i>
<i>Michigan</i>	<i>16</i>
<i>Minnesota</i>	<i>17</i>
<i>New York</i>	<i>18</i>
<i>Ohio</i>	<i>19</i>
<i>Ontario</i>	<i>20</i>
<i>Pennsylvania</i>	<i>22</i>
<i>Quebec</i>	<i>23</i>
<i>Wisconsin</i>	<i>24</i>
<i>IV. APPENDIX</i>	<i>i</i>

# ***I. INTRODUCTION***

## **Background on the Great Lakes Regional Water Use Database Repository**

The Great Lakes Regional Water Use Database provides a common base of data and information on water use in the Great Lakes Basin as called for in the Great Lakes Charter of 1985. Housed at Great Lakes Commission offices, the database uses a modified Microsoft Access<sup>7</sup> software package using Visual Basic for Applications. A customized program, first prepared in 1987 by Acres International, Ltd. and revised in 1999/2000 by Eastern Michigan University's (EMU) Center for Environmental Information, Technology and Application (CEITA), performs routine database operations and includes standard data entry, retrieval and report generation options.

The Regional Water Use Database has been operational since the summer of 1988, following a multi-year cooperative effort in the design and development of the database system. This included input from and involvement of many state, provincial, and federal agencies. The U.S. Geological Survey provided much of the leadership on this effort.

The operation and use of this database system represents one of several ongoing activities on behalf of the Great Lakes states and provinces to fulfill obligations of the Great Lakes Charter of 1985. Continued state and provincial involvement in refining and expanding the database is necessary to ensure that the database can support other ongoing Charter initiatives, such as improving consumptive use information, conducting trend analysis, developing uniform and consistent demand forecasting applications and promoting regional water conservation programs.

## **Database Management System**

The Great Lakes Water Use Database Management System (DBMS) is the user interface for the Great Lakes Regional Water Use Database Repository. The Great Lakes Commission has served as the repository since 1988.

The Database was established by the Great Lakes states and provinces to address a recommendation of the Great Lakes Charter that calls for a uniform, consistent base of data of water withdrawals, diversions and consumptive uses in the Great Lakes Basin. Water use data are provided to the repository on an annual basis, and data are compiled and reports provided to assist the jurisdictions in water resources planning and management. The Database catalogs the set of annual data on withdrawals and consumptive uses of Great Lakes water by water use category, sub-basin, and jurisdiction, as specified by the Water Resources Management Committee in its 1987 report, *Managing the Waters of the Great Lakes Basin*.

The original version of the DBMS was developed on the MS/DOS platform using a modified version of the DbaseIII<sup>®</sup> commercial software package. With the rapid advancement of computer hardware and software and the evolving needs of the Great Lakes state and provincial water resources management programs, the old system soon became outdated.

In July 1998, the Great Lakes Commission and EMU's CEITA began work on the revised DBMS. The new system was developed by CEITA using Visual Basic for Applications, based on Microsoft Access<sup>®</sup>.

The new DBMS contains all of the functions of the old system (including data entry, a data check facility and report generation), but also has new features such as a flexible data interface, automatic data checking and graphing capability for data visualization.

The 1998 water use data report is the first report to utilize the improved DBMS. Data presented in this report were submitted to the Regional Water Use Database Repository by the Great Lakes states and provinces in 2001. All data are submitted in two different unit measures: millions of U.S. gallons per day (mgd) or millions of litres per day (mld). Each jurisdiction is required to select one of these measurements on a consistent basis for all data submissions. The Database records corresponding to the jurisdictions are maintained in the selected units.

All values in the Database are initially set to zero. Numeric values are required for all active categories of use. A zero value indicates either zero water use or water use not meeting the Charter trigger level of 100,000 gallons per day (380,000 litres per day) average over a 30-day period. All incoming interbasin diversion values are indicated by a minus sign. The Database treats diversions from a water balance perspective: that is, the diversion total for each report is the sum of incoming diversions and outgoing diversions. In reviewing the utility of the report, the Great Lakes Commission staff and the TSC members agree that a better way to present the diversion information in the future will be to display incoming and outgoing diversions separately. This will allow the diversion data to be viewed in a more meaningful way. Additionally, it will solve the problem of having the diversion amount for principal facilities appearing as greater than the diversion amount for all facilities, which by definition cannot be correct (see description under principal facilities below). The presentation of diversion information will be revised beginning with the 1999 water use report.

The quality of data for each entry is rated as a 1, 2 or 3 indicating the level of accuracy (measured, partially measured, or estimated) and a 1 or 2 indicating the level of aggregation (originating from site-specific sources or from higher level aggregate sources such as county or census databases.) Both measures of quality are based on percentages of total volume.

### **Database Definitions**

Each water use category includes three withdrawal/discharge types:

- **Great Lakes Surface Water (GLSW)** – the Great Lakes, their connecting channels (the St. Clair River, the Detroit River, the Niagara River and the St. Mary's River), and the St. Lawrence River
- **Other Surface Water (OSW)** – tributary streams, lakes, ponds, and reservoirs within the Great Lakes Basin
- **Groundwater (GW)** – all subsurface water distinct from surface water

The following list includes other important definitions pertaining to the use of the Great Lakes Regional Water Use Database summary tables.

- **Withdrawal Amount** – The amount of water removed or taken from surface or groundwater.
- **Intrabasin Diversion** – The amount of water transferred from the watershed of one of the Great Lakes into that of another.
- **Interbasin Diversion** – The amount of water transferred from the Great Lakes Basin into another watershed.

- **Consumptive Use** – 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 evapotranspiration, incorporation into products, or other processes.

### Categories of Use for the Regional Water Use Database

The following list of nine categories reflects original definitions from the February 1987 Water Resources Management Committee Report, *Managing the Waters of the Great Lakes Basin*. These definitions were revised and expanded in 1989 and 1990 through discussion with the Great Lakes states and provinces.

1. **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 water use.)
2. **Self-Supply – Domestic:** (residential, commercial, institutional): Water used for normal household purposes. Also referred to as residential water use, this category includes water used for drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns. Commercial uses include water used by motels, hotels, restaurants, office buildings and institutions, both civilian and military. This category also includes water for mobile homes, hospitals, schools, fire fighting, air conditioning and other similar uses not covered under a public supply. In addition, this category includes amusement and recreational water uses such as snowmaking and water slides. The coefficient for domestic per capita water use is 75 gallons a day (U.S.) unless otherwise indicated by the reporting state or province.
3. **Self-Supply – Irrigation:** Water artificially applied on lands to assist in the growing of crops and pastures or in the maintenance of recreational lands, such as parks and golf courses.
4. **Self-Supply – Livestock:** Water used by horses, cattle, sheep, goats, hogs, poultry, and other commercially important animals. Water used in fish hatchery operations are also included under this category.
5. **Self-Supply – Industrial** (manufacturing and mining): Industrial water includes water used in the manufacture of metals, chemicals, paper, and allied products. Mining water use includes water used in the extraction or washing of minerals; for example solids, such as coal and ores, and liquids such as crude petroleum and natural gas. Water used in quarrying and milling is also included in the industrial category. Brine extraction from oil and gas operations is not included. Withdrawals and consumptive uses for industrial and mining purposes (including dewatering operations) recorded under another category (e.g., public supply) will not be recorded here. Water uses in a closed cycle (recirculation) will not be reported as a withdrawal. Other situations should be evaluated on a case-by-case basis.
6. **Self-Supply – Thermoelectric Power** (fossil fuel plants): Water used by plants fueled by fossil fuels such as coal, oil or natural gas. Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here.
7. **Self-Supply – Thermoelectric Power** (nuclear plants): Water used by plants fueled by nuclear generation. Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here.
8. **Self-Supply – Hydroelectric Power:** Water used to drive turbines that generate electric power. This category includes both “instream use” where water is used on a once-through basis and “offstream use” where water is recycled through pumped-storage systems. Neither use is considered a consumptive use.

9. **Other:** Water used for purposes not reported in categories one through nine. Examples include, but are not limited to, withdrawals for fish/wildlife, environmental, recreation, navigation, and water quality purposes. Specifically, water used to maintain levels for navigation, for recreation, for fish and wildlife habitat creation and enhancement (excluding fish hatchery operations included under Category 5), for flow augmentation (or diversion), for sanitation, pollution confinement, and other water quality purposes and agricultural activities (services) other than those directly related to irrigation such as field drainage are included. Water used in temporary or immediate emergency situations (e.g., fighting forest or peat fires) is also reported here.

### **Principal Facilities Definition**

The question was raised by the Water Resources Management Committee's Technical Work Group in 1989 as to whether principal facilities should be defined by single source withdrawals (i.e., Great Lakes surface water) in excess of the Charter trigger level of 100,000 U.S. gallons per day, or 380,000 litres per day, over a 30-day period, or whether total withdrawal (all sources combined) should determine a principal facility.

The following represents a revised definition of a principal facility as developed by the state and provinces through the Technical Work Group:

**Principal Facilities** – Facilities withdrawing (or consuming) in excess of the Great Lakes Charter uniform trigger level of 100,000 U.S. gallons/day (380,000 liters/day) average over a 30-day period. A principal facility is determined by the total withdrawal (or consumption) of all sources combined (Great Lakes surface water, other surface water, and groundwater) rather than a single source. The combined withdrawals (or consumption) of separate wells or operations undertaken by the same facility or company will be evaluated separately for the purpose of determining principal facility status unless those operations are covered under the same registration (or permit) or are physically contiguous. Principal facilities are a subset of all facilities in the Database. Therefore, when viewing the reports generated by the Database, the withdrawal amount for principal facilities must always be equal to or less than the amount for all facilities for any summary report. This is true except for diversions. Here, principal facility amounts may be greater than all facilities due to the fact that the Database sums outgoing and incoming diversion amounts. If the number and amount of incoming diversions (shown as a negative number) is greater for all facilities than for principal facilities, the summary table may show a greater amount for the principal facilities.

### **Current State and Provincial Activities Related to the Operation and Use of the Great Lakes Regional Water Use Database**

The Great Lakes Protection Fund is providing financial support to the Great Lakes Commission to develop a framework for a comprehensive decision support system to provide the data, information and process required to ensure timely and well informed public policy decisions concerning the use and management of surface and groundwater in the Great Lakes system. The Commission is working with multiple agencies, stakeholders and collaborators on this effort, which will strengthen water quantity decisionmaking, and management processes in the Great Lakes-St. Lawrence region.

The project titled *A Great Lakes Water Resources Decision Support System* is founded upon seven premises that are guiding project methodology and outcomes:

- All project activities and outcomes will be state and province driven; representatives of these jurisdictions will have a role in all project elements and in shaping all project deliverables.
- The project is ensuring that Great Lakes Protection Fund support is leveraged to the greatest extent possible, through significant direct and in-kind contributions from project partners.
- Access to and use of existing and planned initiatives by project partners and other collaborators is being maximized.
- A number of interim products with immediate applicability to the water resources management needs of the states and provinces have recently been completed.
- The assembly and synthesis of existing data and information is a priority, and will be complemented by the identification of gaps, unmet needs and means to address them.
- Project outcomes will be practical, pragmatic and additive, providing a strong foundation for necessary follow-up work yielding the structural and operational characteristics of a water resources decision support system.
- All project activities and outcomes will be directed at ensuring the sustainability of data and information gathering, analysis, and application well beyond the conclusion of project funding.

A Project Management Team (PMT) was established in late summer of 2000 and provides overall leadership and direction in the design and conduct of all project elements. It is comprised of representatives from all ten Great Lakes states and provinces (10); the Council of Great Lakes Governors; one representative each from the several U.S. and Canadian federal agencies with major roles in the primary project elements (i.e., U.S. Geological Survey; National Oceanic and Atmospheric Administration; U.S. Army Corps of Engineers; Environment Canada); and several Great Lakes Commission staff members who are providing secretariat support. The PMT members have a working familiarity with, and responsibility for, water use monitoring, data analysis, management and policy activities in their jurisdiction. The eighteen member body, chaired by Richard S. Bartz, Assistant Chief, Division of Water, Ohio Department of Natural Resources, has been meeting quarterly to provide leadership and direction, guide project element implementation, advise the Project Secretariat and, generally, ensure that project commitments are met fully and in a timely manner. Project Management Team members are also involved in ongoing regional discussions concerning water resources management policy and ensure that project activities and products are consistent with/contribute to these discussions.

A Stakeholders Advisory Committee (SAC) has also been formed to provide advice and guidance to the PMT and the three technical subcommittees (TSCs) working on the substantive project elements. The SAC includes representatives from an array of agencies, organizations and user groups responsible for the acquisition, analysis, dissemination and/or application of water resources-related data and information. The SAC has met three times since project inception in August 2000 and will meet formally one more time before the end of the project in October 2002.

Commission staff and the Project Management Team (PMT) have also been working closely with the Council of Great Lakes Governors (CGLG) on the implementation of the Great Lakes Charter Annex signed by the governors and premiers at their annual meeting in June 2001. The PMT has established a sub-committee structure to work on the varied and complex issues of this project and to help better incorporate work products into the framework of an overall decision support system. The three technical sub-committees (TSCs) are involved with: Status Assessment of Water Resources (TSC2); Water Withdrawal and Use (TSC3); and Ecological Impacts (TSC4). In addition to their prescribed work as outlined in detailed project element work plans, the PMT and the TSCs

are working to define, scope, and answer questions associated with three priority issues identified by the Great Lakes Charter Annex: water conservation, resource improvement, and (as part of the improvement standard discussion) developing better consumptive use data to support a water resources management decision support system.

## ***II. GREAT LAKES BASIN SUMMARY FOR 1998 WATER WITHDRAWAL AND USE INFORMATION***

### **Overview**

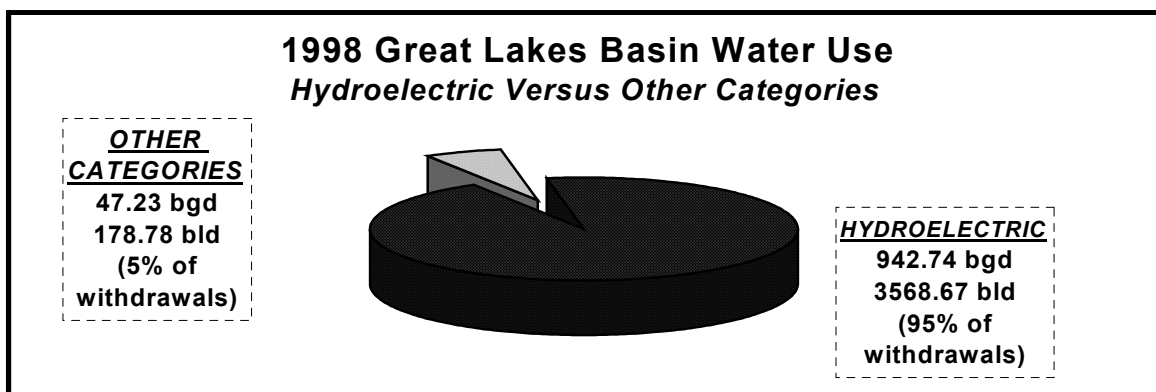
The following tables and figures represent 1998 Great Lakes water use data submitted to the Regional Water Use Database Repository from the ten Great Lakes jurisdictions for the nine active categories of use. In total, water withdrawals in the Great Lakes Basin for 1998 were 989.97 billion gallons per day, or about 3.75 trillion litres per day. Of this total, 52% was withdrawn directly from the Great Lakes, their connecting channels, or the St. Lawrence River.

### **Hydroelectric Power Summary**

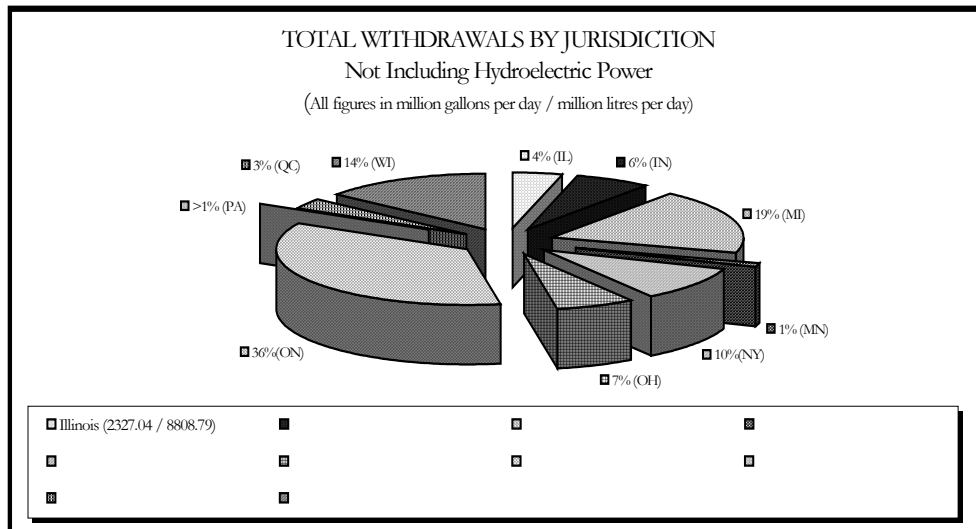
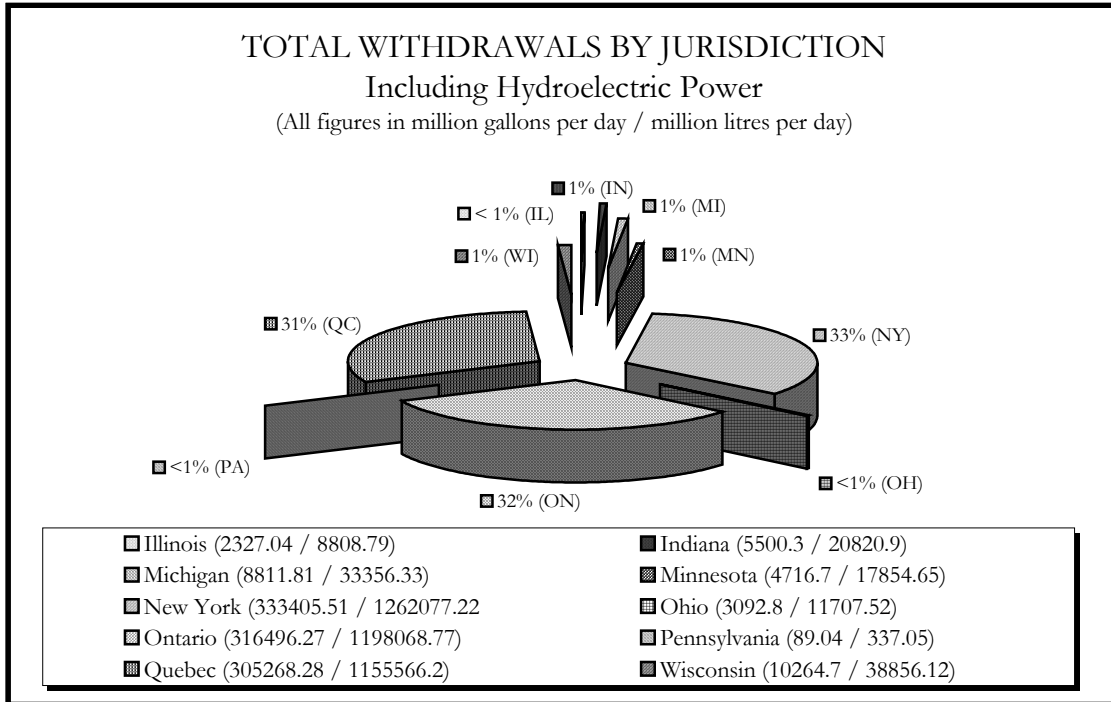
Prior to the discussion of overall water use activities in the Great Lakes-St. Lawrence River Basin, it is important to provide some context regarding the inclusion of information on hydroelectric power generation in this report. Hydroelectric power generation as a category is inherently different than other water use categories because water used to generate hydroelectric power is considered an “in-stream” use. Instream use as defined by the U.S. Geological Survey is water that is used but not withdrawn from a ground or surface source for such purposes as hydroelectric power generation, navigation, water quality improvement, fish propagation, and recreation. For hydroelectric power generation, the term refers to the water used in the generation of electricity at plants where turbine generators are driven by falling water.

The decision to include hydroelectric power generation information in the annual water use reports was made by the Water Resources Management Committee in 1987 and is consistent with the approach taken by the USGS in the preparation of its five-year water use reports. In the Great Lakes Basin (and in the U.S. and Canada as a whole), fresh surface water provides nearly all of the water for hydroelectric power; all of this water is estimated to be returned to Great Lakes Basin rivers and streams (USGS, Estimated Use of Water in the U.S. in 1995, circular 1200).

For this report, “withdrawal” refers to any water removed from the ground or diverted from a surface water source, while “water use” refers to the specific category of use, such as domestic, irrigation, or industrial. Self-supply – hydroelectric, as noted in all previous annual reports of the repository, continues to be the largest single category of use and represents 95% of the total amount of water used per day.



Each of the ten jurisdictions' water uses is represented in the following charts. The first chart shows the overall water use of all nine reported categories. However, the second chart more accurately reflects the true water withdrawals within the Basin, as it excludes hydroelectric uses. Water withdrawals from the eight "offstream" categories totaled 47.23 billion gallons per day, or 178.78 billion litres per day.



## **Consumptive Uses of Great Lakes Water**

Collecting and reporting defensible data for consumptive uses of Great Lakes water continues to be a major challenge for the Great Lakes jurisdictions. The states and provinces currently use a variety of methods to report consumptive use. These include direct facility measurements, facility estimates and jurisdiction estimates. The most common practice is for the states or provinces to estimate consumptive use, based on water withdrawal quantities multiplied by an established coefficient for a particular water use category.

The use of coefficients has been an established practice to assist water managers in developing estimates for consumptive use by sector. These coefficients may be based on scientific research, knowledge of practices used by different sectors or may be just “rule of thumb” guidelines that have some historical basis for use. In 1988-89, the Technical Work Group of the Water Resources Management Committee conducted an exercise to review and establish coefficients for the nine categories of use of the Regional Water Use Database. The Work Group first reviewed the coefficients used by USGS at the time and then made modifications based on additional information or knowledge of particular water use sectors. The Great Lakes Commission was then asked in 1990 to undertake an analysis of reported consumption based on data submitted to the Repository versus the anticipated consumption derived from the use of the coefficients developed by the states and provinces in the exercise mentioned above.

The table on page 10 presents the consumptive use coefficients for the nine categories of use currently employed by the Regional Water Use Database. The table on page 11 compares the reported consumptive uses within each water category by jurisdiction, with the estimated range of consumptive use using the coefficients from page 10. The reported total consumptive use of 2168.13 mgd (8207.25 mld) in 1998 was proportionally similar to the total consumptive use of 2639.23 mgd (9990.56 mld) in 1993.

The Great Lakes Commission staff with oversight from the Water Withdrawal and Use TSC recently conducted a consumptive use literature review and is preparing a briefing paper on the state of knowledge of consumptive use as part of the WRMDSS project. These products are expected by the fall of 2002. The TSC is also reviewing the current consumptive use coefficients and may recommend some modifications to these coefficients for the next (1999) water use report.

## **Interbasin Diversions of Great Lakes Water**

Interbasin Diversions are defined as water transferred from the Great Lakes Basin into another watershed, thus they are by definition outgoing. Incoming diversion amounts are enclosed in parentheses.

<b><i>INCOMING INTERBASIN DIVERSIONS</i></b>			
<b><u>Source</u></b>	<b><u>Destination</u></b>	<b><u>Quantity</u></b>	<b><u>Purpose</u></b>
	Lake Michigan Basin/Indiana	(2.08) mgd (7.87) mld	Public Supply
	Lake Erie Basin/Ohio	(9.18) mgd (34.75) mld	Other
Albany-James Bay Basin (Long Lake and Ogoki projects)	Lake Superior Basin/Ontario	(1639.38) mgd (6205.72) mld	Hydroelectric
French Creek (Allegheny River Basin)/Borough of North East, PA	Lake Erie Basin (Sixteen Mile Creek)/Pennsylvania	(0.86) mgd (3.26) mld	Public Supply
<b>TOTAL</b>		(1651.5) mgd (6251.6) mld	

<b><i>OUTGOING INTERBASIN DIVERSIONS</i></b>			
<b><u>Source/Location</u></b>	<b><u>Destination</u></b>	<b><u>Quantity</u></b>	<b><u>Purpose</u></b>
Lake Michigan Basin (Illinois Diversion)/Illinois	Mississippi River Basin (Illinois River)	1119.47 mgd 4237.67 mld	Public Supply
Lake Michigan Basin /Illinois	Mississippi River Basin	3.87 mgd 14.66 mld	Domestic Supply
Lake Michigan Basin /Illinois	Mississippi River Basin	2.99 mgd 11.32 mld	Industrial
Lake Michigan Basin/Illinois	Mississippi River Basin	436.46 mgd 1652.19 mld	Other
Lake Erie Basin/Avon Lake, Ohio	Ohio River Basin	.19 mgd .72 mld	Public Supply
Lake Erie Basin/Ravenna, Ohio	Ohio River Basin	.11 mgd .42 mld	Public Supply
<b>TOTAL</b>		1563.09 mgd 5916.98 mld	

Water Use Category	<u>Illinois</u>	<u>Indiana</u>	<u>Michigan</u>	<u>Minnesota</u>	<u>New York</u>	<u>Ohio</u>	<u>Ontario</u>	<u>Pennsylvania</u>	<u>Quebec</u>	<u>Wisconsin</u>	USGS (NY District)
<b>Public Supply</b>	Range for all states and provinces is 10-21%										
<b>Domestic</b>	Range for all states and provinces is 8-15%										
<b>Irrigation*</b>	90%	90%	90%	90%	90%	90%	78%	90%	90%	70%	100%
<b>Livestock</b>	Coefficient for all states and provinces is 80%										
<b>Industrial</b>	For both mfg. & mining varies by plant and SIC code	6%	10%	For both mfg. & mining varies by plant and SIC code	10% for mfg. and mining, except salt mines at 90%	10%	6.8% calculated from reported water losses by individual plant	For both mfg. & mining varies by plant and SIC code	10% for pulp and paper industry	10.20% for both mfg. and mining	10%
<b>Thermoelectric (Fossil Fuel)</b>	Varies by individual plant; est. using makeup water for each system.	2%	1% for plants using once-through cooling; plant-by-plant analysis for wet cooling towers.	Measured; varies by individual plant.		Negligible; estimates based on indiv. plant reports of withdrawals, return flows.	0.9% based on reports of increased local lake evaporation due to discharge of heated water to lakes.	Varies with individual plants.	10%; estimates obtained from USGS report	0.5% - 1%	10%
<b>Thermoelectric (Nuclear)</b>	Varies by individual plant; est. using makeup water for each system.	2%		Measured; varies by individual plant.		14%; based on reports of increased local lake evaporation due to discharge of heated water to lakes.	0.9% based on reports of increased local lake evaporation due to discharge of heated water to lakes.	Varies with individual plants.	10%; estimates obtained from USGS report	0.5% - 1%	10%
<b>Hydroelectric</b>	Coefficient for all states and provinces is 0%										
<b>Other</b>	Varies among states and provinces; based on individual evaluations and best information available										

	<u>Illinois</u>		<u>Indiana</u>		<u>Michigan</u>		<u>Minnesota</u>		<u>New York</u>		<u>Ohio</u>		<u>Ontario</u>		<u>Pennsylvania</u>		<u>Quebec</u>		<u>Wisconsin</u>	
<u>Water Use Category</u>	Rep	Est.	Rep	Est.	Rep	Est.	Rep	Est.	Rep	Est.	Rep	Est.	Rep	Est.	Rep	Est.	Rep	Est.	Rep	Est.
Public Supply	0	114-171	28.98	14.25-21.37	153.52	122.4-183.6	9.4	4.31-6.47	71.06	59.8-89.7	88.29	59.9-89.9	197.0	136.9-205.27	4.47	4.43-6.65	109.9	110-165	56.64	35-52.5
Domestic	0	1.8-2.7	8.14	5.15-7.73	NR	NA	.19	0.4-0.61	12.14	45.6-68.4	8.68	5.97-8.95	15.79	13.36-20.04	.2	0.2-0.3	7.13	7.15-10.74	5.18	3.1-4.7
Irrigation	0	0	23.06	18.54	245.82	213.3	.34	0.2	3.21	9.6	13.31	9.98	46.38	146.06	0.32	0.31	8.3	8.3	33.84	376.25
Livestock	0	0	4.89	7.39	NR	NA	0	0.19	18.51	9.72	10.41	10.5	34.95	42.91	0	0	15.28	15.28	18.98	0.53
Industrial	0	Varies by plant, SIC code	114.71	99.62	68.19	131.8	74.99	Varies by plant, SIC code	90.07	35.1	24.48	20.52	56.18	164.45	8.95	Varies by plant, SIC code	12.55	12.5	40.08	32.8
Thermo--fossil fuels	0	Varies by plant	16.58	20.65	77.37	62.3	3.07	Varies by plant	43.62	na	.03	Varies by plant	30.97	45.02	0	Varies by plant	4.7	4.7	39.05	6.3-12.5
Thermo--nuclear	0	Varies by plant	0	0	3.46	0	0	Varies by plant	67.73	na	20.98	16.59	94.39	112.37	0	0	NA	0	19.66	24.7-49.4
Hydroelectric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	Varies by jurisdiction	0.03	Varies by jurisdiction	0	Varies by jurisdiction	0	Varies by jurisdiction	0	Varies by jurisdiction	0	Varies by jurisdiction	0	Varies by jurisdiction	0	Varies by jurisdiction	NA	Varies by jurisdiction	0	Varies by jurisdiction
TOTAL	0	115.8-173.7	196.39	165.6-175.3	548.36	557.9-619.1	88.0	5.1-7.5	306.34	159.8-212.5	166.18	123.5-156.5	477.63	680.97-738.12	13.94	4.94-7.26	157.86	157.93-216.52	213.43	445.88-528.68

### ***III. JURISDICTION REPORT ANALYSES***

The following summaries of individual state and provincial water uses for 1998 include:

- data on overall water use;
- total water use compared to 1993 figures;
- consumptive use, comparing 1998 to 1993;
- diversions, comparing 1998 to 1993; and
- Basin specific data for states with more than one Great Lakes shoreline.

Questions on individual data collection and reporting programs should be directed to the member of the Technical Work Group for the appropriate jurisdiction (page III).

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#### **Abbreviations**

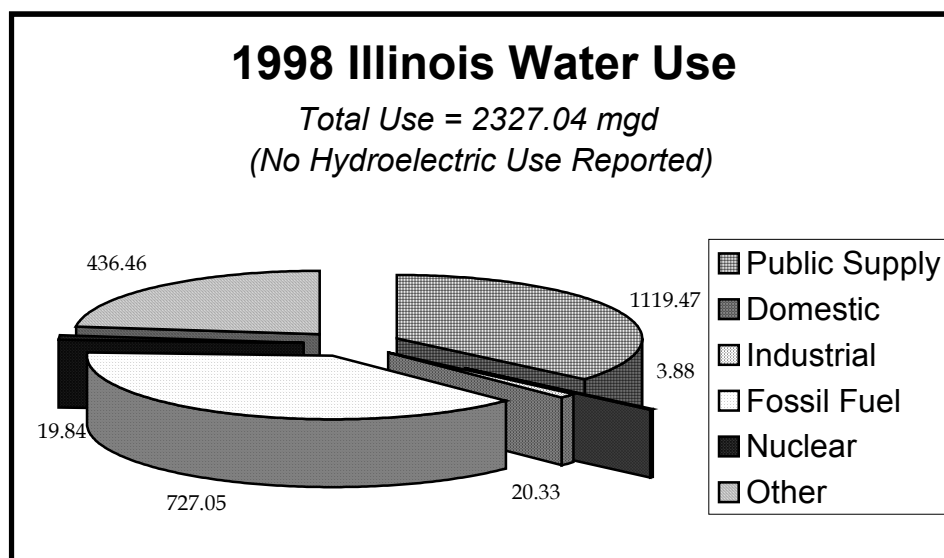
mgd = million gallons per day  
mld = million litres per day  
bgd = billion gallons per day  
bld = billion litres per day  
tgd = trillion gallons per day  
tld = trillion litres per day

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## Illinois

**Data Source:** Water use data for Illinois was provided by the Department of Natural Resources-Office of Water Resources, and the State Water Survey.

**Withdrawals:** Illinois' water withdrawals from Lake Michigan in 1998 totaled 2327.04 mgd, a significant decrease from 4193.67 mgd in 1993. Shut down of the nuclear power plant in Zion, Illinois accounted for a precipitous drop in nuclear power withdrawals (from 1726.11 mgd in 1993 to 19.84 mgd in 1998). Domestic supply withdrawals were also much lower in 1998, down 79% from 1993.



**Consumptive Use:** As in 1993, there was no reported consumption in public supply or in domestic uses. Estimated consumptive use using coefficients would be between 68 mgd-102 mgd for public supply, and 0.4 -0.7 mgd for domestic uses.

**Diversions:** Total diversions from the Lake Michigan Basin in 1998 were 1562.8 mgd, a slight increase over the 1993 figure of 1481.79 mgd. Public water supply accounted for about 77% of these diversions. All diversions for Illinois are outgoing interbasin diversions—water transferred from the Great Lakes Basin into another watershed.

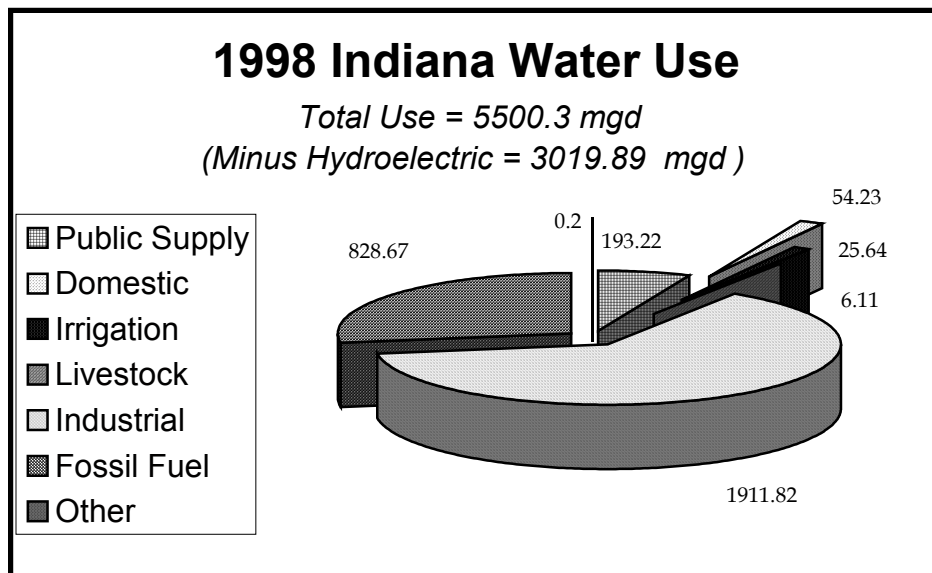
The withdrawal data submitted by the Illinois DNR to the repository were 100 percent measured and 100 percent site-specific.

## Indiana

**Data Source:** The Indiana Department of Natural Resources—Division of Water compiled the 1998 data for the Regional Water Use Database for the Lake Erie and Lake Michigan Basins.

The Indiana Business Research Center at Indiana University provides population estimates for counties used in calculating self-supply domestic withdrawals. The Indiana Agricultural Statistics service at Purdue University provides livestock estimates by county. The local office of USGS Water Resources Division provides estimates of percent of population by county on domestic wells. Hydroelectric data are from 1997.

**Withdrawals:** In 1998, total withdrawals were 5.5 bgd, exceeding the 1993 amount by .18 bgd. As in 1993, more than 99% of the water withdrawn was from Lake Michigan. Hydroelectric use was responsible for 46% of Indiana's Lake Michigan totals, with two plants on the St. Joseph River accounting for 99.5% of the hydroelectric uses. The primary use of Lake Erie withdrawals was public supply, which accounted for more than 69% of withdrawals in this Basin.



**Consumptive Use:** The total consumptive use of water in Indiana's portion of the Great Lakes Basin was 196.39 mgd, up slightly from 1993 figure of 181 mgd. Industrial uses consume the most water in the Lake Michigan Basin (114.05 mgd), and in the Lake Erie Basin public supply accounts for just over 65% of all consumptive use (6.72 mgd of a total of 10.27 mgd).

**Diversions:** Diversions by public water suppliers into Lake Michigan from outside the Great Lakes Basin totaled 2.08 mgd.

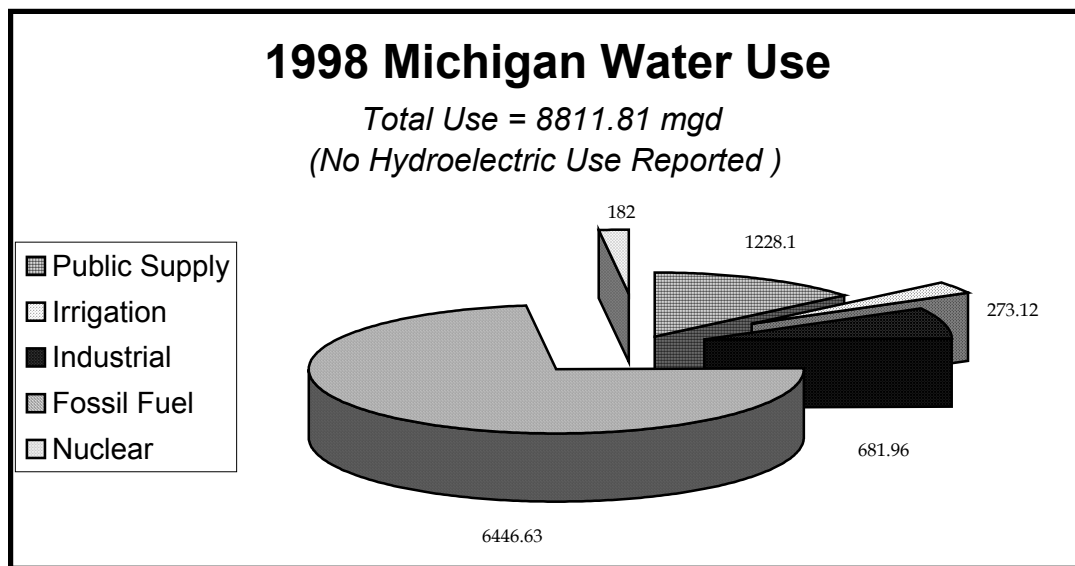
Indiana data for 1998 were 4% measured, 50% partially measured, and 46% calculated or estimated. The level of aggregation was 99% site-specific and 1% aggregated.

## Michigan

**Data Source:** The 1998 water use data for Michigan was submitted to the Regional Water Use Database by the Michigan Department of Environmental Quality (DEQ). All data are reported to the Michigan DEQ by the facilities within each category except Irrigation, which is divided into agricultural and nonagricultural (golf course, park, etc.) irrigation. Agricultural irrigation is estimated using federal Agricultural Census data and a water use estimation model developed for Michigan. Nonagricultural irrigation facilities report directly to the DEQ.

Michigan did not submit water use data for principal facilities in 1998 due to system limitations, the large number of reporting facilities, and lack of staff resources. Most of the data are available within the state database, and staff expects to provide breakdowns by principal facilities in subsequent years.

**Withdrawals:** Reported water withdrawals for the Lake Superior, Lake Michigan, Lake Huron, and Lake Erie Basins of Michigan were approximately 8.81 bgd. Withdrawals from the Lake Erie Basin accounted for about 59% of total withdrawals. Thermoelectric uses for fossil fuel plants were the single largest use, responsible for 47% of the total use.



**Consumptive Use:** Consumptive uses in the Michigan Great Lakes Basin were approximately 548 mgd; irrigation accounted for more than 45% of the total consumptive use. The total reported consumptive use falls slightly below the estimated range of 557.9 mgd-619.1 mgd if coefficients were applied.

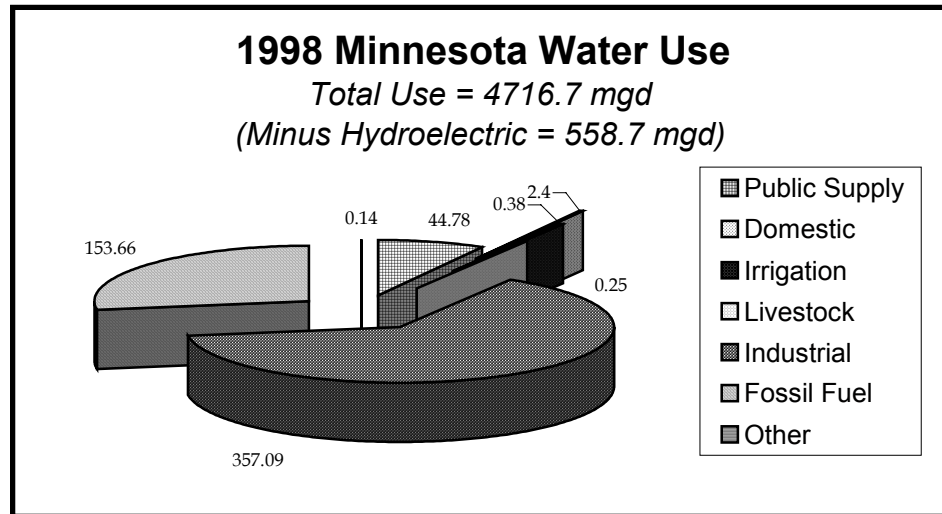
**Diversions:** Not able to report.

Michigan data of base year 1998 were 89% measured, 8% partially measured, 3% estimated, and 100% site-specific.

## Minnesota

**Data Source:** The Minnesota Department of Natural Resources, Division of Waters provides the data on the Lake Superior Basin to the Regional Water Use Database.

**Withdrawals:** Withdrawals from the Lake Superior Basin in 1998 were 4.72 bgd, showing a decrease from 5.03 bgd in 1993. Hydroelectric water use accounts for 88% of Minnesota's total water uses. Of the remainder, industrial uses account for more than half of the water withdrawn.



**Consumptive Use:** Industrial consumptive uses were 75 mgd, or about 21% of the industrial withdrawals. Public supply consumptive uses were 21% of public supply withdrawals (9.3 mgd).

**Diversions:** NA

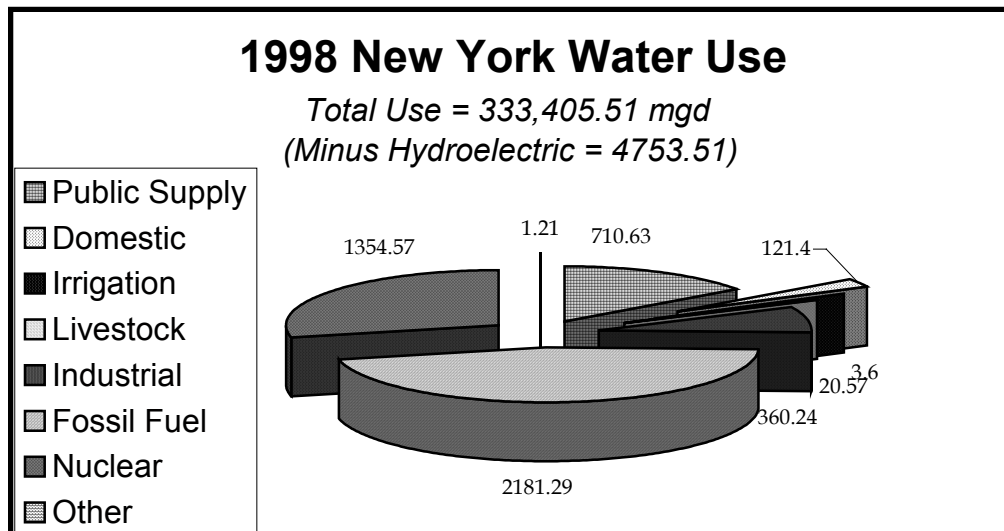
Minnesota water use data were 100% measured and 100% site-specific.

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## *New York*

**Data Source:** Water use data collection in New York is performed by the Department of Environmental Conservation (DEC), the Department of Health, and the U.S. Geological Survey.

**Withdrawals:** In 1998, withdrawals from the Great Lakes totaled 333.4 bgd, an increase from 308.3 bgd in 1993. Excluding hydroelectric uses, the total was 4.75 bgd compared to 5.34 bgd in 1993. St. Lawrence River uses accounted for 57% of the total New York water uses (190 bgd); Lake Ontario and Lake Erie uses were 83.8 bgd and 59.6 bgd respectively. Hydroelectric power is by far the largest water use sector in New York State, with uses of 328.7 bgd, up from 302.9 bgd in 1993.



**Consumptive Use:** New York reported total consumptive uses of 306.3 mgd. Consumptive uses were 119.27 mgd from Lake Erie, 170.4 mgd from Lake Ontario, and 16.62 mgd from the St. Lawrence River. The largest categories of consumptive use were industrial (90.07 mgd) and public water supply (71.06 mgd).

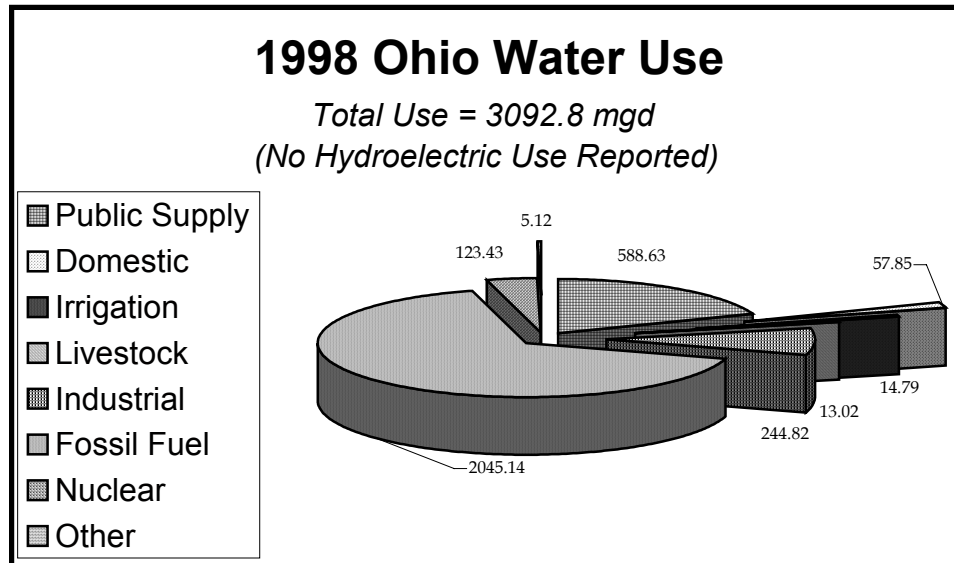
**Diversions:** Not able to report.

For New York, the data reported were 100% partially measured. The level of aggregation was 100% site-specific.

## Ohio

**Data Source:** Water use data for Ohio is collected by the Ohio Department of Natural Resources-Division of Water, the Ohio Environmental Protection Agency, and the U.S. Geological Survey.

**Withdrawals:** Total withdrawals from the Ohio Lake Erie Basin for 1998 were just over 3.09 bgd, lower than the 1993 total of 3.36 bgd. As in 1993, fossil fuel plants and public supply were the two primary water use sectors; thermoelectric-fossil fuel uses accounted for 2.05 bgd or 66% of withdrawals, and public supply uses accounted for 588.63 mgd or about 19%.



**Consumptive Use:** Total consumptive uses were 166.2 mgd. Public supply represents the largest consumptive use sector at 88.29 mgd, accounting for more than 50% of the total. Consumptive uses from nuclear plants and industrial facilities were 24 mgd and 20 mgd respectively.

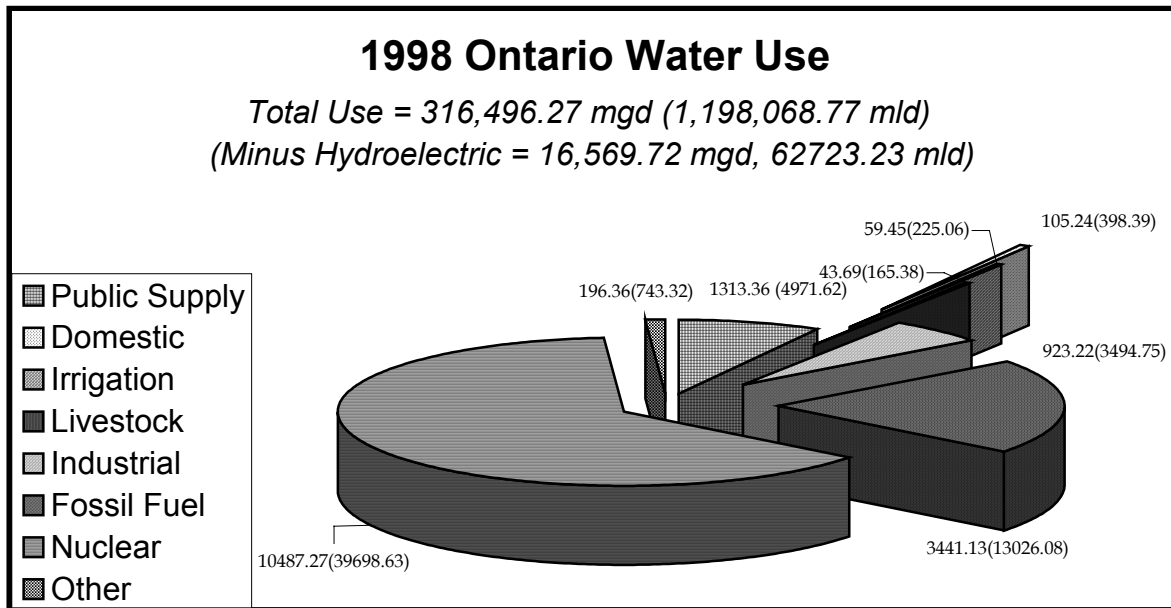
**Diversions:** Diversions by public water suppliers out of the Lake Erie basin totaled 0.3 mgd; diversions into the Lake Erie Basin totaled 9.18 mgd.

The 1998 water use data for Ohio were 100% partially measured while the level of aggregation was 100% site-specific.

## Ontario

**Data Source:** Water use data for Ontario was prepared by the Ontario Ministry of Natural Resources (MNR). Public Supply and Industrial data were collected by Environment Canada and shared with MNR. All categories contain water use data from 1998 except industrial, livestock and irrigation categories, which contain water use data from 1996. Data for some water users is not available, and this database does not represent all water use in the province.

**Withdrawals:** Total 1998 Great Lakes water uses for Ontario were approximately 1.2 tld, or 316.5 bgd. Of this, hydroelectric uses represented more than 95% of the total (1.15 tld, or 299.9 bgd). Of the remainder, thermoelectric—nuclear plant withdrawals were the second largest at 3% (39.7 bld, or 10.49 bgd).



**Consumptive Use:** The reported industrial consumptive use was 220 mld (58.16 mgd). Ontario's total reported consumptive use of 1.81 bld (477.63 mgd) is less than the estimated range of 660.97 to 736.12 mgd derived when applying the consumptive use coefficients.

The following table shows the consumptive uses for all basins utilized by Ontario for 1998.

<i>Basin</i>	<i>Consumptive Uses (bld)</i>	<i>% of Total Use</i>
Superior	.06	4%
Huron	.38	21%
Erie	.37	20%
Ontario	.82	45%
St. Lawrence	.17	10%
<b>TOTAL</b>	<b>1.80</b>	<b>100%</b>

**Diversions:** Ontario reported incoming interbasin diversions for Lake Superior and intrabasin diversions (incoming or outgoing) for Lakes Huron, Erie, and Ontario. These values are represented in the following table; incoming diversion values are negative.

<i>Basin</i>	<i>Interbasin Diversion (bld)</i>	<i>Intrabasin Diversion (bld)</i>
Superior	-6.21	na
Huron	na	-0.04
Erie	na	21.48
Ontario	na	-21.32
<b>TOTAL</b>	-6.21	.12

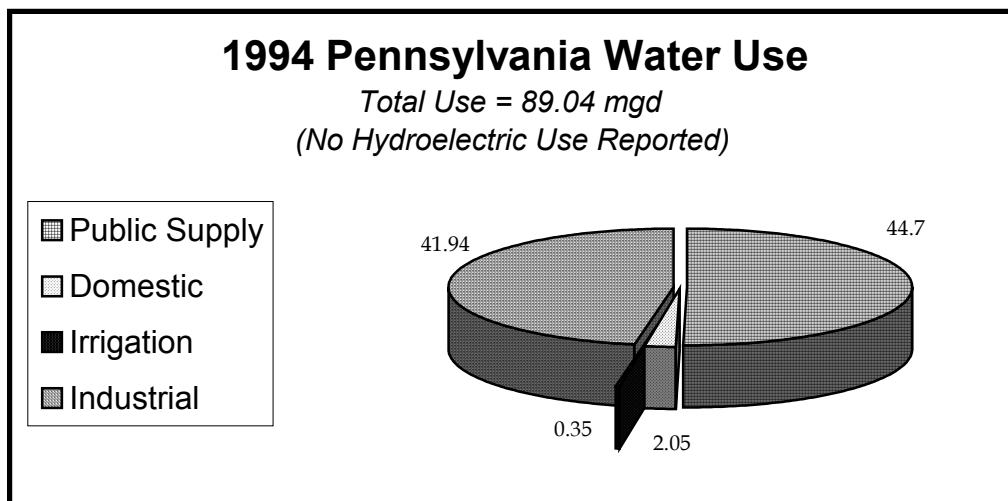
Ontario's withdrawal data for this report were 99.9% partially measured and the level of aggregation was 99.5% site-specific.

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## *Pennsylvania*

**Data Source:** Due to staffing and other programmatic constraints, this report utilizes 1994 data. The Department of Environmental Protection – Bureau of Water Supply and Community Health submitted water use data for the Lake Erie and Lake Ontario Basins of Pennsylvania.

**Withdrawals:** Total withdrawals from the two basins were 89.04 mgd, up from 86.32 mgd in 1993. Industrial uses, which account for more than 47% of withdrawals, increased from 39.6 mgd in 1993, to 41.9 mgd in 1994. Nearly 100% of withdrawals were from the Lake Erie Basin (88.87 mgd).



**Consumptive Use:** Consumptive use totaled 13.94 mgd, up from 13.01 mgd in 1993. The consumptive use from Lake Ontario was negligible at 0.02 mgd, in comparison to a consumptive use of 13.93 mgd from the Lake Erie Basin.

**Diversions:** NA

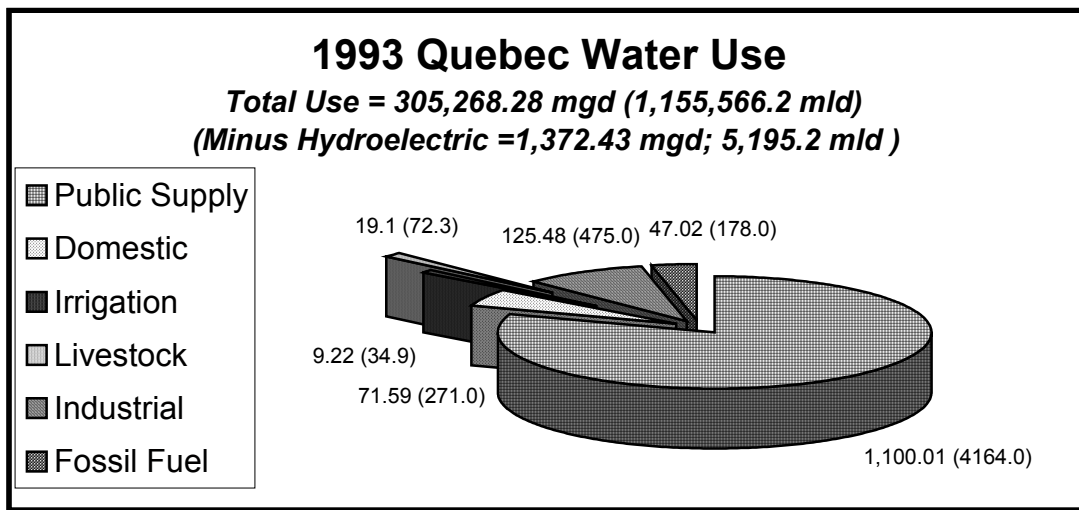
The Pennsylvania 1994 data were 50% measured and 50% estimated, with a 98% site-specific level of aggregation.

## Quebec

**Data Source:** Due to staffing and other programmatic constraints, this report utilizes 1993 data. The Ministre de l'Environnement—Centre d'expertise hydrique du Quebec provided Quebec water use data.

**Withdrawals:** Water uses in Quebec's St. Lawrence River Basin were approximately 1.15 tld (305 bgd) in 1998. Nearly 100% of these uses were for hydroelectric power purposes. There continues to be an increase in industrial withdrawals, as reflected in the most recent available figures.

Because the processing of water use data occurs within eight provincial ministries, eight federal ministries and all municipalities in the Great Lakes Basin in Quebec, data collection and reporting is logistically difficult. Quebec's water reporting structure is also not currently designed to focus specifically on water use and withdrawal information; however, a new water management policy is under consideration.



**Consumptive Use:** Total consumptive use in 1993 was 597.55 mld (157.9 mgd). Public supply accounted for 416 mld (109.9 mgd), or nearly 70% of the total consumptive use.

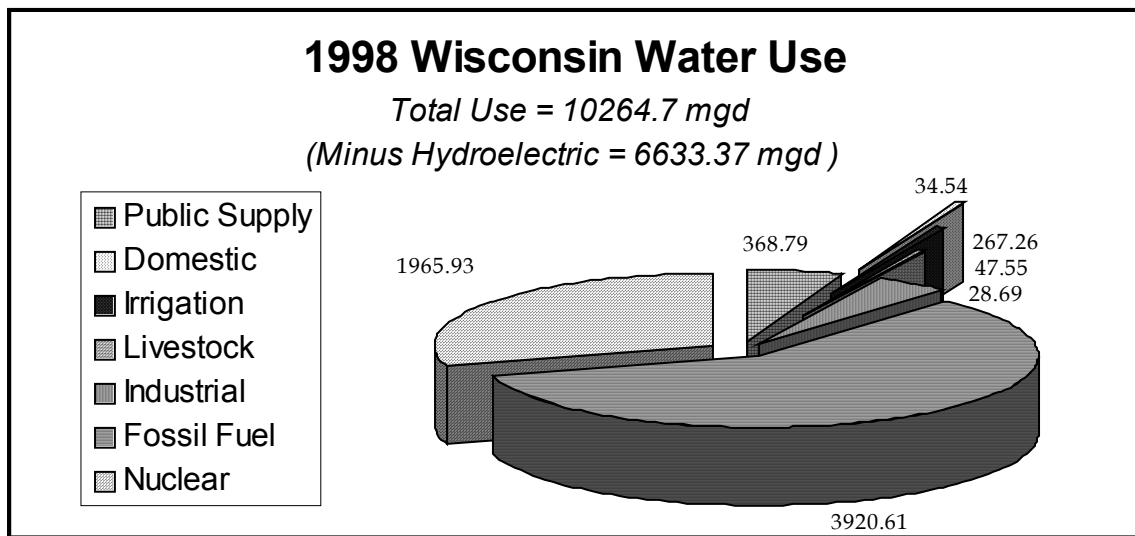
**Diversions:** NA

The Quebec water use data for 1993 were 99.5% measured and 0.5 % partially measured. The level of aggregation was 100% site-specific.

## Wisconsin

**Data Source:** 1998 water use data for the Lake Michigan and Lake Superior Basins of Wisconsin were submitted by the Wisconsin Department of Natural Resources—Bureau of Water Resources Management.

**Withdrawals:** Withdrawals from Lake Michigan and Lake Superior Basins totaled 10.3 bgd, a decrease of 1.6 bgd from 1993 figures. More than 97% of the total withdrawals were from the Lake Michigan Basin; only 236.5 mgd were withdrawn from Lake Superior. Of the Lake Superior uses, 209.4 mgd or 88% were for hydroelectric purposes. Water uses in the Lake Michigan Basin were primarily for fossil fuel and hydroelectric power purposes—at 39% and 34% of total use respectively.



**Consumptive Use:** 98% of Wisconsin's 1998 consumptive uses were from the Lake Michigan Basin (208.8 mgd). Of this amount, consumptive uses from public supply, industrial, fossil fuel, and irrigation were 56.6 mgd, 40.1 mgd, 39.1 mgd, and 33.8 mgd respectively.

**Diversions:** NA

Wisconsin's 1998 water use data were 100% calculated or estimated. The level of aggregation was 100%.

## ***IV. APPENDIX***

### **GREAT LAKES BASIN SUMMARY REPORTS**

Jurisdiction Summary Report  
Basin Summary Report  
Water Use Category Summary Report

#### **JURISDICTION REPORTS**

- |              |                 |
|--------------|-----------------|
| 1. Illinois  | 6. Ohio         |
| 2. Indiana   | 7. Ontario      |
| 3. Michigan  | 8. Pennsylvania |
| 4. Minnesota | 9. Quebec       |
| 5. New York  | 10. Wisconsin   |

*There are 3 reports for each jurisdiction:  
Withdrawals, Diversions and Consumptive Uses  
Withdrawals by Source  
Jurisdiction Totals*

#### **BASIN REPORTS**

- |                  |                       |
|------------------|-----------------------|
| 1. Lake Superior | 4. Lake Erie          |
| 2. Lake Michigan | 5. Lake Ontario       |
| 3. Lake Huron    | 6. St. Lawrence River |

*There are 3 reports for each basin:  
Withdrawals, Diversions and Consumptive Uses  
Withdrawals by Source  
Basin Totals*

#### **WATER USE CATEGORY REPORTS**

- |                                        |                                                    |
|----------------------------------------|----------------------------------------------------|
| 1. Public Supply-Domestic & Industrial | 5. Self Supply-Industrial                          |
| 2. Self Supply-Domestic                | 6. Self Supply-Thermoelectric Power, Fossil Fuel   |
| 3. Self Supply – Irrigation            | 7. Self Supply-Thermoelectric Power, Nuclear Power |
| 4. Self Supply-Livestock               | 8. Self Supply Hydroelectric Power                 |
|                                        | 9. Other                                           |

*There are 2 reports for each water use category:  
Water Use by Jurisdiction  
Water Use by Basin*

#### **DATA QUALITY REPORTS**

- |                                            |                                               |
|--------------------------------------------|-----------------------------------------------|
| 1. Level of Accuracy by Jurisdiction       | 4. Level of Aggregation by Jurisdiction       |
| 2. Level of Accuracy by Basin              | 5. Level of Aggregation by Basin              |
| 3. Level of Accuracy by Water Use Category | 6. Level of Aggregation by Water Use Category |