Annual Report of the Great Lakes Regional Water Use Database

Representing 2016 Water Use Data

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Acknowledgments

The Great Lakes Commission thanks the states and provinces for their commitment in collecting and reporting the water use data included in this report. Appreciation is extended to Jim Casey (Illinois), Allison Mann (Indiana), Andrew LeBaron (Michigan), Sean Hunt (Minnesota), Rich Kruzansky (New York), Mike Hallfrisch and Leonard Black (Ohio), Jonathan Staples (Ontario), Michael Hill (Pennsylvania), Marc-Olivier Bédard (Québec), and Shaili Pfeiffer (Wisconsin) for their time and effort in preparing and reviewing the 2016 water use data included in this report. Special thanks go to the Conference of Great Lakes and St. Lawrence Governors and Premiers for their financial support of this effort and their input in the review of this report.

Preface

This is the Annual Report of the Great Lakes-St. Lawrence River Regional Water Use Database, representing 2016 water use data. These data are provided by the Great Lakes-St. Lawrence River states and provinces to the Great Lakes Commission (GLC), which serves as the database repository, under the Great Lakes-St. Lawrence River Basin Water Resources Compact (Compact) and the Great Lakes St. Lawrence River Basin Sustainable Water Resources Agreement (Agreement).

The Great Lakes-St. Lawrence River Regional Water Use Database has been operational since 1988. It was established by the states and provinces in response to a provision of the 1985 Great Lakes Charter, which called for the establishment and maintenance of a regional system for the collection of data on major water uses, diversions and consumptive uses in the binational Great Lakes-St. Lawrence River Basin (Basin). The Charter (a precursor to the Compact and Agreement) was a non-binding, “good faith” agreement signed by the Great Lakes governors and premiers that set forth a series of principles and procedures for strengthening water management activities in the Basin. The Charter envisioned a centralized database as an important tool to support a regional water resources management program that guides the future development, management and conservation of the water resources of the Basin. In 1988, the GLC was selected to serve as the repository for the regional water use database. The maintenance and operation of the database has been provided by the GLC since that time, in partial fulfillment of the Charter obligations and since 2009 supporting the requirements under the Compact and Agreement through a new set of water use data collection and reporting protocols.

In 2008, to help implement the needed improvements in jurisdictional water use data collection and reporting programs, the Conference of Great Lakes and St. Lawrence Governors and premiers (formerly the Council of Great Lakes Governors), through its Great Lakes Water Use Information Initiative, led the states and provinces through a process that culminated in the drafting of new water use data collection and reporting protocols. The Compact Council and Regional Body adopted the new protocols in 2009. The protocols offer guidance to ensure that water use data provided to the database by the states and provinces is accurate, of the highest quality, and reported in a common and consistent manner. The 2016 annual water use report presents the fifth dataset that was assembled using the 2009 water use data collection and reporting protocols.

While the common data protocols are an important step in support of a more robust regional water management regime, it is recognized that improvements in data collection, reporting, quality, accuracy and compatibility must continue to occur. The following section describes the progress made in 2017 to improve data quality and describes the quality of the data for the 2016 annual report.

Overview

Improving Data Quality

Together with the Conference of Great Lakes-St. Lawrence Governors and Premiers, the GLC is working with the Great Lakes and St. Lawrence River states and provinces to improve data collection, reporting, quality, accuracy, and compatibility. To guide the preparation of 2016 data and this report, several steps have been made to improve data quality.

Starting with the 2014 water use year, GLC collected information from each jurisdiction that describes water use data and includes information related to data sources, reporting compliance rates by water use sector, documenting the year for which the data is collected, any significant changes in the data between the current year and previous years, and describing reasons for those changes. To achieve this, GLC created an online data management system that assists in the creation of metadata. For this report, the states and provinces have submitted metadata along with the associated 2016 water use data to the GLC. Project staff met by phone with representatives from each jurisdiction to discuss year to year changes in compliance and reported water use. Implementing this process and the follow up phone meetings has resulted in improvements to the database in both compliance and data quality.

The GLC will continue to work with the states and provinces to identify additional areas for improvement. While this report contains the best available information as of its publishing date, the states and provinces may continue to update their data which is maintained in the online water use database (https://waterusedata.glc.org/). Discrepancies between the data online and those summarized in this report may appear. In all cases, the online database will contain the best-available data.

In compiling this report, the project team noted specific steps taken by each jurisdiction to improve reporting compliance and data quality. In particular, Ohio has very high rates of compliance supported by cooperation from their Office of the Attorney General, which encourages compliance by communicating directly with water use permit holders. Similarly, Minnesota's compliance program successfully emphasizes permit holders' obligations to report their water withdrawals. Low rates of compliance are typically associated with new reporting programs that are still being established within each jurisdiction.

Data Reporting by Jurisdiction

The states and provinces have water use reporting programs in place that require water users to report their water use each year to their jurisdiction. The reporting compliance, (i.e., the percentage of water users submitting the required water use reports to the jurisdiction), varies across the Basin by jurisdiction and water use sector, affecting the quality of the data. Minnesota and Ohio report a 100 percent reporting compliance for all sectors. Wisconsin recently developed a new reporting system and is still rolling it out to all sectors, reducing their expected compliance rate. Québec is still developing its reporting program so reporting compliance could not be calculated for the commercial and institutional, livestock and other self-supply sectors. Table 1 summarizes reporting compliance rates by jurisdiction.

Table 1. Reporting Compliance to the Jurisdiction by Water Use Sector

Sector	IL	IN	MI	MN	NY	OH	ONT	PA	QC	WI
Public Water Supply	100	94	99	100	94	100	99	87	100	99
Self-Supply Commercial & Institutional	100	89	85	100	89	100	97	100	N/A**	96
Self-Supply Irrigation	33	94	75	100	98	100	97	80	N/A	96
Self-Supply Livestock	-	100	75	100	80	100	99	90	N/A	96
Self-Supply Industrial	100	98	85	100	94	100	91	89	100	96
Self-Supply Thermoelectric Power Production (Once-through cooling)	100	100	95	100	92	100	95	-	-	100
Self-Supply Thermoelectric Power Production (Recirculated cooling)	-*	100	95	100	92	100	-	-	-	100
Off-Stream Hydroelectric Power Production	-	-	-	100	100	100	-	-	-	-
In-Stream Hydroelectric Water Use	-	-	-	100	100	-	92	-	-	-
Other Self-Supply	100	93	85	100	100	100	98	-	N/A	97

**A blank indicated that the jurisdiction did not report any water use figures for that particular sector.*

***N/A indicated that reporting compliance percentage could not be calculated.*

Great Lakes Regional Water Use for 2016

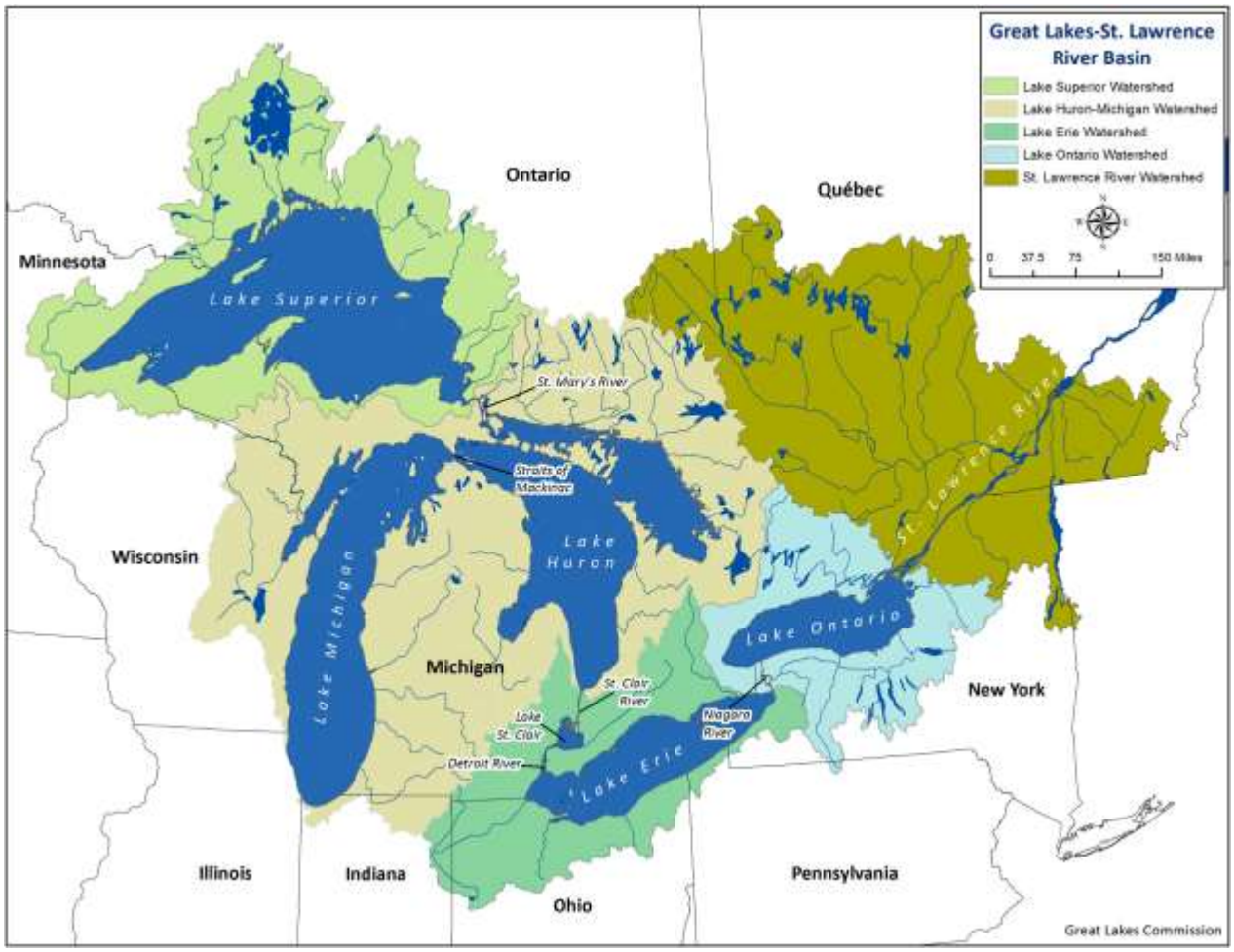

Figure 1. Great Lakes-St. Lawrence River Basin

The Great Lakes and the St. Lawrence River – the world's largest freshwater system – span an area of 289,600 square miles (750,000 square kilometers). Its total volume is 6.5 quadrillion gallons (25 quadrillion liters), an amount that would fill 9 billion Olympic size swimming pools.[1]

In 2016, the total reported withdrawal amount for the Great Lakes-St. Lawrence River Basin, excluding in-stream hydroelectric water use, was 42,246 million gallons per day (mgd) or 159,916 million liters per day (mld). This total represents a 1.1 percent decrease from the 2015 reported total withdrawal amount of 42,714 mgd (161,690 mld). Nearly five percent of the total reported amount withdrawn (2,106 mgd or 7,972 mld) was consumed or otherwise lost to the basin.

Water withdrawals for all water use sectors, excluding the in-stream hydroelectric water use sector, are presented in Figure 2 below. The water use sectors are defined in Appendix B. Thermoelectric power production, public water supply, and industrial use are the primary water use sectors, (i.e., those withdrawing the largest volumes of water).

[1] An Olympic size swimming pool holds at least 2.5 million liters.

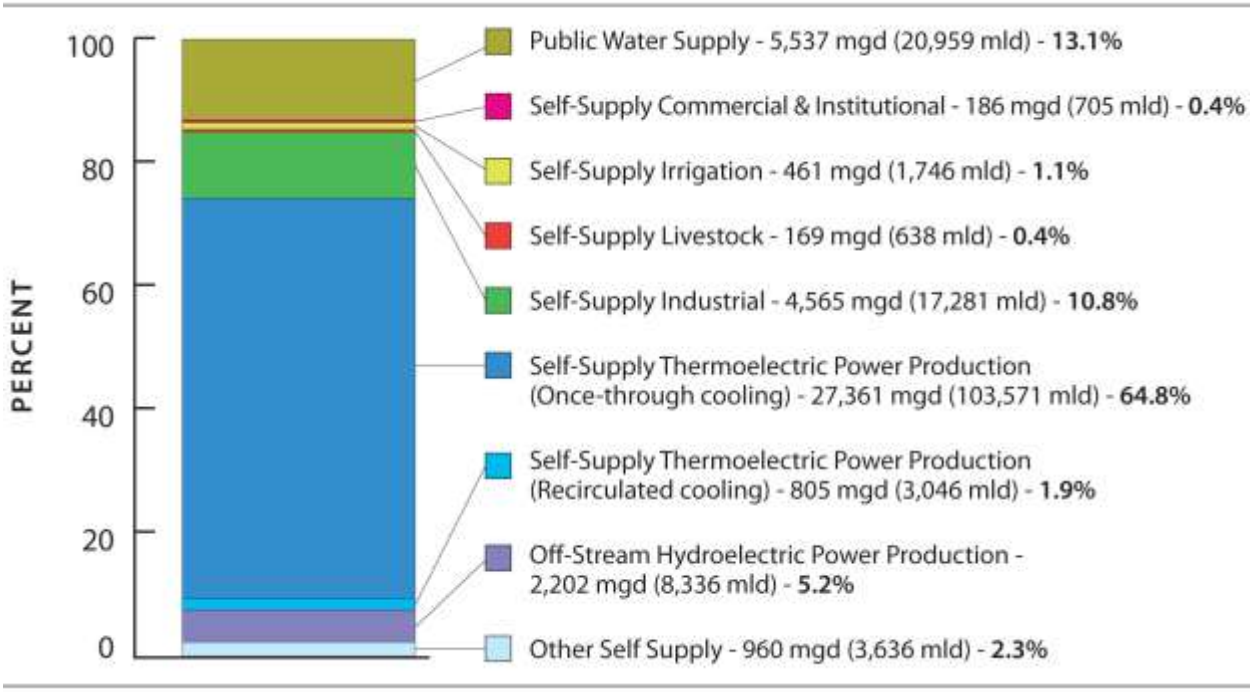

Figure 2. Water Withdrawals by Water Use Sector (excluding in-stream hydroelectric water use)

The Lake Michigan watershed has the greatest withdrawal, followed by Lakes Ontario and Huron, respectively. Figure 3, below, shows withdrawals by watershed broken down by water source: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW).

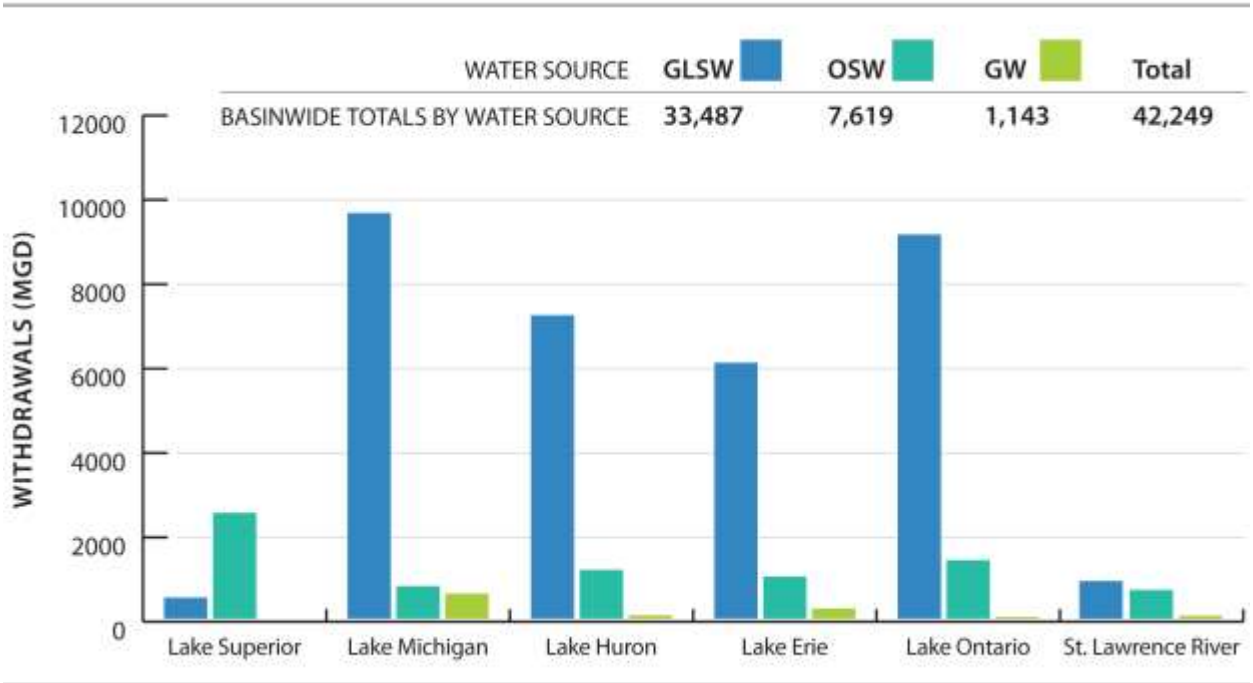

Figure 3. Water Withdrawals by Watershed in mgd (excludes in-stream hydroelectric water use)

Figure 4 shows total withdrawals excluding in-stream hydroelectric water use by jurisdiction. It should be noted withdrawals are not a measure of water consumed or lost to the basin, as much of the withdrawn water is returned to the basin after use. Ontario, which has the largest land area of the ten jurisdictions (108,680 square miles or 281,377 square kilometers), spanning five watersheds was the largest withdrawer of Great Lakes water. Facilities in Ontario withdrew 16,524 mgd (62,548 mld) or 39 percent of the total withdrawal amount across all jurisdictions. In contrast, Pennsylvania, which has the least land area (508 square miles or 1316 square kilometers), withdrew just 39 mgd (147 mld).

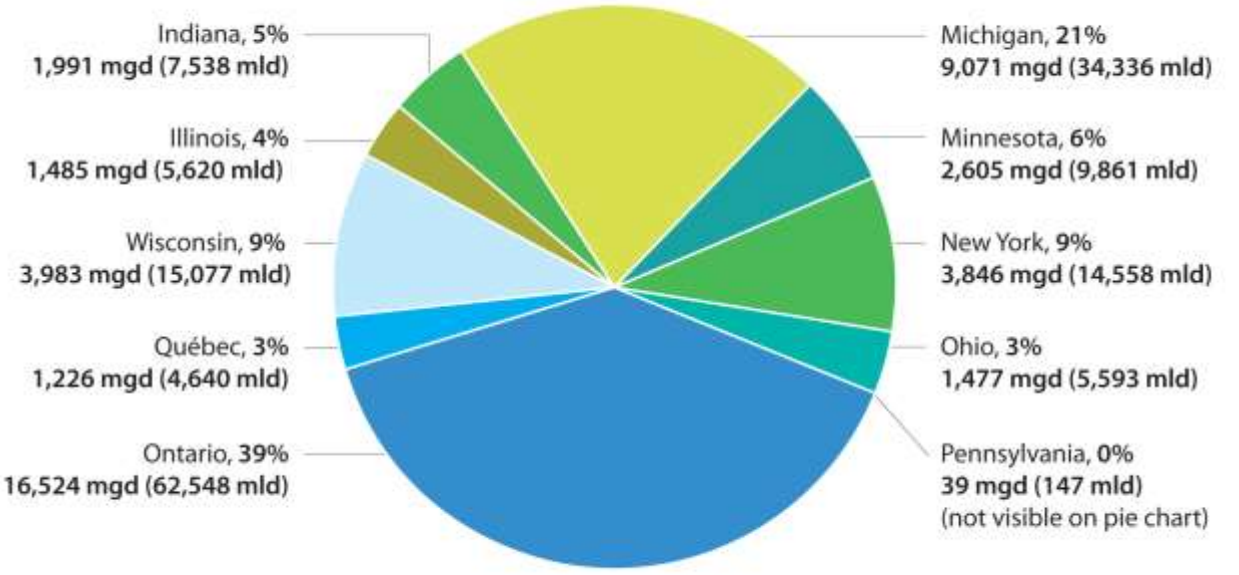

Figure 4. Water Withdrawals by Jurisdiction (excludes in-stream hydroelectric water use)

Figure 5 shows total water withdrawals by jurisdiction over the past five years (excluding in-stream hydroelectric water use). Water use in each jurisdiction has generally decreased or stayed steady over the past five years. Variances from this general trend are typically explained by one or two large water users in those jurisdictions using more or less water from previous years. Figure 6 shows total consumptive use by jurisdiction over the past five years. Consumptive use in each jurisdiction follows a similar decreasing or steady trend seen in overall water use. Because each water use sector has different consumptive use factors, changes in the composite makeup of each jurisdiction's water withdrawals can impact trends in consumptive use.

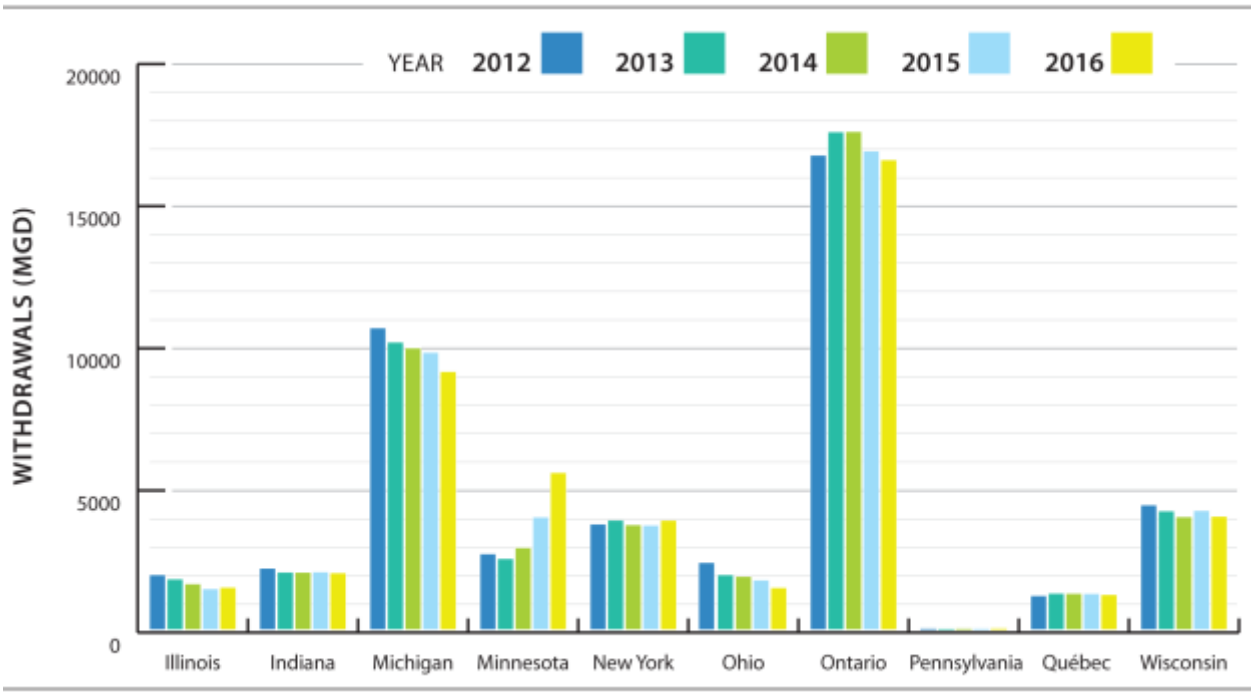

Figure 5. Water withdrawals by jurisdiction over the past five years.

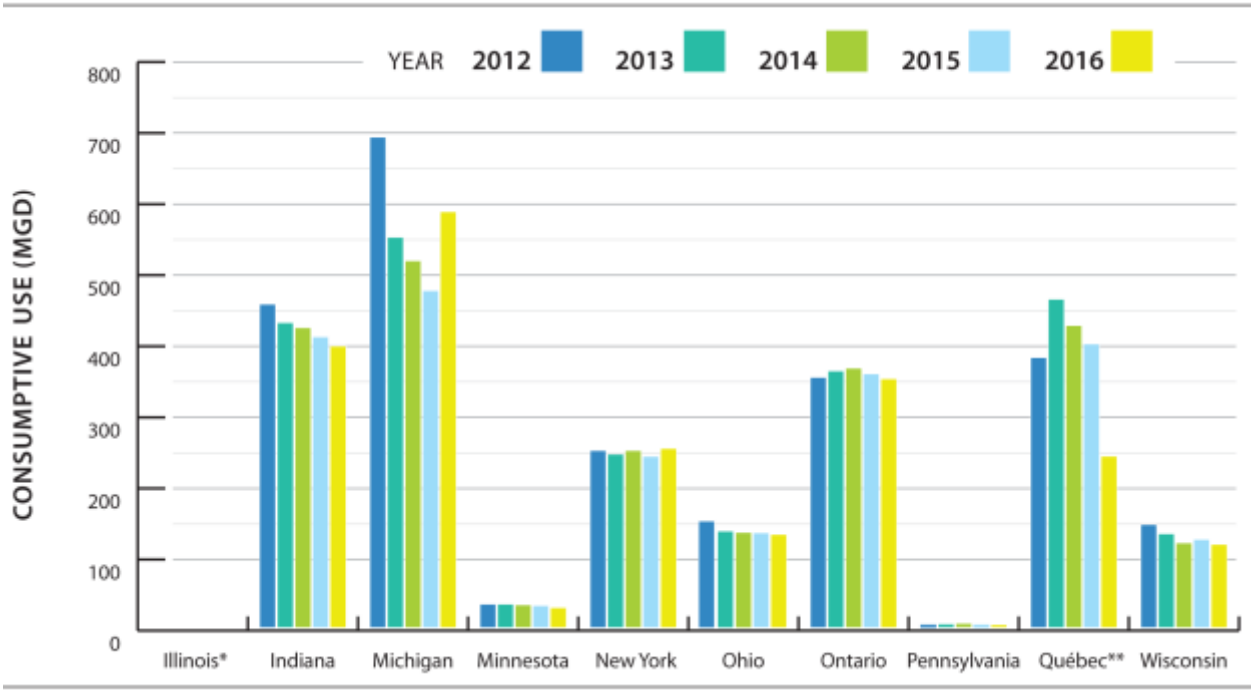

Figure 6. Consumptive use by jurisdiction over the past five years.
** Illinois' overall consumptive use is negligible because the consumptive use resulting from the Chicago diversion, which accounts for the majority of Illinois overall water use, is included in the jurisdiction's diversion reporting.*
*** Québec's overall consumptive use decrease from 2015 to 2016 is the result of a change to the jurisdiction's consumptive use factor for public water supply, which is Québec's primary reported water use.*

For most jurisdictions, self-supply irrigation water use is variable from year-to-year. Figure 7 shows self-supply irrigation water use for each jurisdiction over the past five years. Varying precipitation patterns across the basin explain the fluctuations in water use from this sector. For example, while self-supply irrigation water use may have gone down in Wisconsin in 2016, it increased in Michigan. This was the result of Michigan experiencing less precipitation compared to previous years (i.e. 2016 was a dry year for parts of Michigan), while Wisconsin experienced more (i.e. 2016 was a wet year for parts of Michigan). Three jurisdictions (Illinois, Minnesota, and Pennsylvania) reported negligible water use from the self-supply irrigation sector.

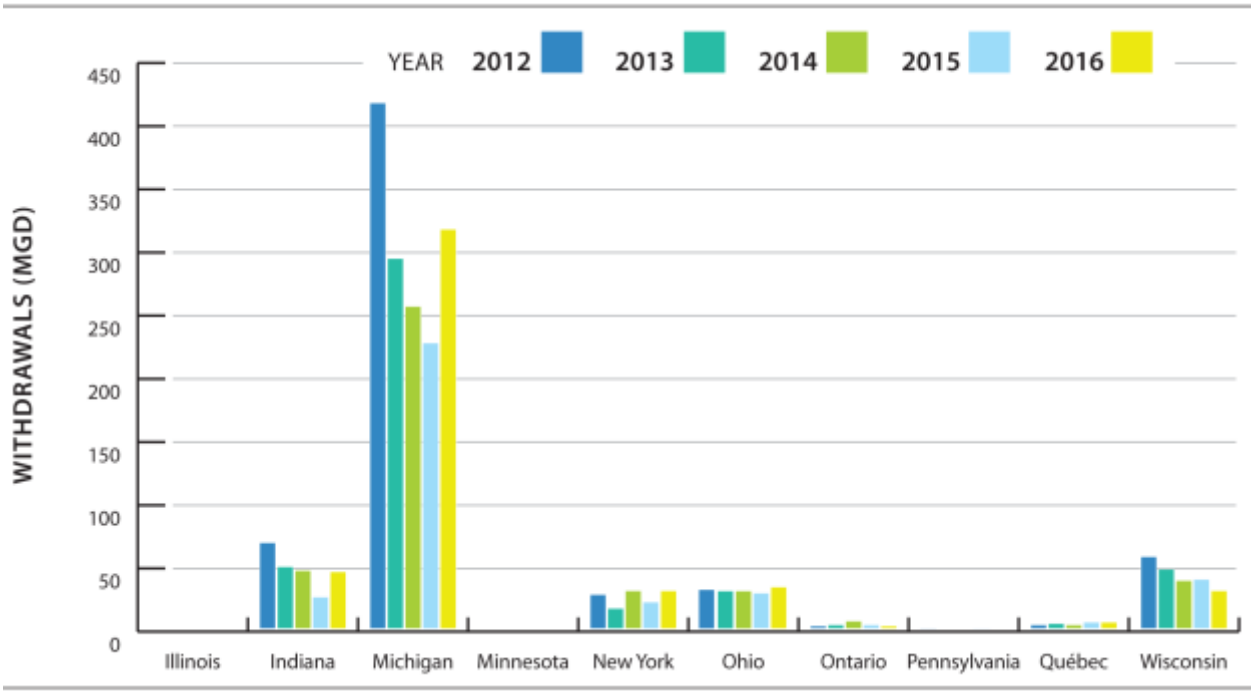

Figure 7. Self-supply irrigation water use for each jurisdiction over the past five years.

Hydroelectric Power Generation

Water use for hydroelectric power generation (both in-stream and off-stream) is the largest single sector of water use, typically representing more than 95 percent of the region's total water use. In-stream hydroelectric power production continues to be a major water use for the Great Lakes-St. Lawrence River region (e.g., New York produced more hydroelectric power than any other state east of the Rocky Mountains in 2011[2]). Under the 2009 water use data collection and reporting protocols, the reporting of in-stream hydroelectric power production data became optional so the database and report do not represent this water use by all jurisdictions. In-stream hydroelectric power water use is not considered a withdrawal because the water remains in the water body and has negligible water consumption.

Off-stream hydroelectric power generation is considered a withdrawal since the water is removed to a retention area or a reservoir that serves as a storage system. This storage substantially increases the surface area of the water body, and in so doing, increases the evaporation resulting in a consumptive use of water. After being used for power generation, the water is returned to the original water source. Both off-stream

[2] U.S. Energy Information Administration. 2012. http://www.eia.gov/state/?sid=NY

and in-stream totals are mentioned in the watershed and jurisdiction summaries in this report, but are typically left out of the overall discussion in those sections. In 2016, a total withdrawal of 2,202 mgd (8,336 mld) was reported for the off-stream hydroelectric power production sector, contrasting with 2015 reported data of 1,272 mgd (4,815 mld).

Diversions and Consumptive Uses

Diversions and consumptive uses of water are key components of the regional water use database. See Appendix A for the Compact's and Agreement's definitions of these terms. These reflect water not returned to the source watershed. These water use data are considered particularly informative for assessing the cumulative hydrologic effects of water use in the region.

The total reported 2016 diversion out of the Great Lakes-St. Lawrence River Basin was 1,158 mgd or 4,382 mld. More than 86 percent (993mgd, 3,757 mld) of this amount was associated with the Illinois diversion, which takes water from Lake Michigan and discharges it into the Mississippi River watershed. The reported amount associated with the Illinois diversion decreased by 7 percent compared to the 2015 reported amount of 1,044 mgd (3,952 mld). Smaller diversions throughout the region make up the balance of the total, and some of the diverted water is returned to the source watershed as return flow. There are a number of diversions into the Basin, including the Long Lac and Ogoki diversions (incoming diversions from the Hudson Bay watershed into northern Lake Superior) which contributed 3,504 mgd (13,262 mld) to the entire Basin in 2016. This is a slight decrease from the 2015 reported amount of 4,063mgd (15,401 mld). Despite this decrease, the inflow from the Long Lac and Ogoki diversions is well within the range of flow variability observed from 1944-2015. The flow from these diversions has ranged from 1,643 mgd (6,219 mld) to 5,181 mgd (19,612 mld).[3] When conditions in the Long Lac and Nipigon (downstream of Ogoki) watersheds are wet, the diversions are often reduced, and water that otherwise would have been diverted into Lake Superior is instead directed through natural outlets that flow toward Hudson Bay. Conversely, when conditions are dry in the downstream watersheds, the diversion flow may be higher. Overall, the net diversion, i.e., incoming diversions minus outgoing diversions, is a gain of 2,357 mgd[4] (8,921 mld), meaning that more water is diverted into the Basin than is diverted out of the Basin.

Consumptive use is that portion of the water withdrawn or withheld from the Basin that is lost or otherwise not returned to the Basin due to evaporation, incorporation into products or other processes. Consumptive use is most often calculated by applying a consumptive use coefficient to the reported withdrawal amount. The database documents the consumptive use coefficient used for each water withdrawal and the consumptive use that was determined through measurement. The total reported consumptive use for the Basin was 2,106 mgd (7,971 mld) – a ten percent drop from the 2015 total consumptive use amount of 2,331 mgd (8,824 mld). The industrial at 656 mgd (2,482 mld) and public water supply at 625 mgd (2,366 mld) were primary contributors to the total consumptive use amount. At 807 mgd (3,054 mld), the Lake Michigan watershed had the largest consumptive use total among the five lake watersheds and the St. Lawrence River watershed.

Considering both consumptive use and diversions in 2016, the Basin gained 251 mgd (950 mld). In comparison, in 2015 the Basin gained 541 mgd (2,046 mld). Tables 2a to 4b summarize water withdrawals, diversions and consumptive uses by watershed, sector, and jurisdiction for 2016.

[3] Information on the flow variability of the Long Lac and Ogoki diversions was provided by Ontario Power Generation.
[4] The Great Lakes Regional Water Use Database records all incoming diversions with a negative sign and all outgoing diversions with a positive sign.

Table 2a. Basin 2016 Water Use Data Summary by Watershed in mgd [5]

Watershed	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Lake Superior	517	38,877	18	39,412	0	-3,490	47
Lake Michigan	9,634	791	616	11,041	0	1,088	807
Lake Huron	31,167	16,319	99	47,584	42	0	148
Lake Erie	55,055	1,557	258	56,871	3,624	-3	466
Lake Ontario	50,268	98,063	60	148,391	-3,662	41	359
St. Lawrence River	161,969	50,018	92	212,080	0	7	279
Total	308,610	205,625	1,143	515,379	4	-2,357	2,106

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 2b. Basin 2016 Water Use Data Summary by Watershed in mld

Watershed	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Lake Superior	1,957	147,165	67	149,189	0	-13,212	179
Lake Michigan	36,467	2,995	2,332	41,794	2	4,120	3,054
Lake Huron	117,978	61,774	375	180,127	157	0	558
Lake Erie	208,407	5,895	978	215,281	13,717	-10	1,762
Lake Ontario	190,287	371,209	226	561,722	-13,861	156	1,361
St. Lawrence River	613,120	189,339	350	802,809	0	25	1,056
Total	1,168,217	778,376	4,328	1,950,921	15	-8,921	7,971

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

[5] Note: For readability, withdrawals, consumptive use and diversions out of the basin are shown as positive values. Negative diversion values indicate water flows into the respective watershed.

Table 3a. Basin 2016 Water Use Data Summary by Sector in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	4,341	744	453	5,537	4	919	625
Self-Supply Commercial & Institutional	17	156	12	186	0	2	26
Self-Supply Irrigation	2	147	312	461	0	0	408
Self-Supply Livestock	1	105	63	169	0	0	16
Self-Supply Industrial	2,933	1,349	283	4,565	0	37	656
Self-Supply Thermoelectric Power Production (Once-through cooling)	25,249	2,110	2	27,361	0	0	259
Self-Supply Thermoelectric Power Production (Recirculated cooling)	768	32	4	805	0	13	80
Off-Stream Hydroelectric Power Production	0	2,202	0	2,202	0	0	0
In-Stream Hydroelectric Water Use	275,124	198,009	0	473,133	0	-3,504	0
Other Self Supply	177	770	13	960	0	177	36
Total	308,610	205,625	1,143	515,379	4	-2,357	2,106

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 3b. Basin 2016 Water Use Data Summary by Sector in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	16,431	2,815	1,713	20,959	15	3,479	2,366
Self-Supply Commercial & Institutional	66	592	47	705	0	7	97
Self-Supply Irrigation	6	557	1,183	1,746	0	0	1,545
Self-Supply Livestock	3	397	239	638	0	-1	62
Self-Supply Industrial	11,101	5,107	1,072	17,281	0	140	2,482
Self-Supply Thermoelectric Power Production (Once-through cooling)	95,577	7,987	7	103,571	0	0	981
Self-Supply Thermoelectric Power Production (Recirculated cooling)	2,907	123	17	3,046	0	48	302
Off-Stream Hydroelectric Power Production	0	8,336	0	8,336	0	0	0
In-Stream Hydroelectric Water Use	1,041,456	749,547	0	1,791,004	0	-13,262	0
Other Self Supply	670	2,917	50	3,636	0	669	136
Total	1,168,217	778,376	4,328	1,950,921	15	-8,921	7,971

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 4a. Basin 2016 Water Use Data Summary by Jurisdiction (includes in-stream hydro) in mgd

Jurisdiction	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Illinois	1,485	0	0	1,485	0	993	0
Indiana	1,817	76	99	1,991	0	84	396
Michigan	7,263	1,253	555	9,071	0	0	585
Minnesota	240	5,276	6	5,522	0	13	28
New York	135,523	82,246	37	217,806	0	45	252
Ohio	990	411	76	1,477	0	-11	131
Ontario	156,970	115,619	191	272,780	4	-3,504	350
Pennsylvania	33	3	3	39	0	0	4
Québec	788	370	68	1,226	0	3	241
Wisconsin	3,501	372	110	3,983	0	20	117
Total	308,610	205,625	1,143	515,379	4	-2,357	2,106

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 4b. Basin 2016 Water Use Data Summary by Jurisdiction (includes in-stream hydro) in mld

Jurisdiction	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Illinois	5,620	0	0	5,620	0	3,757	1
Indiana	6,878	286	374	7,538	0	319	1,500
Michigan	27,492	4,743	2,100	34,336	2	0	2,216
Minnesota	908	19,973	22	20,902	0	50	107
New York	513,011	311,335	139	824,485	0	169	956
Ohio	3,748	1,556	289	5,593	0	-40	497
Ontario	594,195	437,665	724	1,032,584	14	-13,262	1,326
Pennsylvania	126	11	10	147	0	0	15
Québec	2,984	1,400	256	4,640	0	12	911
Wisconsin	13,254	1,400	415	15,077	0	74	443
Total	1,168,217	778,377	4,328	1,950,921	15	-8,921	7,971

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Watershed Summaries

Lake Superior

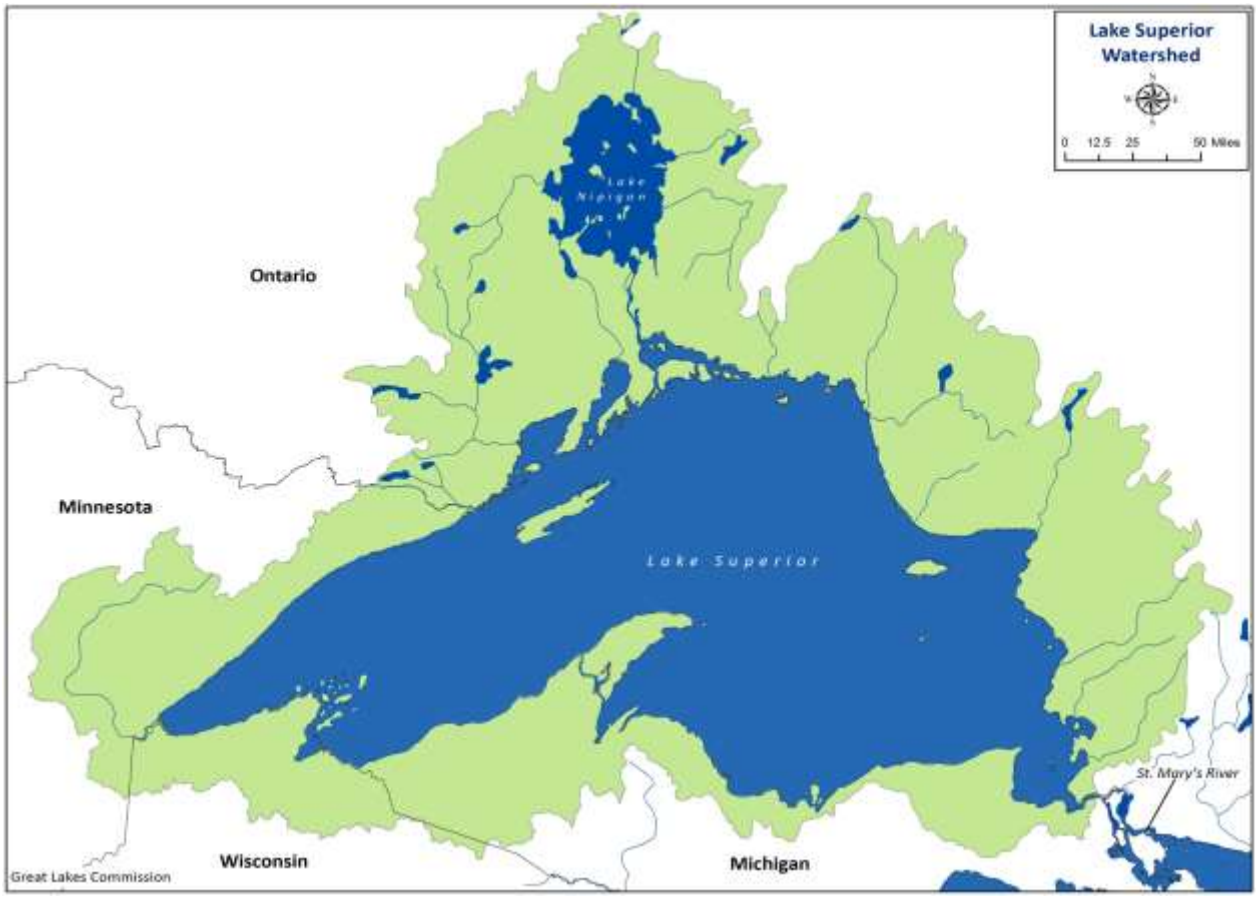

Figure 8. Lake Superior Watershed

Overview of Watershed Characteristics

Lake Superior is the largest of the Great Lakes and the world's third-largest freshwater lake by volume, holding about 2,900 cubic miles (12,100 cubic kilometers) of water. Lake Superior can hold all the water in the other Great Lakes, plus three more Lake Eries.[6] Its surface area is roughly the size of South Carolina, or approximately 31,700 square miles (82,103 square kilometers).

Water Withdrawals

Four jurisdictions share the Lake Superior watershed – Michigan, Minnesota, Ontario, and Wisconsin – which collectively withdrew 3,060 mgd (11,585 mld), excluding in-stream hydroelectric water use of 36,351 mgd (137,604

Basic Stats of Lake Superior

Length: 350 mi / 563 km

Breadth: 160 mi / 257 km

Elevation: 600 ft / 183 m

Depth: 483 ft / 147 m average, 1,330 ft / 406 m maximum

Volume: 2,900 cubic mi / 12,100 cubic km

Lake Surface Area: 31,700 square mi / 82,100 square km

Watershed Drainage Area: 49,300 square mi / 127,700 square km

Outlet: St. Marys River to Lake Huron

Retention / Replacement Time: 191 years

Population in the Watershed: United States 444,000; Canada 229,000. Total: 673,000

[6]Retention time is the calculated quantity expressing the mean time water

mld). This amount is a 40 percent increase from the 2015 total withdrawal amount of 2,193 mgd (8,300 mld). This overall increase is mainly explained by an increase in withdrawals in Minnesota's off-stream hydroelectric power production sector, which grew from 1,227 mgd (4,644 mld) in 2015 to 2,160 mgd (8,177 mld) in 2016. This substantial increase in withdrawals was attributed to normal fluctuations from facilities in Minnesota. The off-stream hydroelectric power production sector now represents 70 percent of all withdrawals from the watershed. Thermoelectric power production, once-through and recirculated cooling (483 mgd or 1,827 mld) and industrial (322 mgd or 1,220 mld) were the other significant water use sectors.

Other surface waters within the Lake Superior watershed were primarily used to generate electricity with in-stream hydroelectric power. Excluding in-stream hydroelectric water use, 83 percent (2,526 mgd or 9,561 mld) of the total reported withdrawal amount from the watershed came directly from other surface waters. The remaining withdrawals came directly from Lake Superior (17 percent or 517 mgd or 1,957 mld) and groundwater (0.6 percent or 18 mgd or 67 mld).

Water Diversions and Consumptive Uses

The total watershed consumptive use for all four jurisdictions was 47 mgd (179 mld). Industrial use (34 mgd or 128 mld), public water supply (7 mgd or 25 mld), and thermoelectric power, recirculated cooling (5 mgd or 26 mld) sectors were the largest contributors, respectively, to the total consumptive use for the watershed.

Reported net water gain (3,490 mgd or 13,212 mld) in the Lake Superior watershed came from the Long Lac and Ogoki diversion in Northern Ontario. On average, these diversions into the basin together are about two times by volume larger than the Illinois diversion out of the Basin.

spends in the lake
Minnesota Sea Grant. 2012. http://www.seagrant.umn.edu/superior/facts

Table 5a. Lake Superior Watershed 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	44	3	13	60	0	0	7
Self-Supply Commercial & Institutional	1	1	0	2	0	0	0
Self-Supply Irrigation	0	0	1	1	0	0	1
Self-Supply Livestock	1	25	2	28	0	0	1
Self-Supply Industrial	133	189	1	322	0	13	34
Self-Supply Thermoelectric Power Production (Once-through cooling)	338	144	0	483	0	0	5
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	2,160	0	2,160	0	0	0
In-Stream Hydroelectric Water Use	0	36,351	0	36,351	0	-3,504	0
Other Self Supply	0	4	0	4	0	0	0
Total	517	38,877	18	39,412	0	3,490	47

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 5b. Lake Superior Watershed 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	167	10	50	228	0	0	25
Self-Supply Commercial & Institutional	4	2	0	7	0	0	1
Self-Supply Irrigation	0	1	3	4	0	0	4
Self-Supply Livestock	3	96	9	107	0	0	2
Self-Supply Industrial	502	715	3	1,220	0	50	128
Self-Supply Thermoelectric Power Production (Once-through cooling)	1,281	545	2	1,827	0	0	19
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	8,177	0	8,177	0	0	0
In-Stream Hydroelectric Water Use	0	137,604	0	137,604	0	-13,262	0
Other Self Supply	0	0	0	0	0	0	0
Total	1,957	147,165	67	149,189	0	-13,212	179

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Michigan

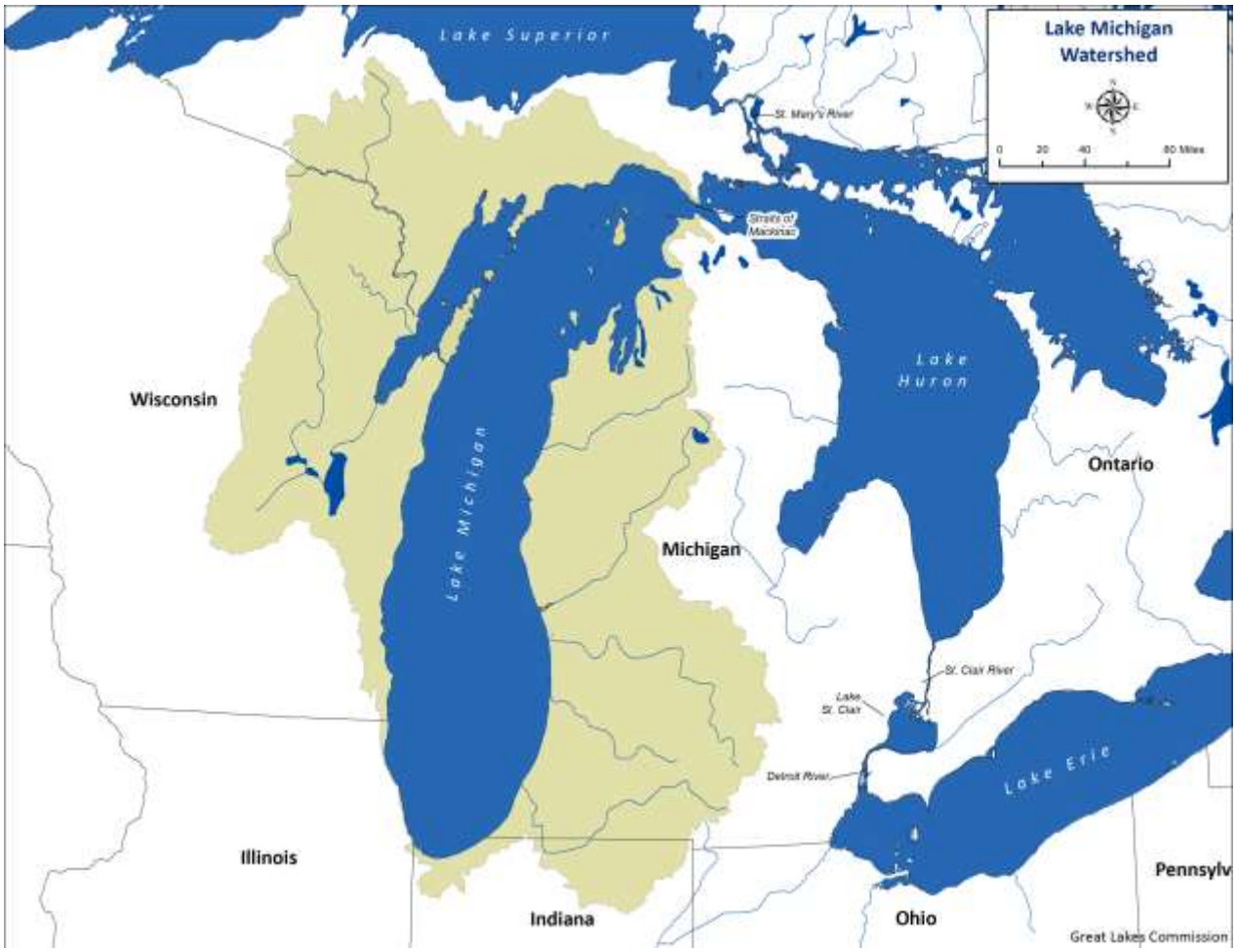

Figure 9. Lake Michigan Watershed

Overview of Watershed Characteristics

Lake Michigan is the only Great Lake entirely within the United States. It is the second largest of the Great Lakes by volume, holding about 1,180 cubic miles (4,918 cubic kilometers) of water. Its surface area is roughly the size of West Virginia, approximately 22,300 square miles (57,753 square kilometers). More than 12 million people call the Lake Michigan watershed home; about a third of the entire population of the Great Lakes-St. Lawrence River Basin lives in the Lake Michigan watershed.

Water Withdrawals

Four jurisdictions share the Lake Michigan watershed – Illinois, Indiana, Michigan, and Wisconsin – and collectively withdrew 11,041 mgd (41,794 mld). The primary water uses were thermoelectric power, both once-through and recirculated cooling (7,146 mgd or 27,049

Basic Stats of Lake Michigan

Length: 307 mi / 494 km

Breadth: 118 mi / 190 km

Elevation: 577.5 ft / 176 m

Depth: 279 ft / 85 m average, 923 ft / 281 m maximum

Volume: 1,180 cubic mi / 4,918 cubic km

Lake Surface Area: 22,300 square mi / 57,753 square km

Watershed Drainage Area: 45,600 square mi / 118,095 square km

Outlet: Straits of Mackinac to Lake Huron

Retention / Replacement Time: 62 years

Population in the Watershed: 12,052,743

mld), industrial use (1,816 mgd or 6,875 mld) and public water supply (1,509 mgd or 5,712 mld). Lake Michigan was the primary source of water withdrawals in the watershed (87 percent of total withdrawals, or 9,634 mgd or 36,467 mld).

Water Diversions and Consumptive Uses

Reported net water loss in the Lake Michigan watershed, totaling 1,088 mgd (4,120 mld), represents 10 percent of total withdrawals. This was a 48% drop in water loss from Lake Michigan over 2015, which was the result of 2016 being a wet year in the Chicago area and the resulting drop in diversions. Total water loss was comprised mainly of the Illinois diversion 1,050 mgd or 3,975 mld) for public water supply and other purposes. The total consumptive use of the four jurisdictions was 807 mgd (3,054 mld). The water use sectors that contribute the majority of the consumptive uses in the watershed were self-supply industrial use (350 mgd or 1,326 mld), irrigation (287 mgd or 1,085 mld), public water supply (81 mgd or 317 mld), and thermoelectric (77 mgd or 292 mld).

Table 6a. Lake Michigan Watershed 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	1,258	21	230	1,509	0	883	84
Self-Supply Commercial & Institutional	3	9	8	20	0	2	1
Self-Supply Irrigation	0	55	270	326	0	0	287
Self-Supply Livestock	0	25	22	47	0	0	8
Self-Supply Industrial	1,548	196	72	1,816	0	24	350
Self-Supply Thermoelectric Power Production (Once-through cooling)	6,498	458	1	6,957	0	0	54
Self-Supply Thermoelectric Power Production (Recirculated cooling)	158	27	4	188	0	13	23
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	168	1	9	177	0	168	0
Total	9,634	791	616	11,041	0	1,088	807

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 6b. Lake Michigan Watershed 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	4,762	79	871	5,712	2	3,341	317
Self-Supply Commercial & Institutional	11	34	31	77	0	7	6
Self-Supply Irrigation	1	209	1,023	1,233	0	0	1,085
Self-Supply Livestock	0	94	83	178	0	0	29
Self-Supply Industrial	5,861	741	274	6,875	0	90	1,326
Self-Supply Thermoelectric Power Production (Once-through cooling)	24,599	1,733	4	26,336	0	0	206
Self-Supply Thermoelectric Power Production (Recirculated cooling)	598	101	14	713	0	48	86
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	634	4	32	670	0	634	1
Total	36,467	2,995	2,332	41,794	2	4,120	3,054

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Huron

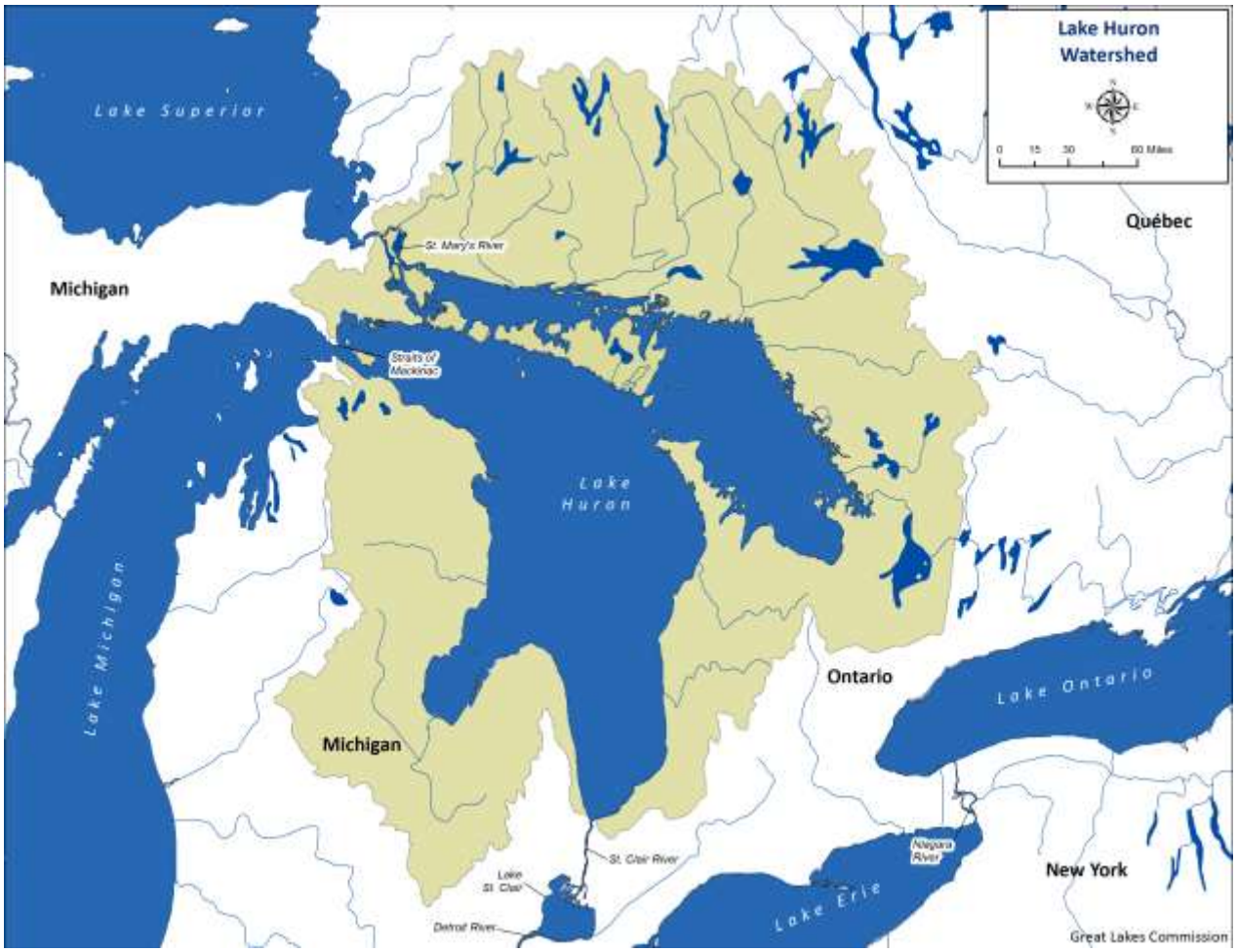

Figure 10. Lake Huron Watershed

Overview of Watershed Characteristics

By surface area, Lake Huron is the second-largest of the Great Lakes. It covers 23,000 square miles (59,600 square kilometers), making it the third-largest fresh water lake on Earth. By volume however, Lake Huron is only the third largest of the Great Lakes.

Basic Stats of Lake Huron

Length: 206 mi / 332 km

Breadth: 183 mi / 295 km

Elevation: 577.5 ft / 176 m

Depth: 195 ft / 59 m average, 750 ft / 229 m maximum

Volume: 849 cubic mi / 3,538 cubic km

Lake Surface Area: 23,000 square mi / 59,565 square km

Watershed Drainage Area: 50,700 square mi / 131,303 square km

Outlet: St. Clair River to Lake Erie

Retention / Replacement Time: 21 years

Population in the Watershed: United States 1,483,872; Canada 1,476,487. Total: 2,960,359

Water Withdrawals

Two jurisdictions – Michigan and Ontario – share the watershed and collectively withdrew 8,483 mgd (32,110 mld) of the water, excluding in-stream hydroelectric water use (39,102 mgd or 148,016 mld). This is a four percent decrease from the 2015 water withdrawal amount of 8,861 mgd (33,543 mld).

The primary water uses were thermoelectric power once-through cooling (8,064 mgd or 30,546 mld), public water supply (199 mgd or 751 mld), and industrial use (134 mgd or 508 mld). Excluding in-stream hydroelectric

water use, Lake Huron surface water was the source of 85 percent of the total withdrawals in the watershed.

Water Diversions and Consumptive Uses

Reported net water loss to the Lake Huron watershed was 42 mgd (157 mld), which was entirely an intrabasin transfer for public water supply in Ontario. While hydrologically this intrabasin transfer remained in the Great Lakes-St. Lawrence River Basin, it represented a loss to the Lake Huron watershed and a net gain to the Lake Erie watershed. Public water supply (24 mgd or 92 mld), irrigation (36 mgd or 137 mld), and thermoelectric power production (72 mgd or 261 mld) made up the majority (74 percent) of the consumptive uses in the watershed.

Table 7a. Lake Huron Watershed 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	118	43	38	199	42	0	24
Self-Supply Commercial & Institutional	0	4	0	5	0	0	1
Self-Supply Irrigation	0	20	20	40	0	0	36
Self-Supply Livestock	0	18	15	33	0	0	0
Self-Supply Industrial	12	98	25	134	0	0	14
Self-Supply Thermoelectric Power Production (Once-through cooling)	7,078	985	0	8,064	0	0	69
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	5	1	6	0	0	3
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	23,957	15,144	0	39	0	0	0
Other Self Supply	0	2	0	9	0	0	0
Total	31,167	16,319	99	47,584	42	0	148

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 7b. Lake Huron Watershed 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	446	161	144	751	157	0	92
Self-Supply Commercial & Institutional	1	15	2	18	0	0	2
Self-Supply Irrigation	0	76	76	152	0	0	137
Self-Supply Livestock	0	68	57	125	0	0	1
Self-Supply Industrial	46	369	93	508	0	0	52
Self-Supply Thermoelectric Power Production (Once-through cooling)	26,795	3,730	0	30,525	0	0	261
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	18	3	21	0	0	13
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	90,688	57,328	0	148,016	0	0	0
Other Self Supply	2	8	0	10	0	0	0
Total	117,978	61,774	375	180,127	157	0	558

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Erie

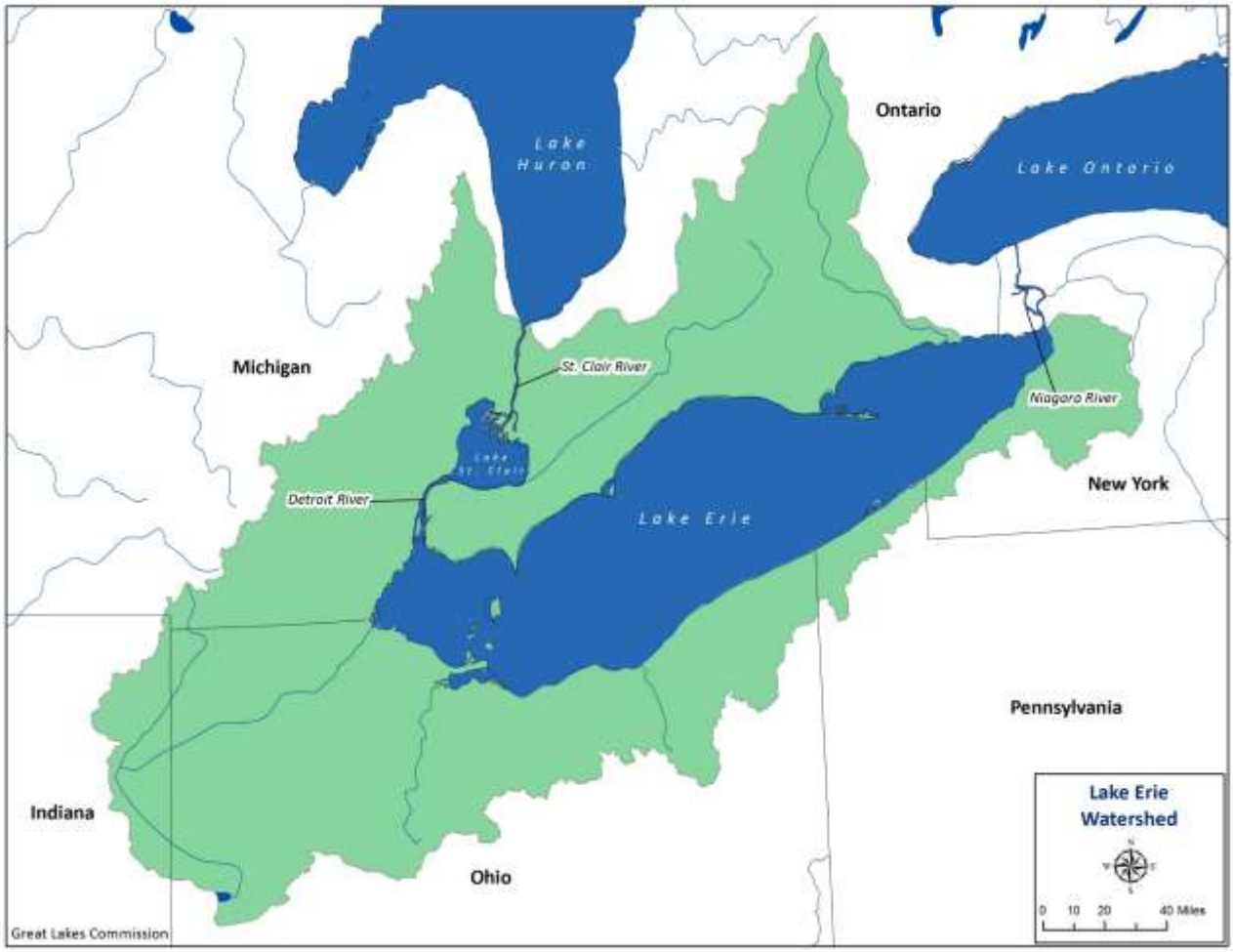

Figure 11. Lake Erie Watershed

Overview of Watershed Characteristics

By surface area, Lake Erie is the 12th largest freshwater lake in the world. The shallowest of the Great Lakes, it has an average depth of 62 feet and a maximum depth of 210 feet. The lake holds about 116 cubic miles (4,863 cubic kilometers) of water. Lake Erie is warmer than the other Great Lakes, which also helps make it the most productive. However, its size makes it more ecologically sensitive than the other Great Lakes.

The watershed is home to more than 12.5 million people, representing more than one-third of the entire population of the Great Lakes-St. Lawrence River Basin.

Basic Stats of Lake Erie

Length: 241 mi / 388 km

Breadth: 57 mi / 92 km

Elevation: 569.2 ft / 173.5 m

Depth: 62 ft / 19 m average, 210 ft / 64 m maximum

Volume: 116 cubic mi / 483 cubic km

Lake Surface Area: 9,910 square mi / 25,655 square km

Watershed Drainage Area: 22,700 square mi / 58,788 square km

Outlets: Niagara River and Welland Canal

Retention/Replacement Time: 2.7 years

Population in the Watershed: United States, est. 10,640,671; Canada est. 1,892,306. Total: est. 12,532,977

Water Withdrawals

Six jurisdictions – Indiana, Michigan, New York, Ohio, Ontario and Pennsylvania – share the watershed and collectively withdrew 7,362 mgd (27,869 mld) of the water, excluding in-stream hydroelectric water use,

which accounted for 49,509 mgd (187,412 mld). This amount is a seven percent decrease from the 2015 total withdrawal amount of 7,891 mgd (29,872 mld). Aside from water used for hydroelectric power generation purposes, the primary water uses were thermoelectric power generation, both once-through and recirculated cooling (4,225 mgd or 16,107 mld), public water supply (1,755 mgd or 6,644 mld), and industrial use (1,251 mgd or 4,737 mld).

Lake Erie surface water was the source of 83 percent of the total withdrawals in the watershed. However, other surface water and groundwater were the only sources of Indiana's water use, primarily supporting the public water supply sector.

Water Diversions and Consumptive Uses

Reported net water loss in the Lake Erie watershed totaled 3,621 mgd (13,707 mld). This amount includes a net positive diversion (going into the Lake Erie watershed) of 63 mgd (237 mld) and a net negative diversion of 3,683 mgd (13,707 mld). The largest negative intrabasin diversion is the Welland Canal for other self-supply and navigation purposes (3,663 mgd or 13,867 mld), a 33 percent drop from 2015 (5,449 mgd or 20,628 mld). The Welland Canal was constructed in 1830 as a ship canal in Ontario, Canada, connecting Lake Erie to Lake Ontario. Figure 12 shows the flow through the Welland Canal over the past five years. Consumptive use in the Lake Erie watershed totaled 466 mgd (1,762 mld). The major consumptive uses were for public water supply (225 mgd or 851 mld) and industrial uses (102 mgd or 387 mld).

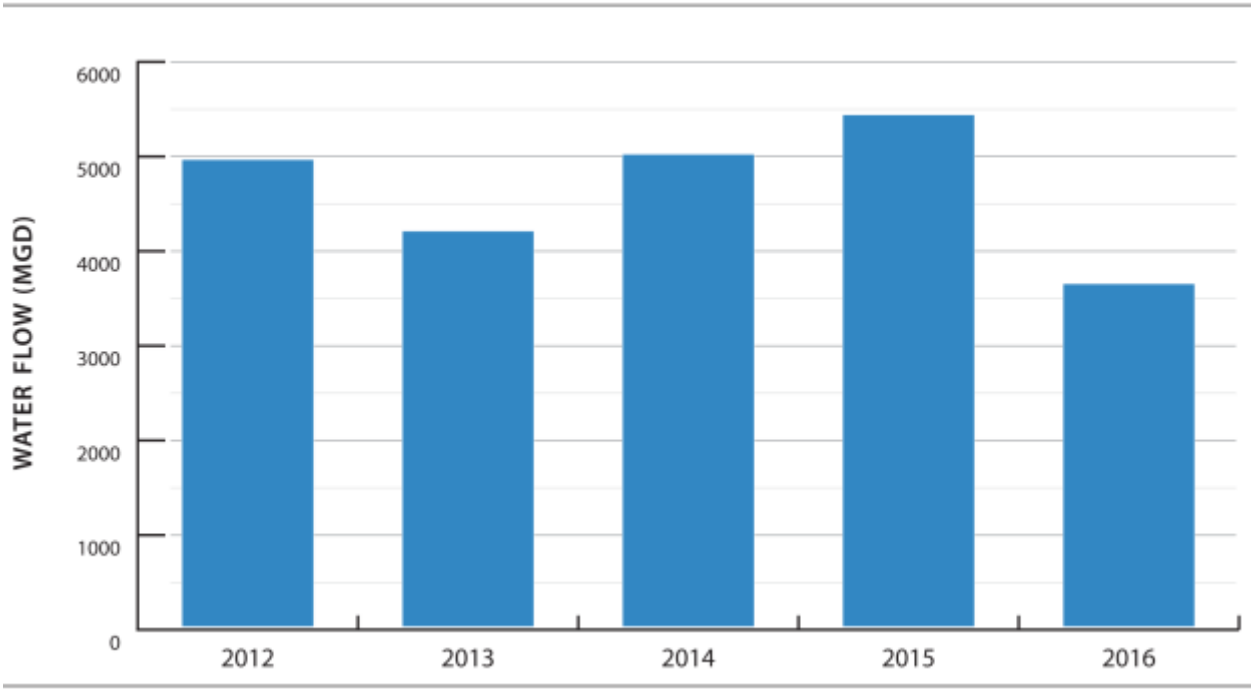

Figure 12. Flow through the Welland Canal over the past five years.

Table 8a. Lake Erie Watershed 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	1,477	173	106	1,755	-40	20	225
Self-Supply Commercial & Institutional	0	3	2	5	0	0	1
Self-Supply Irrigation	1	46	18	65	0	0	58
Self-Supply Livestock	0	7	6	14	0	0	1
Self-Supply Industrial	728	402	122	1,251	0	0	102
Self-Supply Thermoelectric Power Production (Once-through cooling)	3,701	375	0	4,077	0	0	45
Self-Supply Thermoelectric Power Production (Recirculated cooling)	178	0	0	178	0	0	32
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	48,969	540	0	49,509	0	0	0
Other Self Supply	2	11	4	17	3,663	-23	3
Total	55,055	1,557	258	56,871	3,624	-3	466

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 8b. Lake Erie Watershed 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	5,590	653	401	6,644	-150	77	851
Self-Supply Commercial & Institutional	1	10	8	19	0	0	2
Self-Supply Irrigation	3	174	67	244	0	0	219
Self-Supply Livestock	0	28	24	53	0	-1	3
Self-Supply Industrial	2,755	1,520	463	4,737	0	0	387
Self-Supply Thermoelectric Power Production (Once-through cooling)	14,011	1,421	0	15,432	0	0	169
Self-Supply Thermoelectric Power Production (Recirculated cooling)	673	2	0	675	0	0	120
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	185,368	2,044	0	187,412	0	0	0
Other Self Supply	6	43	16	65	13,867	-87	11
Total	208,407	5,895	978	215,281	13,717	-10	1,762

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Lake Ontario

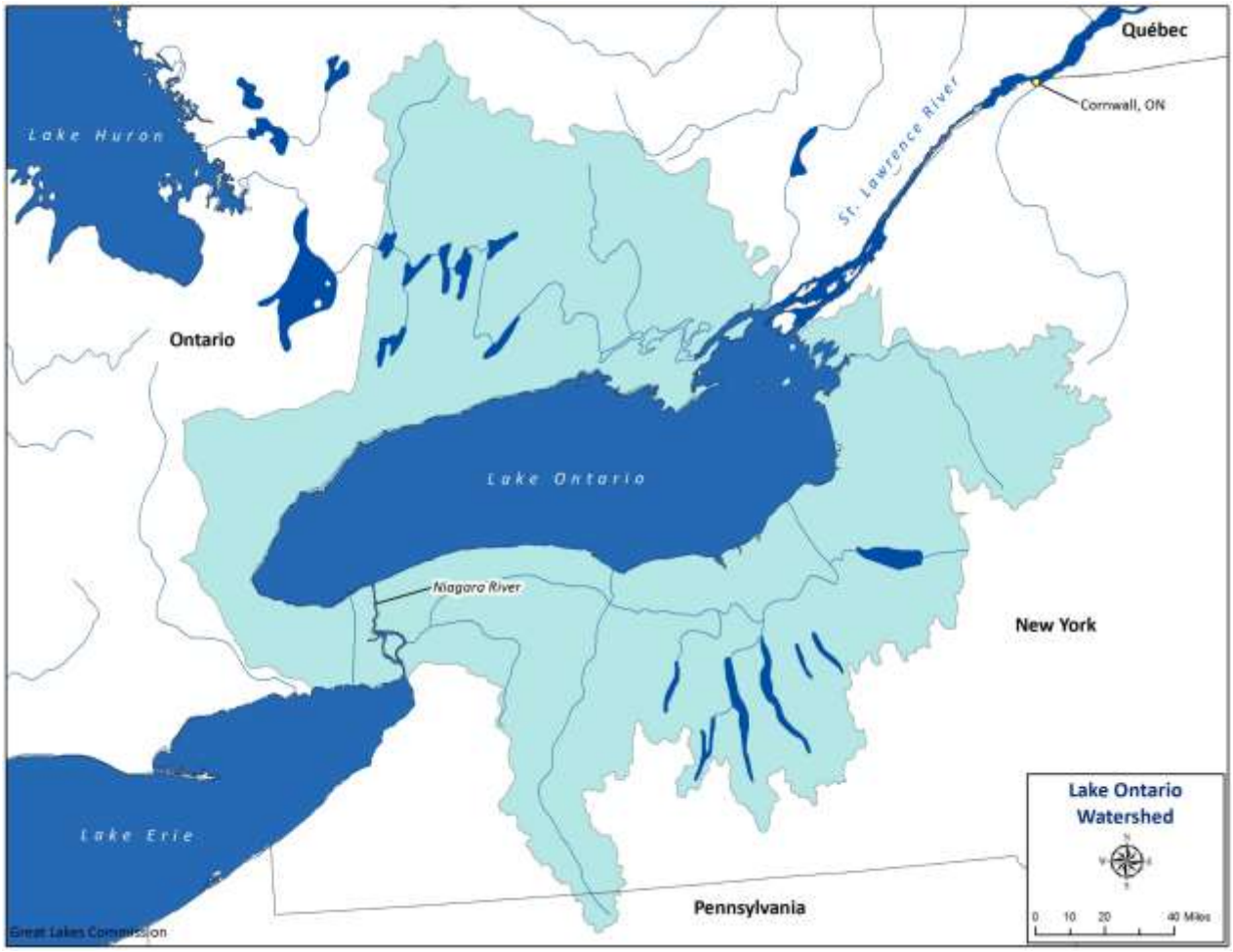

Figure 13. Lake Ontario Watershed

Overview of Watershed Characteristics

Lake Ontario is the easternmost of the Great Lakes and the smallest in surface area (covering 7,340 square miles, 18,960 square kilometers). It is extremely deep (e.g., 802 feet maximum) in some areas and exceeds Lake Erie in volume (393 cubic miles, 1,639 cubic kilometers). By surface area, it is the 14th largest lake in the world.

Water Withdrawals

Three jurisdictions – New York, Ontario and Pennsylvania – share the watershed and collectively withdrew 10,591 mgd (40,092 mld) of water, excluding in-stream hydroelectric water use, which accounted for 148,391 mgd (521,630 mld). This amount is nearly the same as the 2015 withdrawal amount of 10,598 mgd (40,117 mld). Aside from withdrawals for hydroelectric power generation purposes, the primary water uses were for thermoelectric power

Basic Stats of Lake Ontario

Length: 193 mi / 311 km

Breadth: 53 mi / 85 km

Elevation: 243.3 ft / 74.2 m

Depth: 283 ft / 86 m average, 802 ft / 244 m maximum

Volume: 393 cubic mi / 1,639 cubic km

Lake Surface Area: 7,340 square mi / 19,009 square km

Watershed Drainage Area: 23,400 square mi / 60,601 square km

Outlet: St. Lawrence River to the Atlantic Ocean

Retention / Replacement Time: 6 years

Population in the Watershed: United States, est. 2,856,360; Canada est. 2,835,818. Total: est.5,692,178

generation, both once-through and recirculated cooling (8,159 mgd or 30,886 mld), public water supply (965 mgd or 3,653 mld), and other self-supply uses (750 mgd or 2,838 mld).

Lake Ontario surface water was the source for 86 percent of the total withdrawals in the watershed. It was the source for most of the water used for public water supply and thermoelectric power generation. Other sectors like irrigation, livestock and other self-supply relied on surface water in the watershed as the predominant source.

Water Diversions and Consumptive Uses

Reported water loss in the Lake Ontario watershed totaled 402 mgd (1,523 mld). This amount includes interbasin diversions totaling 41 mgd (156 mld), an intrabasin diversion of 2 mgd (6 mld) and a combined consumptive use amount of 359 mgd (1,361 mld). The major consumptive uses were from public water supply (117 mgd or 444 mld), thermoelectric power production (153 mgd or 406 mld) and industrial uses (67 mgd or 256 mld).

Water gained in the Lake Ontario watershed came from the Welland Canal (3,662 mgd or 13,867 mld), which diverts water from the Lake Erie watershed for navigation purposes.

Table 9a. Lake Ontario Watershed 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	756	195	13	965	2	9	117
Self-Supply Commercial & Institutional	12	39	1	52	0	0	10
Self-Supply Irrigation	0	22	3	25	0	0	22
Self-Supply Livestock	0	16	12	28	0	0	3
Self-Supply Industrial	343	197	31	571	0	0	67
Self-Supply Thermoelectric Power Production (Once-through cooling)	7,580	146	0	7,727	0	0	85
Self-Supply Thermoelectric Power Production (Recirculated cooling)	432	0	0	432	0	0	22
Off-Stream Hydroelectric Power Production	0	42	0	42	0	0	0
In-Stream Hydroelectric Water Use	41,143	96,657	0	137,800	0	0	0
Other Self Supply	1	749	0	750	-3,662	32	33
Total	50,268	98,063	60	148,391	-3,660	41	359

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 9b. Lake Ontario Watershed 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	2,863	740	50	3,653	6	35	444
Self-Supply Commercial & Institutional	47	148	3	198	0	0	38
Self-Supply Irrigation	0	82	10	93	0	0	83
Self-Supply Livestock	0	61	45	106	0	0	11
Self-Supply Industrial	1,299	744	117	2,160	0	0	256
Self-Supply Thermoelectric Power Production (Once-through cooling)	28,695	553	1	29,249	0	0	323
Self-Supply Thermoelectric Power Production (Recirculated cooling)	1,636	1	0	1,637	0	0	82
Off-Stream Hydroelectric Power Production	0	159	0	159	0	0	0
In-Stream Hydroelectric Water Use	155,745	365,885	0	521,630	0	0	0
Other Self Supply	3	2,835	0	2,838	-13,867	121	123
Total	190,287	371,209	226	561,722	13,861	156	1,361

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

St. Lawrence River

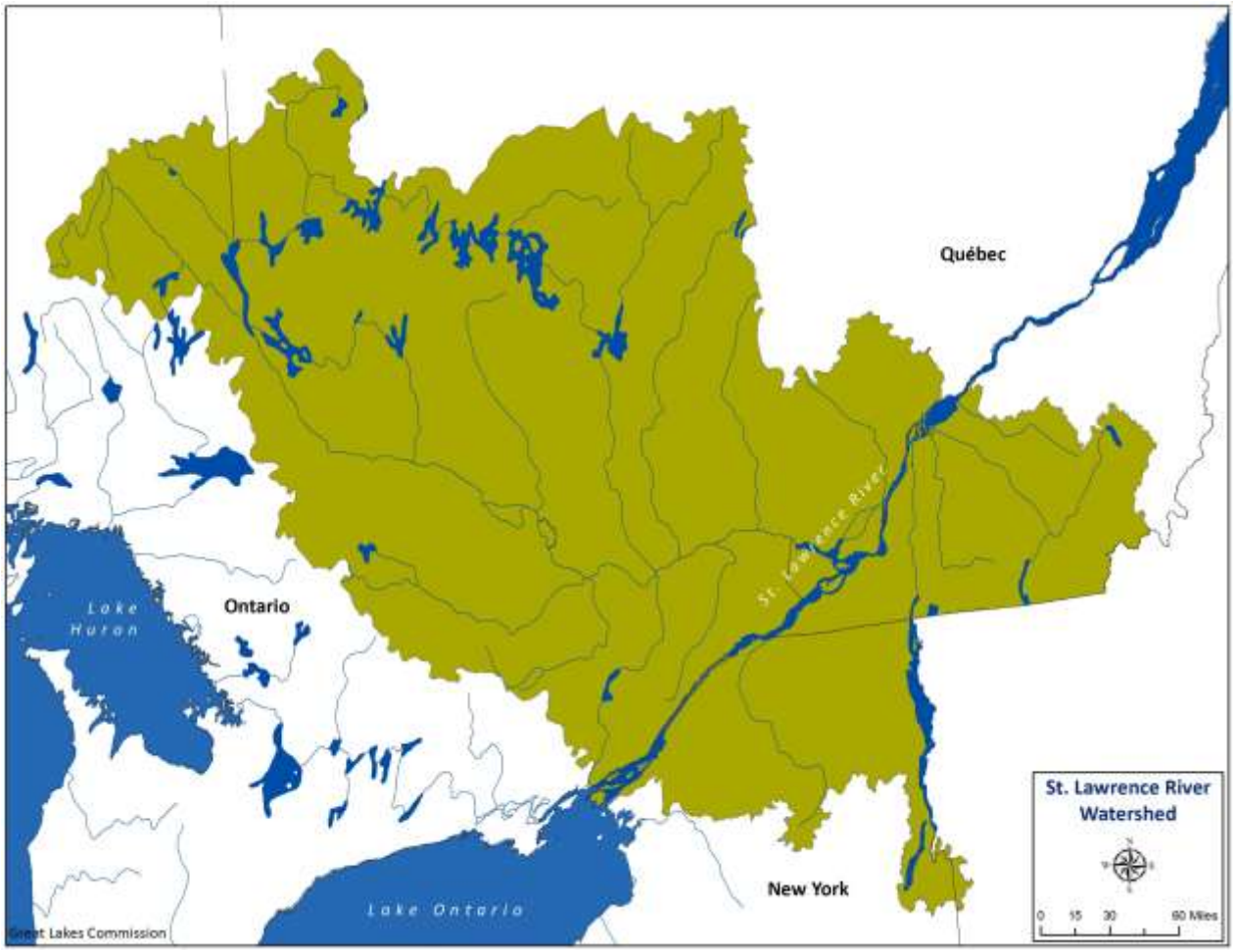

Figure 14. St. Lawrence River Watershed

Overview of Watershed Characteristics

Running 744 miles (1,198 kilometers) in length, the St. Lawrence River is considered a major river of North America. Mostly located in the province of Québec, it links the Great Lakes to the Atlantic Ocean.

Basic Stats of the St. Lawrence River

Length: 744 mi / 1,197 km

Elevation: 245 ft/74.7 m at the source and 0 ft/0 m at the mouth

Average Annual Flow (Montréal): 7,660 cubic meters/second

Volume: 393 cubic mi / 1,639 cubic km

Watershed Drainage Area: 519,000 square mi / 1,344,200 square km

Outlet: Gulf of St. Lawrence/ Atlantic Ocean

Water Withdrawals

Three jurisdictions from the regional body – New York, Ontario and Québec – share the watershed and collectively withdrew 1,708 mgd (6,466 mld) of the water, excluding in-stream hydroelectric water use, which accounted for 210,371 mgd (796,342 mld). This amount is a two percent increase from the 2015 withdrawal total of 1,671 mgd (6,327 mld). Aside from hydroelectric, the primary water uses were public water supply (1,049 mgd or 3,970 mld), and industrial use (470 mgd or 1,780 mld).

St. Lawrence River surface water was the source for over half (54 percent) of the watershed's total withdrawal amount. Other surface water within the St. Lawrence River watershed accounted for 41 percent of the total. The remaining portion of the total withdrawal amount (5 percent) came from groundwater sources.

Water Diversions and Consumptive Uses

Net water loss in the St. Lawrence River watershed totaled 286 mgd (1,081 mld). This total includes a diversion amount of 7 mgd (25 mld) for public supply purposes in New York and Québec and a combined consumptive use amount of 279 mgd (1,056 mld). The largest consumptive uses were the public water supply sector at 168 mgd (638 mld) and industrial at 88 mgd (335 mld).

Table 10a. St. Lawrence River Watershed 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	687	309	52	1,049	0	7	168
Self-Supply Commercial & Institutional	0	101	1	102	0	0	13
Self-Supply Irrigation	0	4	1	5	0	0	4
Self-Supply Livestock	0	13	5	18	0	0	4
Self-Supply Industrial	169	269	32	470	0	0	88
Self-Supply Thermoelectric Power Production (Once-through cooling)	52	2	0	54	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	161,054	49,317	0	210,371	0	0	0
Other Self Supply	6	3	0	10	0	0	1
Total	161,969	50,018	92	212,079	0	7	279

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 10b. St. Lawrence River Watershed 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	2,602	1,171	197	3,970	0	25	638
Self-Supply Commercial & Institutional	1	381	4	386	0	0	48
Self-Supply Irrigation	2	14	4	20	0	0	17
Self-Supply Livestock	0	49	20	69	0	0	15
Self-Supply Industrial	639	1,019	123	1,781	0	0	335
Self-Supply Thermoelectric Power Production (Once-through cooling)	196	7	0	203	0	0	2
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	609,956	186,686	0	796,342	0	0	0
Other Self Supply	24	12	1	38	0	0	2
Total	613,120	189,338	350	802,808	0	25	1,056

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Jurisdiction Reports

Illinois

The Illinois portion of the Lake Michigan watershed is only about 100 square miles, which accounts for less than 0.2 percent of the total area of the state. The Lake Michigan coastline of Illinois is 63 miles long, which is a small fraction of the 1,640 miles of Lake Michigan shoreline. Despite its relatively small size, the Illinois Lake Michigan service area is home to half of the total population of Illinois and the lake itself is the largest public drinking water supply in the state, serving nearly 7 million people.

The total withdrawal amount from the Basin for Illinois in 2016 was 1,485 mgd (5,620 mld), very similar to withdrawal amounts from 2015 (1,436 mgd or 5,435 mld). The largest uses of reported water were public water supply at 823 mgd or 3,115 mld (55 percent of the total withdrawal amount) and thermoelectric power production, once-through cooling at 464 mgd or 1,756 mld (31 percent of the total withdrawal amount). The primary source for all withdrawals was Lake Michigan.

The Illinois Diversion, which takes water from Lake Michigan and discharges it, through the Chicago Area Water System (CAWS) into the Mississippi River watershed, is comprised of three elements: public water supply; stormwater runoff; and direct diversion. Direct diversion occurs at three lakefront structures; the Chicago River Controlling Structure, the O'Brien Lock and Dam and the Wilmette Pumping Station. Direct diversion consists of four elements; lockage, leakage, discretionary flow, and navigational makeup. Lockage is the flow used in locking vessels to and from Lake Michigan and only occurs at the Chicago River Controlling Structure and the O'Brien Lock and Dam. Leakage, is water estimated to pass through or around the three lake front structures. Discretionary flow is used to dilute effluent from sewage discharges and improve water quality in the CAWS. Navigational makeup, is used to maintain navigational depths in the CAWS. The amount of water diverted for public water supply and self-supply commercial and institutional was 824 mgd (3,121 mld). The diversion amount supporting other uses (i.e., discretionary diversion) was 168 mgd (634 mld).

Data collected for this report came from multiple sources including Illinois Department of Natural Resources and the Illinois State Water Survey. This data was generated with a 100 percent reporting compliance from permitted water withdrawal facilities, except for two self-supply irrigation users (both of which are below 0.1 mgd).

Notable changes in 2016 water use by Illinois facilities include:

- A 2 percent reduction in water withdrawals by the City of Chicago for public water supply, a downward trend that has continued since 1994;
- A 28 percent increase in water withdrawals for self-supply thermoelectric cooling due to one plant's increased use; and,
- An 18 percent reduction in diversions for effluent dilution by the Chicago Metropolitan Water Reclamation District.

Table 11a. Illinois 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	823	0	0	823	0	823	0
Self-Supply Commercial & Institutional	2	0	0	2	0	2	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	29	0	0	29	0	1	0
Self-Supply Thermoelectric Power Production (Once-through cooling)	464	0	0	464	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	168	0	0	168	0	168	0
Total	1485	0	0	1485	0	993	0

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 11b. Illinois 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	3,115	0	0	3,115	0	3,170	0
Self-Supply Commercial & Institutional	6	0	0	6	0	6	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	109	0	0	109	0	2	1
Self-Supply Thermoelectric Power Production (Once-through cooling)	1,756	0	0	1,756	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	634	0	0	634	0	634	0
Total	5,620	0	0	5,620	0	3,757	1

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Indiana

The state of Indiana uses the water resources of the Lake Michigan and Lake Erie watersheds. Indiana's portion of Lake Michigan encompasses a total of 241 square miles. Four Indiana counties lie partially within Indiana's portion of the Lake Michigan watershed, but three of these four counties (Lake, Porter and LaPorte) constitute more than 99.5 percent its land area. Abundant freshwater from Lake Michigan has promoted the development of an extensive urban and industrial belt along Indiana's coastline. Water supplies in Indiana's non-coastal counties in the Lake Michigan watershed are drawn primarily from groundwater. Indiana shares a portion of the Maumee River watershed that flows into Lake Erie. The Maumee River watershed encompasses a total of 1,283 square miles of northeast Indiana. Six Indiana counties lie partially within this watershed. The largest withdrawals, for public supply and industrial purposes, come from the surface waters of the St. Joseph (a major tributary within the Maumee watershed) and Maumee Rivers. Groundwater withdrawals in the Maumee River watershed are used primarily for public water supply and industrial dewatering.[7]

In 2016, the total reported water withdrawal amount from the Basin for Indiana was 1,991 mgd (7,537 mld). The largest uses were industrial (1,489 mgd or 5,637 mld), thermoelectric power (281 mgd or 1,064 mld) and public water supply (171 mgd or 647 mld).

The total reported diversion amount for Indiana was 84 mgd (318 mld). Because a small, 65 square miles, portion of Indiana drains into the Illinois River (as a result of the Illinois Diversion), water transferred from the Lake Michigan watershed into this area is considered a diversion of water from the Great Lakes-St. Lawrence River Basin. The majority of reported diversions for Indiana (53 mgd or 200 mld) were distributed for public supply purposes from Lake Michigan surface water and discharged to the "Illinois Diversion" area, with about 1 mgd (3 mld) reported as a diversion from groundwater for public supply. The industrial sector was responsible for about 23 mgd (87 mld) of the reported diversion from the Lake Michigan watershed to the Illinois River.

For the Lake Erie watershed, a portion of the town of Fort Wayne's public water supply distribution system is located in the Upper Wabash watershed. The amount of water (about 8 mgd or 29 mld, primarily from other surface water with a small portion from groundwater) distributed through that portion of the system was reported as a diversion from the Lake Erie watershed. Consumptive use in Indiana totaled 396 mgd (1,499 mld), with the industrial sector in the Lake Michigan watershed (317 mgd or 1,200 mld or 80 percent) as the primary contributor to the total.

Data collected for this report came from the Indiana Department of Natural Resources. These data were generated with reporting compliance rates from permitted water withdrawal facilities ranging from 89 to 100 percent depending on the water use sector. Withdrawals and consumptive uses are not estimated for facilities that did not report.

Notable changes in 2016 water use by Indiana facilities include:

- A substantial increase (17 percent) in water withdrawals for self-supply thermoelectric power production (once-through) was the result of one facility utilizing more of their registered baseline capacity than in previous years.
- An estimated 6 percent decrease in withdrawals from Lake Michigan surface water for industrial self-supply attributed to reduced demand from the steel sector as a result of conservation efforts and reduced production.

[7] Indiana Dept. of Natural Resources. 1996. http://www.in.gov/dnr/water/files/lakemich_basinsums.pdf http://www.in.gov/dnr/water/files/maumee_basinsums.pdf

Table 12a. Indiana 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	91	36	44	171	0	61	21
Self-Supply Commercial & Institutional	0	0	2	2	0	0	0
Self-Supply Irrigation	0	6	39	45	0	0	40
Self-Supply Livestock	0	1	3	4	0	0	2
Self-Supply Industrial	1,472	9	9	1,490	0	23	319
Self-Supply Thermoelectric Power Production (Once-through cooling)	243	0	0	243	0	0	5
Self-Supply Thermoelectric Power Production (Recirculated cooling)	12	25	2	39	0	0	9
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	1	1	0	0	0
Total	1,817	76	99	1,991	0	84	396

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 12b. Indiana 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	344	137	167	647	0	231	79
Self-Supply Commercial & Institutional	0	0	7	7	0	0	1
Self-Supply Irrigation	0	22	147	169	0	0	150
Self-Supply Livestock	0	2	11	13	0	0	6
Self-Supply Industrial	5,572	32	34	5,637	0	88	1,210
Self-Supply Thermoelectric Power Production (Once-through cooling)	918	0	0	918	0	0	18
Self-Supply Thermoelectric Power Production (Recirculated cooling)	44	93	6	144	0	0	35
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	3	3	0	0	0
Total	6,878	286	374	7,538	0	319	1,500

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Michigan

Home to more than 9.8 million people, Michigan borders four of the Great Lakes (Superior, Michigan, Huron and Erie). Some unique features of Michigan include:

- 57,022 square miles of land area in two peninsulas (40,583 square miles in the Lower Peninsula and 16,439 square miles in the Upper Peninsula);
- Virtually the entire land area of the state lies within the Great Lakes basin;
- 38,575 square miles of Great Lakes water area; and
- 3,126 miles of Great Lakes shoreline (more fresh water coastline than any other state).[8]

In 2016, the total reported water withdrawal amount from the Basin for Michigan was 9,017 mgd (34,336 mld), a decrease of 7 percent from the 2015 total water withdrawal amount of 9,783 mgd (37,032 mld). The largest use was thermoelectric power production, once-through and recirculated cooling, totaling 6,751 mgd (25,555 mld) or 74 percent of the total withdrawal amount. The four Great Lakes were the largest source for withdrawals at 80 percent of the total. Half of the total water withdrawal amount (4,537 mgd, 17,174 mld) came from the Lake Erie watershed, mainly used for thermoelectric power production. Forty-one percent of total withdrawal amount (3,674 mgd or 13,907 mld) came from the Lake Michigan watershed, followed by the Lake Huron watershed at 629 mgd or 2,381 mld (7 percent) and the Lake Superior watershed at 230 mgd or 870 mld (3 percent).

Michigan reported no diversions. The total amount of consumptive use was 585 mgd or 2,214 mld (six percent of the total withdrawal amount), with self-supply irrigation being the largest contributor to consumptive use at 284 mgd (1,075 mld).

Data collected for this report came from multiple sources: Michigan Department of Environmental Quality and the Michigan Department of Agriculture and Rural Development. These data were generated with estimated reporting compliance rates ranging from 75 to 99 percent of total water use reporters, depending on the water use sector. Withdrawals and consumptive uses are not estimated for facilities not in compliance with reporting for most water use sectors except for self-supply livestock and self-supply thermoelectric power production once-through cooling, which were partially estimated by the state agency each for a single facility due to a missing 2016 report.

Notable changes in 2016 water use by Michigan facilities include:

- The significant decrease in self-supply thermoelectric power production once-through cooling, down roughly 16%, was mostly the result of one plant closure;
- A drier year across Michigan's lower peninsula resulted in nearly a 40% increase in self-supply irrigation water use. Figure 15 shows the five-year trend in irrigation water use; and,
- An increase in industrial use primarily reported in the Detroit area.

[8] Michigan Dept. of Transportation. http://www.michigan.gov/mdot/0,4616,7-151-9622_11033_11151-67959--,00.html

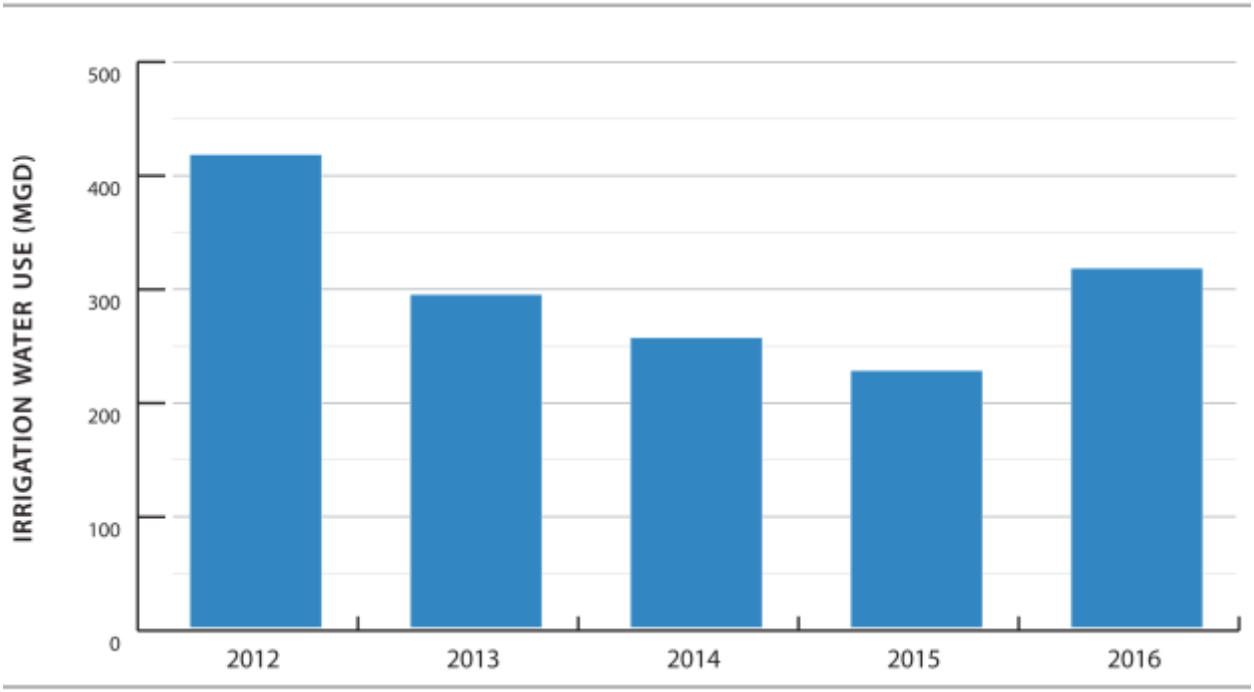

Figure 15. Michigan's self-supply irrigation water use over the past 5 years.

Table 13a. Michigan 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	937	15	201	1,153	0	0	144
Self-Supply Commercial & Institutional	0	3	5	8	0	0	1
Self-Supply Irrigation	1	76	239	316	0	0	284
Self-Supply Livestock	0	30	10	40	0	0	1
Self-Supply Industrial	327	376	87	789	0	0	79
Self-Supply Thermoelectric Power Production (Once-through cooling)	5,815	741	1	6,558	0	0	48
Self-Supply Thermoelectric Power Production (Recirculated cooling)	183	7	3	193	0	0	28
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	4	9	14	0	0	0
Total	7,263	1,253	555	9,071	0	0	585

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 13b. Michigan 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	3,546	56	762	4,364	2	0	497
Self-Supply Commercial & Institutional	0	11	19	30	0	0	4
Self-Supply Irrigation	2	289	904	1,195	0	0	771
Self-Supply Livestock	0	223	39	152	0	0	3
Self-Supply Industrial	1,237	1,424	328	2,988	0	0	248
Self-Supply Thermoelectric Power Production (Once-through cooling)	22,013	2,806	4	24,823	0	0	165
Self-Supply Thermoelectric Power Production (Recirculated cooling)	693	28	11	731	0	0	123
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	2	16	35	53	0	0	0
Total	27,492	4,743	2,100	34,336	2	0	1,810

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Minnesota

The Minnesota part of the Lake Superior watershed encompasses approximately 6,200 square miles. Major river watersheds in the basin include the Cloquet, Nemadji and St. Louis River systems, as well as the north shore tributaries to Lake Superior.[9]

Excluding in-stream hydroelectric water use (2,917 mgd or 11,041 mld), the total withdrawal amount from the Basin for Minnesota was 2,605 mgd (9,861mld), an increase of 47 percent from the total withdrawal amount for 2015 (1,771 mgd or 6,703 mld). This is explained by the continued increase in the off-stream hydroelectric power production sector, withdrawing a total amount of 2,160 mgd (8,177 mld) compared to 1,227 mgd (4,644 mld) in 2015, which is an increase of 76 percent increase from the previous year. Other major water use sectors include thermoelectric power production, once-through cooling at 206 mgd (780 mld) and industrial at 198 mgd (751 mld). In 2016, 91 percent of total withdrawals (2,360 mgd or 8,934 mld) came from other surface water within the Lake Superior watershed, while 9 percent, or 240 mgd (908 mld), came from Lake Superior. The large relative use of 'other surface water' to 'great lakes surface water' comes from water use for hydroelectric power production on the St. Louis River.

The total reported diversion amount of 13 mgd (50 mld) was for industrial purposes. Total consumptive use was 28 mgd (107 mld), which has decreased by at least 1 mgd (4 mld) every year since 2013. The majority of consumptive use was for industrial purposes (20 mgd or 75 mld).

The water use data was provided by the Minnesota Department of Natural Resources which collected measured water use data from water withdrawal permit holders with a 100 percent reporting compliance from permitted water withdrawal facilities.

Notable changes in 2016 water use by Minnesota facilities include:

- The 6% reduction in industrial water use was primarily the result of declines in mining activity at one facility;
- The 30% reduction in self-supply thermoelectric power production once-through cooling was the result of changes in fuel use (coal to natural gas) and plant idling; and,
- The increasing use of in-stream hydroelectric water continues the trend from previous years as increased flow in the St. Louis River was maintained over this period.

[9] Minnesota Pollution Control Agency. 2013. http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/basins/lake-superior-basin/index.html

Table 14a. Minnesota 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	28	2	5	34	0	0	3
Self-Supply Commercial & Institutional	1	1	0	2	0	0	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	1	0	0	1	0	0	1
Self-Supply Industrial	103	96	0	198	0	13	20
Self-Supply Thermoelectric Power Production (Once-through cooling)	108	98	0	206	0	0	4
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	2,160	0	2,160	0	0	0
In-Stream Hydroelectric Water Use	0	2,917	0	2,917	0	0	0
Other Self Supply	0	4	0	4	0	0	0
Total	240	5,276	6	5,522	0	13	28

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 14b. Minnesota 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	104	6	20	130	0	0	13
Self-Supply Commercial & Institutional	4	2	0	6	0	0	1
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	3	0	0	3	0	0	2
Self-Supply Industrial	388	363	2	751	0	50	75
Self-Supply Thermoelectric Power Production (Once-through cooling)	408	369	2	780	0	0	16
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	8,177	0	8,177	0	0	0
In-Stream Hydroelectric Water Use	0	11,041	0	11,041	0	0	0
Other Self Supply	0	15	0	15	0	0	0
Total	908	19,973	22	20,902	0	50	106

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW) totals may not sum exactly due to rounding

New York

Approximately 80 percent of New York State's fresh surface water, over 700 miles of shoreline and nearly 48 percent of New York lands are contained in the drainage watersheds of Lake Erie, Lake Ontario and the St. Lawrence River, which includes the Lake Champlain/Lake George watersheds. More than four million New Yorkers depend on the fresh water of these watersheds for drinking water, and hundreds of miles of waterways and border waters for navigation.[10]

Excluding in-stream hydroelectric water use (213,960 mgd or 809,927 mld), the total withdrawal amount from the Basin for New York was 3,846 mgd (14,558 mld), a 5 percent increase from 2015 (3,667 mgd or 13,882 mld). The Lake Ontario watershed was the source of the majority of New York's water withdrawals at 3,077mgd (11,649 mld) or 80 percent of the total withdrawal amount. Thermoelectric power production (both once-through and recirculated cooling) at 2,148mgd (8,131 mld) represented 56 percent of the total withdrawal amount; public water supply (484 mgd or 1,832mld) represented nearly 13 percent of the total; and industrial (319 mgd or 1,207 mld) represented 8 percent of the total. For the Lake Erie and Lake Ontario watersheds, Great Lakes surface water was the primary source of water, when in-stream hydroelectric is excluded. For the St. Lawrence River watershed, other surface water was the primary source of water, when in-stream hydroelectric is excluded.

The 2016 total diversion amount for New York was 45 mgd (169 mld) of which 13 mgd (48 mld) was for public supply and 32 mgd (121 mld) for other self-supply purposes. The total consumptive use amount was 252 mgd (956 mld). The largest consumptive uses were attributed to industrial purposes at 64 mgd (242 mld) and public water supply at 60 mgd (227 mld).

The water use data was provided by the New York State Department of Environmental Conservation. The data collected was metered and estimated water use. Reporting compliance varies among the water use sectors from 80 percent for the livestock sector to 100 percent for the hydroelectric power sector. Low reporting compliance for the livestock sector might be the result of users failing to report when their use was below the reporting threshold. New York State does not estimate the water use for facilities that did not report their use. New York's 5-year implementation of permits for water withdrawal will be completed during 2017. These permits include a requirement to report use, which should support continuing improvement in compliance.

Notable changes in 2016 water use by New York facilities include:

- The 10% increase in water use for self-supply thermoelectric power production once-through cooling was the result of a handful of facilities increasing their water use.

[10] Great Lakes Basin Advisory Council. 2013. Our Great Lakes Water Resources: Conserving and Protecting Our Water Today for Use Tomorrow Final Report. http://www.dec.ny.gov/docs/regions_pdf/glbacfrpt.pdf

Table 15a. New York 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	304	164	16	484	0	13	60
Self-Supply Commercial & Institutional	0	46	1	48	0	0	9
Self-Supply Irrigation	0	28	3	31	0	0	27
Self-Supply Livestock	0	16	9	26	0	0	4
Self-Supply Industrial	165	150	6	319	0	0	64
Self-Supply Thermoelectric Power Production (Once-through cooling)	1,569	146	0	1,715	0	0	34
Self-Supply Thermoelectric Power Production (Recirculated cooling)	432	0	0	432	0	0	22
Off-Stream Hydroelectric Power Production	0	42	0	42	0	0	0
In-Stream Hydroelectric Water Use	135,523	80,908	0	213,960	0	0	0
Other Self Supply	0	748	1	749	0	32	33
Total	135,523	82,246	37	217,806	0	45	252

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 15b. New York 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	1,150	621	61	1,833	0	48	227
Self-Supply Commercial & Institutional	0	175	5	180	0	0	34
Self-Supply Irrigation	1	104	10	115	0	0	103
Self-Supply Livestock	0	61	35	97	0	0	13
Self-Supply Industrial	626	558	23	1,207	0	0	242
Self-Supply Thermoelectric Power Production (Once-through cooling)	5,941	553	1	6,495	0	0	130
Self-Supply Thermoelectric Power Production (Recirculated cooling)	1,636	1	0	1,637	0	0	82
Off-Stream Hydroelectric Power Production	0	159	0	159	0	0	0
In-Stream Hydroelectric Water Use	503,657	306,270	0	809,927	0	0	0
Other Self Supply	0	2,831	3	2,835	0	121	123
Total	513,011	311,335	139	824,485	0	169	956

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Ohio

Ohio's portion of the Lake Erie watershed drains 11,649 square miles and is home to 4.65 million people. Ohio's 312 mile-long shoreline includes the cities of Toledo, Sandusky and Cleveland. Agricultural row crops account for 59 percent of the land use in the Ohio watersheds draining to Lake Erie, followed by urban residential and commercial land use at a combined 16 percent. Another 16 percent are forested lands and wetlands, and pasture land makes up another 5 percent of total land use.[11]

The 2016 total reported withdrawal amount from the Basin for Ohio was 1,477 mgd (5,593mld), a 15 percent decrease from the total withdrawal amount for 2015 (1,739 mgd or 6,582 mld). Primary water use sectors included thermoelectric power production (once-through and recirculated cooling) at 596 mgd 2,258 mld), representing 40 percent of total withdrawal amount; public water supply (501 mgd or 1,898 mld), representing 34 percent; and industrial (208 mgd or 786 mld), representing 14 percent. The source for 67 percent of the total withdrawal amount was Lake Erie. However, within the irrigation and industrial water use sectors, other surface water was the primary source at 89 percent and 56 percent of the total withdrawal amount, respectively.

Diversions out of the Lake Erie watershed totaled 13 mgd (47 mld), all for public water supply purposes. Outgoing diversions were offset by incoming diversions totaling 23 mgd (87 mld), primarily for other self-supply purposes, resulting in a net diversion of 10 mgd (40 mld) into the Lake Erie watershed. Total consumptive use was 131 mgd (497 mld). Fifty-seven percent of the total consumptive use was attributed to the public water supply sector.

The water use data was provided by the Ohio Department of Natural Resources, Division of Water Resources with a 100 percent reporting compliance from every water use sector.

Notable changes in 2016 water use by Ohio facilities include:

- The closure of one power plant is the main cause of the 34% drop in self-supply industrial water use in 2016. This plant closure is the primary factor in Ohio's overall decline in water use between 2016 and 2015.

[11] Ohio Environmental Protection Agency. 2010. Ohio Lake Erie Phosphorus Task Force Final Report. http://www.epa.ohio.gov/portals/35/lakeerie/ptaskforce/Task_Force_Final_Report_April_2010.pdf

Table 16a. Ohio 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	380	94	28	501	0	13	75
Self-Supply Commercial & Institutional	0	0	0	0	0	0	0
Self-Supply Irrigation	0	29	3	33	0	0	30
Self-Supply Livestock	0	0	1	1	0	0	0
Self-Supply Industrial	48	115	44	208	0	0	4
Self-Supply Thermoelectric Power Production (Once-through cooling)	431	165	0	596	0	0	6
Self-Supply Thermoelectric Power Production (Recirculated cooling)	129	0	0	129	0	0	13
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	1	8	1	9	0	-23	3
Total	990	411	76	1,477	0	-10	131

In millions of gallons per day Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 16b. Ohio 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	1,439	355	104	1,897	0	47	285
Self-Supply Commercial & Institutional	1	0	0	1	0	0	0
Self-Supply Irrigation	2	112	11	125	0	0	113
Self-Supply Livestock	0	0	2	2	0	-1	2
Self-Supply Industrial	182	437	167	786	0	0	16
Self-Supply Thermoelectric Power Production (Once-through cooling)	1,635	623	0	2,258	0	0	32
Self-Supply Thermoelectric Power Production (Recirculated cooling)	487	0	0	487	0	0	49
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	2	28	4	35	0	-87	10
Total	3,748	1,556	289	5,592	0	-40	497

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Ontario

More than 98 percent of Ontario residents (over 12 million people) live within the Great Lakes-St. Lawrence River Basin. Most live along the coast in eight of Canada's 20 largest cities, which include Toronto, Hamilton, Windsor, and Sarnia.[12] Ontario's portion of the Great Lakes forms the longest freshwater coastline in the world stretching more than 6,800 miles (11,000 kilometers)[13] across five major watersheds in the Great Lakes-St. Lawrence River system: Lake Superior, Lake Huron, Lake Erie, Lake Ontario and the St. Lawrence River watersheds.

Excluding in-stream hydroelectric water use (reported amount of 256,256 mgd or 970,0036 mld), the total water withdrawal amount from the Basin was approximately 16,523 mgd (62,548 mld). The three largest water use categories were thermoelectric power (once-through cooling) at 14,085 mgd (53,319 mld) or 85 percent of the total withdrawal amount; public supply at 1,169 mgd (4,425 mld); and industrial at 1,100 mgd (4,164 mld). Except for the Lake Superior and St. Lawrence River watersheds, where other surface water was the primary source for withdrawals, the primary source for withdrawals came from Great Lakes surface water.

No diversions out of the Great Lakes-St. Lawrence River Basin were reported for Ontario, while diversions into the basin were approximately 3,504 mgd (13,262 mld). The Welland Canal is entirely within Ontario and functions as two intrabasin transfers (one out of the Lake Erie Basin and one into the Lake Ontario Basin). These transfers effectively cancel each other out, resulting in a net zero intrabasin transfer. For more information about the volume of these transfers, see the Lake Erie Basin section above. The total consumptive use amount was approximately 350 mgd (1,326 mld). The three water use sectors representing the largest consumptive uses included thermoelectric power at 127 mgd (480 mld), public water supply at 138 mgd (524 mld) and industrial at 72 mgd (272 mld). Ontario reported intrabasin diversions totaling 4 mgd (14 mld).

These data were provided collaboratively by the Ontario Ministry of Natural Resources and Forestry and the Ontario Ministry of Environment and Climate Change, and were collected primarily through the provincial water taking and reporting system. Additional estimates were provided by water use sector to capture water use that was not reported. Reporting data varied among water use sectors from 91 percent for the industrial sector to 99 percent for public water supply and self-supply livestock.

Notable changes in 2016 water use by Ontario facilities include:

- The major changes in self-supply commercial & industrial are the result of reclassification of one user from other self-supply and one user to public water supply; and,
- While there was not significant change in the overall self-supply industrial water use, there were offsetting changes in water use among a small number of users.

[12] Ontario Ministry of Natural Resources. 2012. http://www.mnr.gov.on.ca/en/Business/GreatLakes/2ColumnSubPage/STEL02_173888.html
[13] Ontario Ministry of the Environment. 2012, http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_096933.pdf

Table 17a. Ontario 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	882	222	65	1,169	4	0	138
Self-Supply Commercial & Institutional	13	96	2	110	0	0	11
Self-Supply Irrigation	0	2	0	2	0	0	2
Self-Supply Livestock	0	29	23	52	0	0	0
Self-Supply Industrial	654	346	101	1,100	0	0	72
Self-Supply Thermoelectric Power Production (Once-through cooling)	13,349	737	0	14,085	0	0	127
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	142,072	114,185	0	256,256	0	-3,504	0
Other Self Supply	2	3	0	5	0*	0	0
Total	156,970	115,619	191	272,780	4	-3,504	350

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

** The intrabasin transfers associated with the Welland Canal effectively cancel each other out, resulting in a net zero intrabasin transfer. For more information about the volume of these transfers, see the Lake Erie Basin section above.*

Table 17b. Ontario 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	3,337	842	246	4,425	14	0	524
Self-Supply Commercial & Institutional	48	362	6	417	0	0	42
Self-Supply Irrigation	0	8	0	9	0	0	7
Self-Supply Livestock	0	108	88	196	0	0	2
Self-Supply Industrial	2,474	1,309	381	4,164	0	0	272
Self-Supply Thermoelectric Power Production (Once-through cooling)	50,530	2,789	0	53,319	0	0	480
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	537,800	432,237	0	970,036	0	-13,262	0
Other Self Supply	6	10	2	18	0*	0	0
Total	594,195	437,665	724	1,032,584	14	-13,262	1,326

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

** The intrabasin transfers associated with the Welland Canal effectively cancel each other out, resulting in a net zero intrabasin transfer. For more information about the volume of these transfers, see the Lake Erie Basin section above.*

Pennsylvania

The Pennsylvania portion of the Lake Erie watershed spans 508 square miles. The largest land uses in Pennsylvania's portion of the Basin are agriculture and forest.[14] While it is the smallest watershed in the state, it is home to more than 240,000 people concentrated along the 76.6 miles of Lake Erie coastline.

The total withdrawal amount from the Basin for Pennsylvania was 39 mgd (147 mld). The majority (31 mgd or 117 mld), or 87 percent of the total withdrawal amount, was used for public water supply purposes.

No diversions were reported in 2016. The total consumptive use was 4 mgd (15 mld). The public water supply sector made up the vast majority (78 percent) of the total consumptive use.

The water use data were provided by the Pennsylvania Department of Environmental Protection (DEP). Reporting compliance varied among water use sectors from 80 percent for the irrigation sector to 100 percent for the self-supply commercial and institutional sector. Pennsylvania DEP did not include estimated water use for the facilities that failed to report their water use to the state.

[14] Email communications with David Skellie, Pennsylvania Sea Grant. 2013.

Table 19a. Pennsylvania 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	29	0	1	31	0	0	3
Self-Supply Commercial & Institutional	0	0	0	0	0	0	0
Self-Supply Irrigation	0	0	0	0	0	0	0
Self-Supply Livestock	0	3	1	4	0	0	0
Self-Supply Industrial	4	0	0	4	0	0	0
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	0	0	0	0	0
Total	33	3	3	39	0	0	4

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 19b. Pennsylvania 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	112	0	5	117	0	0	12
Self-Supply Commercial & Institutional	0	0	0	0	0	0	0
Self-Supply Irrigation	0	1	0	1	0	0	1
Self-Supply Livestock	0	10	5	15	0	0	1
Self-Supply Industrial	14	0	0	14	0	0	1
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	0	0	0	0	0	0
Total	126	11	10	147	0	0	15

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Québec

The majority of Québec's population lives in the Great-Lakes St. Lawrence River watershed. The portion of the St. Lawrence River included in the Great Lakes – St. Lawrence Basin Agreement territory includes the Montreal metropolitan area that represents nearly 50 percent of Québec's population. Some of the tributaries with the greatest flow within that portion are the Outaouais (Ottawa) River, the Richelieu River, and the St. François River.

The total withdrawal amount from the Basin for Québec was 1,228 mgd (4,634 mld) – similar to the 2015 withdrawal total of 1,232 mgd (4,662 mld). The majority (72 percent) of this amount was used for public water supply purposes at 884 mgd (3,345 mld). The next major water use, industrial sector, made up a s6 percent of the total withdrawals at 320 mgd (1,203 mld).

The total diversion amount was 3 mgd (12 mld) for public supply purposes. The total consumptive use amount was 241 mgd (911 mld), representing 20 percent of the total withdrawal amount, but a 37 percent drop from 2015 (383 mgd, 1,451 mld). The primary water use sectors contributing to the total consumptive use were public supply at 146 mgd (553 mld) and industrial at 83 mgd (316 mld).

Starting with 2012 water use data, the province of Québec began its water use data collection program, which gathers estimated or metered water use data reported by water users. Being rather new, this program has made progress in identifying and correcting reporting errors, and increasing reporting compliance for all the water use sectors. Québec began collecting water use reports from the irrigation (agricultural users), livestock, and fish breeding users in 2016. Because of the new sectors reporting and the relatively new system overall, Québec data is getting better year after year, but regarding Québec's 2016 water use report, the data for the irrigation, livestock, and fish breeding sectors must be considered as incomplete and unrepresentative.

Notable changes in 2016 water use by Québec facilities include:

- Differences in consumptive use between 2016 and 2015 are primarily the result of fine tuning the methodology of calculating consumptive use for public water supply, with an effort to get municipalities to calculate consumptive use similarly.

Table 20a. Québec 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	650	190	44	884	0	3	146
Self-Supply Commercial & Institutional	0	5	0	5	0	0	4
Self-Supply Irrigation	0	3	1	5	0	0	4
Self-Supply Livestock	0	4	0	4	0	0	3
Self-Supply Industrial	132	165	21	318	0	0	83
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	6	3	0	10	0	0	1
Total	788	370	68	1,225	0	3	241

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 20b. Québec 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	2,459	718	168	3,345	0	12	553
Self-Supply Commercial & Institutional	1	17	2	20	0	0	15
Self-Supply Irrigation	1	12	4	17	0	0	15
Self-Supply Livestock	0	16	0	16	0	0	12
Self-Supply Industrial	498	624	81	1,203	0	0	316
Self-Supply Thermoelectric Power Production (Once-through cooling)	0	0	0	0	0	0	0
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0	0	0	0	0
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	24	12	1	38	0	0	2
Total	2983	1,399	256	4,638	0	12	911

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Wisconsin

About 10,000 square miles of Lakes Michigan and Superior lie within Wisconsin's borders.[15] The state has more than 1,000 miles of Great Lakes shoreline and more than 20 percent of the state's land area lies within the Basin where half the population of the state also lives. More than 1.6 million Wisconsin citizens get their drinking water from Lake Michigan or Lake Superior.[16]

The total reported water withdrawal amount from the Basin for Wisconsin was 3,983 mgd (15,077 mld), a five percent decrease from the 2015 water withdrawal total of 4,185 mgd (15,843 mld). The majority (99 percent) of the withdrawals came from the Lake Michigan watershed. The primary water use sectors were thermoelectric power production (once-through and recirculated cooling) at 3,493 mgd (13,222 mld), public water supply at 287 mgd (1,085 mld), and industrial at 111 mgd (421 mld).

The total reported diversion was 20 mgd (74 mld) from the Lake Michigan watershed, mainly for thermoelectric power production (recirculated cooling) purposes. The total consumptive use was 117 mgd (443 mld). The primary consumptive uses came from thermoelectric power (43 mgd or 161 mld), public water supply (34 mgd or 130 mld), and irrigation (21 mgd or 79 mld).

The water use data were provided by the Wisconsin Department of Natural Resources. Reporting compliance varied among water use sectors from 96 percent for multiple sectors to 100 percent for the thermoelectric sector. Data was not estimated for the facilities that did not report water use.

[15] Wisconsin Sea Grant. 2013. http://seagrant.wisc.edu/Home/AboutUsSection/PressRoom/Details.aspx?PostID=796
[16] Wisconsin Department of Natural Resources. 2013. http://dnr.wi.gov/topic/greatlakes/learn.html

Table 21a. Wisconsin 2016 Water Use Data Summary in mgd

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	218	21	48	287	0	7	34
Self-Supply Commercial & Institutional	1	6	2	10	0	0	0
Self-Supply Irrigation	0	2	28	30	0	0	21
Self-Supply Livestock	0	23	16	38	0	0	5
Self-Supply Industrial	0	95	15	111	0	0	14
Self-Supply Thermoelectric Power Production (Once-through cooling)	3,269	224	0	3,493	0	0	35
Self-Supply Thermoelectric Power Production (Recirculated cooling)	13	0	0	13	0	13	8
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	1	1	2	0	0	0
Total	3,501	372	110	3,983	0	20	117

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Table 21b. Wisconsin 2016 Water Use Data Summary in mld

Sector	Withdrawals				Diversions		Consumptive Use
	GLSW	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	825	79	180	1,085	0	26	130
Self-Supply Commercial & Institutional	5	23	9	37	0	0	2
Self-Supply Irrigation	0	8	106	114	0	0	79
Self-Supply Livestock	0	86	59	145	0	0	20
Self-Supply Industrial	1	59	59	421	0	0	51
Self-Supply Thermoelectric Power Production (Once-through cooling)	12,375	847	0	13,222	0	0	132
Self-Supply Thermoelectric Power Production (Recirculated cooling)	48	0	0	48	0	48	29
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	0	0	0	0	0	0
Other Self Supply	0	3	3	6	0	0	0
Total	13,254	1,407	415	15,077	0	74	443

In millions of liters per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW); totals may not sum exactly due to rounding

Appendices

Appendix A. General Definitions from the Compact and Agreement

Basin or Great Lakes-St. Lawrence River Basin means the watershed of the Great Lakes and the St. Lawrence River upstream from Trois-Rivières, Québec.

Consumptive Use means that portion of the water withdrawn or withheld from the basin that is lost or otherwise not returned to the basin due to evaporation, incorporation into products or other processes.

Diversion means a transfer of water from the basin into another watershed, or from the watershed of one of the Great Lakes into that of another by any means of transfer, including but not limited to a pipeline, canal, tunnel, aqueduct, channel, modification of the direction of a water course, a tanker ship, tanker truck or rail tanker but does not apply to water that is used in the basin or a Great Lake watershed to manufacture or produce a product that is then transferred out of the basin or watershed.

Divert has a corresponding meaning.

Withdrawal means the taking of water from surface water or groundwater.

Source Watershed means the watershed from which a withdrawal originates. If water is withdrawn directly from a Great Lake or from the St. Lawrence River, then the Source Watershed shall be considered to be the watershed of that Great Lake or the watershed of the St. Lawrence River, respectively. If water is withdrawn from the watershed of a stream that is a direct tributary to a Great Lake or a direct tributary to the St. Lawrence River, then the Source Watershed shall be considered to be the watershed of that Great Lake or the watershed of the St. Lawrence River, respectively, with a preference to the direct tributary stream watershed from which it was withdrawn.

Appendix B. Water Use Sector Definitions

Public Water Supply

Water distributed to the public through a physically connected system of treatment, storage and distribution facilities serving a group of largely residential customers that may also serve industrial, commercial and other institutional operators. Water withdrawn directly from the basin and not through such a system shall not be considered to be used for Public Water Supply purposes.

Self-Supply Commercial and Institutional

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, 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.

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.

Self-Supply Livestock

Water used by animals such as horses, cattle, sheep, goats, hogs and poultry. Water used in fish hatchery operations is also included under this category.

Self-Supply Industrial

Industrial water includes water used in the manufacture of metals, chemicals, paper, food and beverage and other 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. Once initially reported, water used in a closed cycle (recirculation) will not be reported as a withdrawal. "Make-up water[17]" will be reported once upon entering the system. Other situations should be evaluated on a case-by-case basis.

Self-Supply Thermoelectric Power Production (Once-through cooling)

Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here.

Self-Supply Thermoelectric Power Production (Recirculated cooling)

Withdrawals and consumptive uses already recorded under another category (e.g., public supply) will not be reported here. Once initially reported, water used in a closed cycle (recirculation) will not be reported as a withdrawal. "Make-up water" will be reported once upon entering the system.

[17] For industrial boiler systems, make-up water is the raw water, softened water or demineralized water required for steam generation. http://www.pdhcenter.com/courses/m165/m165content.pdf

Off-Stream Hydroelectric Power Production

Water removed from a stream channel and used to drive turbines that generate electric power. This category also includes "off-stream use" for pumped-storage systems [e.g., reservoir storage] that return water to the source.

In-Stream Hydroelectric Water Use

This category includes "run of the river" use, which is not considered a water withdrawal or consumptive use. Reporting for this category is voluntary.

Other Self Supply

Water used for purposes not reported in categories 1-9. Examples include, but are not limited to, withdrawals for fish/wildlife, environmental, navigation and water quality purposes. Specifically, water used to maintain levels for navigation, for fish and wildlife habitat creation and enhancement (excluding fish hatchery operations included in category four), 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.