Annual Report of the Great Lakes Regional Water Use Database

Representing 2013 Water Use Data

Prepared by the Great Lakes Commission for the
Great Lakes-St. Lawrence River Water Resources Regional Body and the
Great Lakes-St. Lawrence River Basin Water Resources Council

Great Lakes Commission
des Grands Lacs

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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 and Dan Injerd (Illinois), Allison Mann (Indiana), Andrew LeBaron (Michigan), Sean Hunt (Minnesota), Rich Kruzansky (New York), Lenn Black (Ohio), Jonathan Staples (Ontario), Dave Jostenski (Pennsylvania), Marc-Olivier Bedard (Québec), Kathleen Mooney and Shaili Pfeiffer (Wisconsin) for their time and effort in preparing and reviewing the 2013 water use data. We are also appreciative of the Council of Great Lakes Governors for their financial support of this effort and careful review of this report.

Preface

This is the Annual Report of the Great Lakes-St. Lawrence River Regional Water Use Database, representing 2013 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.

After two decades of collecting water use data and issuing the annual water use reports under the Charter, the database has been revised and upgraded to meet the requirements set forth by the Compact and Agreement. In 2008, to help implement the needed improvements in jurisdictional water use data collection and reporting programs, 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 repository by the states and provinces is accurate, of the highest quality, and reported in a common and consistent manner. The 2013 annual water use report presents the second 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 much additional work needs to be done and that improvements in data collection, reporting, quality, accuracy and compatibility must continue to occur. Additional information describing the improvements to the data collected under the 2009 regional water use data

collection and reporting protocols is provided in Appendix A. The proceeding section describes the progress made in 2014 to improve data quality.

Overview

Improving Data Quality

Together with the Council of the Great Lakes Governors, the GLC is leading the states and provinces to improve data collection, reporting, quality, accuracy and compatibility. To guide the preparation of 2013 data and this report, several steps have been made to improve data quality. The first one was the convening of a May 2014 workshop of the state and provincial water use managers to discuss issues related to data sharing and improving overall data quality. In addition to sharing experiences related to each jurisdiction's water use data collection program, workshop participants identified the following actions: 1) improve documentation and reporting of metadata through an automated process using online forms, 2) update the regional consumptive use coefficient table and 3) post information related to data updates to the Great Lakes Regional Water Use Data website.

The next step toward improving data quality was the creation of metadata. Metadata is information 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 purpose, the GLC created a template to document metadata. Beginning with this report, the states and provinces have submitted metadata along with the associated 2013 water use data to the GLC. Through the creation of metadata, states, provinces and the GLC were better able to identify and correct errors in 2013 and 2012 datasets.

An additional step taken in 2014 for improving data quality was an in-depth examination of trends in consumptive uses between 2010, 2011 and 2012. The GLC together with the state and provincial water use data managers reviewed consumptive use amounts for 2010, 2011 and 2012 to get a better understanding of why the total reported consumptive use has increased over those years. This activity led to some jurisdictions re-examining and correcting their data for those years. How much these reported increases can be attributed to actual increases in consumptive uses is not well understood. The GLC identified the following factors to be associated with these increases: errors in the data, changes in the weather, the application of new consumptive use calculation methods, large gaps in time in reporting new data, improved reporting compliance and actual water use changes. A full summary of this analysis can be found in Appendix E of this report.

The GLC will continue to work with the states and province to identify additional areas for improvement and will carry out the activities begun in 2014. While this report contains the best available information as of its publishing date (December, 2014), the states and provinces may continue to update their 2013 data housed in the online database. Therefore, discrepancies between the data online and those summarized in this report may appear. Data summarized in this report are available to download from the GLC website at projects.glc.org/waterusedata.

Interim Cumulative Impact Assessment

An addition to the 2013 annual water use report is the interim cumulative impact assessment found in Appendix D. The interim assessment was developed in response to requirements of the Agreement and

Compact to conduct cumulative impact assessments for each lake and St. Lawrence River watershed and for the entire Basin. According to the Agreement and the Compact, these assessments shall be conducted: a) every 5 years; b) each time the incremental losses to the Basin reach 50 million gallons per day (mgd) [190 million liters per day (mld)] average in any 90-day period in excess of the quantity at the time of the last assessment; or c) at the request of one or more the states or provinces. The data submitted to the Great Lakes-St. Lawrence Regional Water Use Database indicate an increase in incremental water losses[1] to the Basin over the years 2010 to 2012. From 2010 to 2011, the total water loss for Basin increased by 280 mgd; from 2011 to 2012, total water loss increased by 348 mgd[2]. The annual increase from 2010 to 2012 in total water loss exceeded the threshold for conducting the regional cumulative impact assessment. Hence, the interim cumulative impact assessment for the years 2011-2012 was developed to fulfill the requirements of the Compact and Agreement.

The first cumulative impact assessment covered five years from 2006 to 2010. It used the Basin water budget as an accounting of water flows into and out of the Basin. The following observations were made in the first assessment:

- Diversions and consumptive use are very small relative to inflows.
- The uncertainty associated with estimated inflow and outflow data was significantly larger than total consumptive use for the Basin.

The full report, *Cumulative Impact Assessment of Withdrawals, Consumptive Uses and Diversions, 2006-2010*, is available at http://glslregionalbody.org/ or http://www.glslcompactcouncil.org/.

The approach taken for the interim cumulative impact assessment is similar to that of the first assessment. The interim assessment focuses on the hydrologic effects of consumptive uses and diversions on water supply and flow at watershed and Basin scales for the years 2011-2012.

The interim assessments reflects the same observations made in the first cumulative impacts assessment for the years 2006-2010; mainly, that diversions and consumptive uses are very small relative to inflows. Additionally, the following observations were made in the interim assessment:

- For the years 2006-2012, the net effect of consumptive uses and diversions was positive for the Basin. In other words, more water was diverted into the Basin than the total combined amount of water diverted out of the Basin or withdrawn and not returned.
- For the years 2011-2012, diversions and consumptive use remained very small relative to inflows.

[1] Incremental water loss is defined as new or increased outgoing diversions plus consumptive uses.
[2] It should be noted that the implementation of the 2009 Water Use Data Protocols and the new or improved jurisdictional data collection and reporting programs began with the collection of 2012 water use data. Therefore, the increase of water loss between 2011 and 2012 may reflect the improvements in data collection and reporting among other factors which are described in Appendix E of the 2013 Annual Water Use Report.

Great Lakes Regional Water Use for 2013

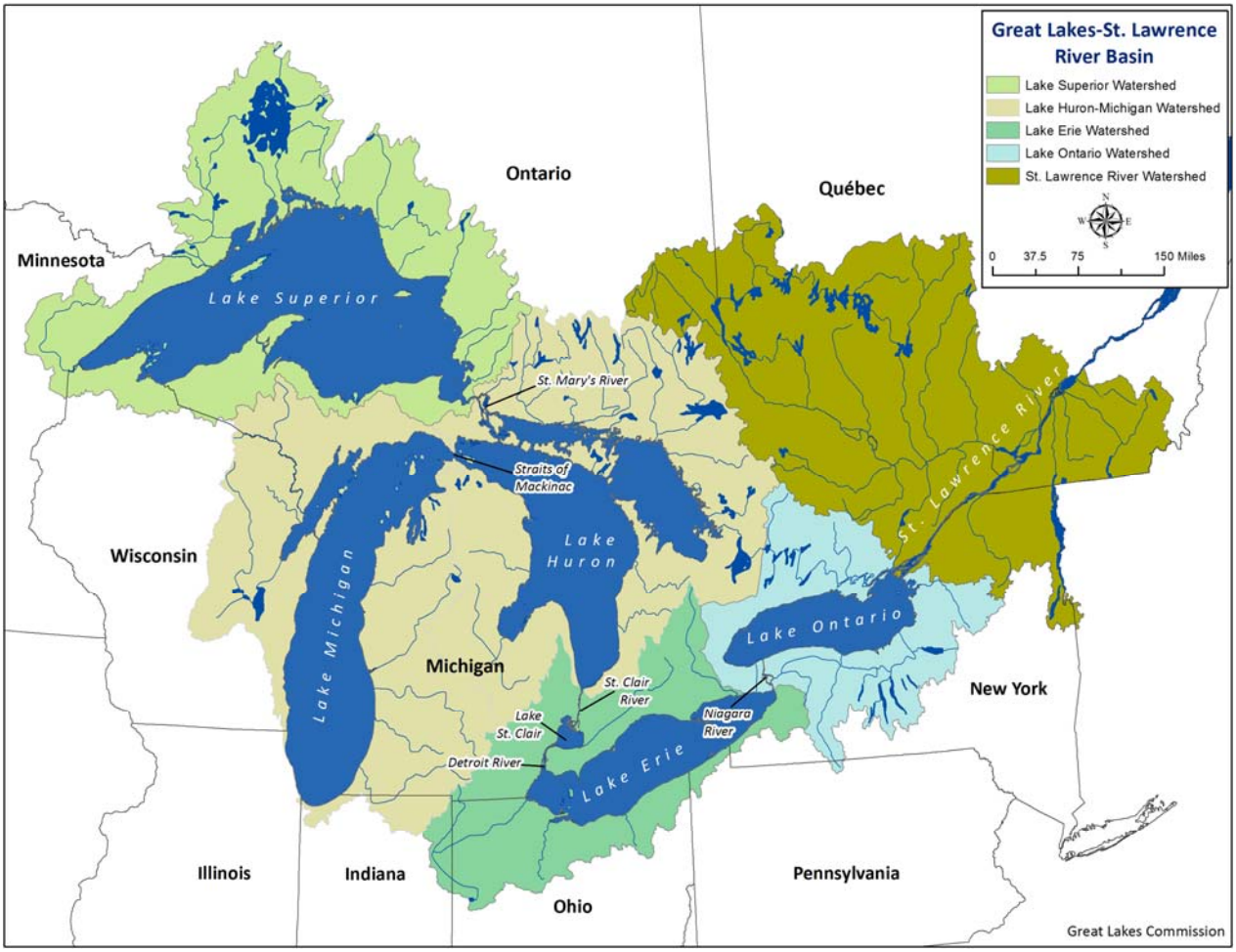

Figure 1. Great Lakes-St. Lawrence River Basin

The Great Lakes-St. Lawrence River – the world's largest freshwater system – spans an area of 289,600 square miles (750,000 square kilometers). Its total volume is 6.5 quadrillion gallons, an amount that would fill 9 billion Olympic size swimming pools.[3]

In 2013, the total withdrawal amount for the Great Lakes-St. Lawrence River Basin, excluding in-stream hydroelectric water use, was 42,380 million gallons per day (mgd) or 160,420 million liters per day (mld). This total represents a 5 percent decrease from the 2012 withdrawal amount total of 44,490 mgd. Only 5.5 percent of the total amount withdrawn (2,330 mgd) 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 the pie chart below. The 10 water use sectors are defined in Appendix C. Thermoelectric power production, industrial and public water supply are the primary water use sectors, (i.e., those withdrawing the largest volumes of water).

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

Water Withdrawals by Water Use Sector in mgd (excluding in-stream hydroelectric water use)

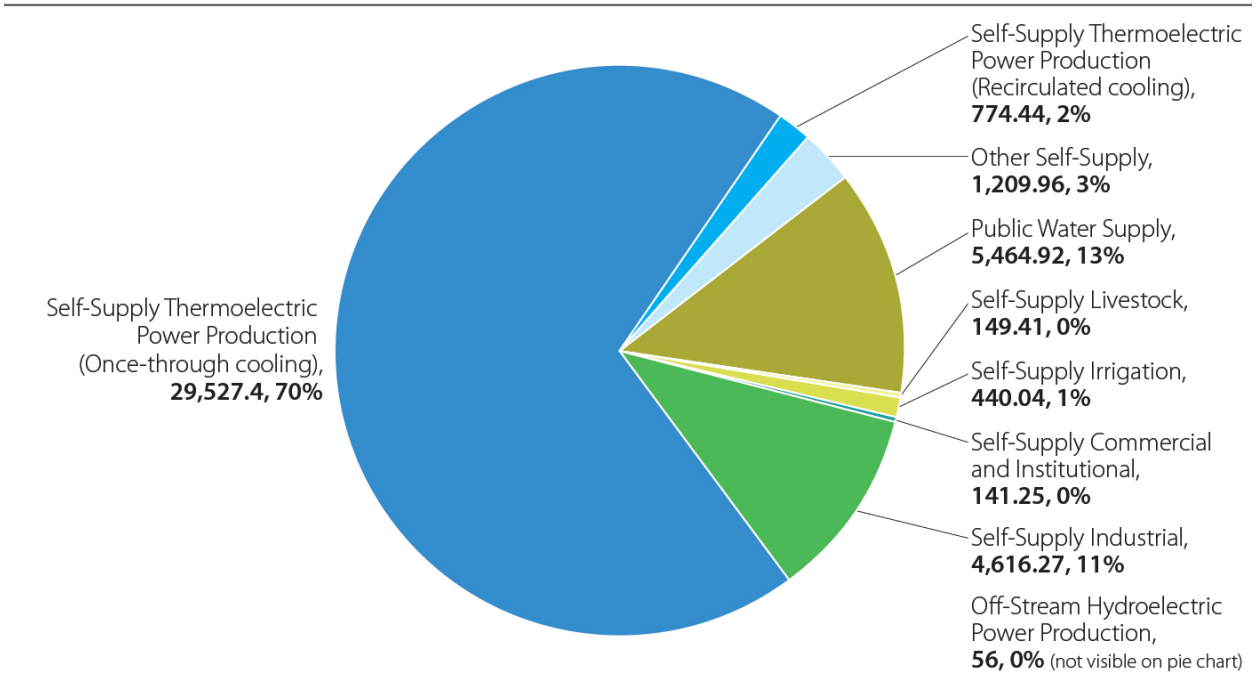

Figure 2.

The lake watershed that has the greatest withdrawal is Lake Michigan, followed by lakes Ontario and Erie respectively. The graph below shows withdrawals by watershed broken down by water source, e.g., Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW).

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

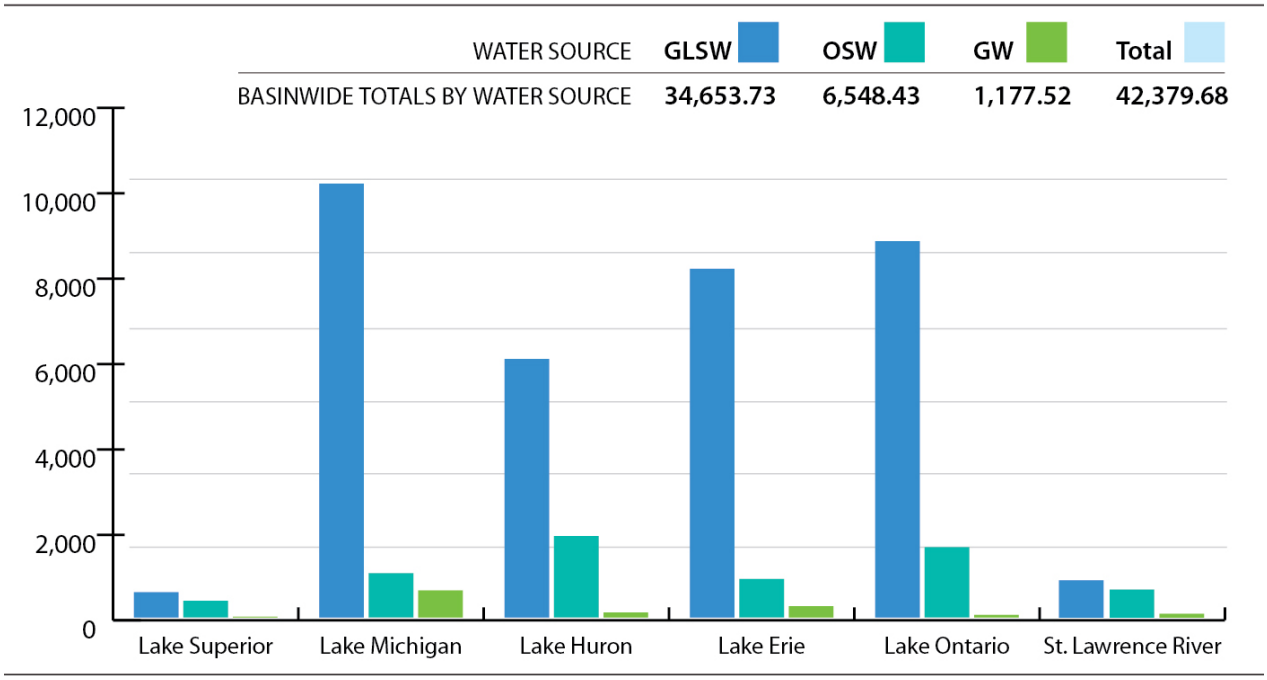

Figure 3.

The pie chart below shows total withdrawals portioned by jurisdiction, excluding in-stream hydroelectric water use. Ontario, with a land area spanning five watersheds, was the largest withdrawer of Great Lakes water at 16,6683.87 mgd or 39 percent of the total withdrawal amount. In contrast, Pennsylvania, with a land area of 508 square miles within the Lake Erie watershed, withdrew just 32.2 mgd.

Water Withdrawals by Jurisdiction in mgd (excludes in-stream hydroelectric water use)

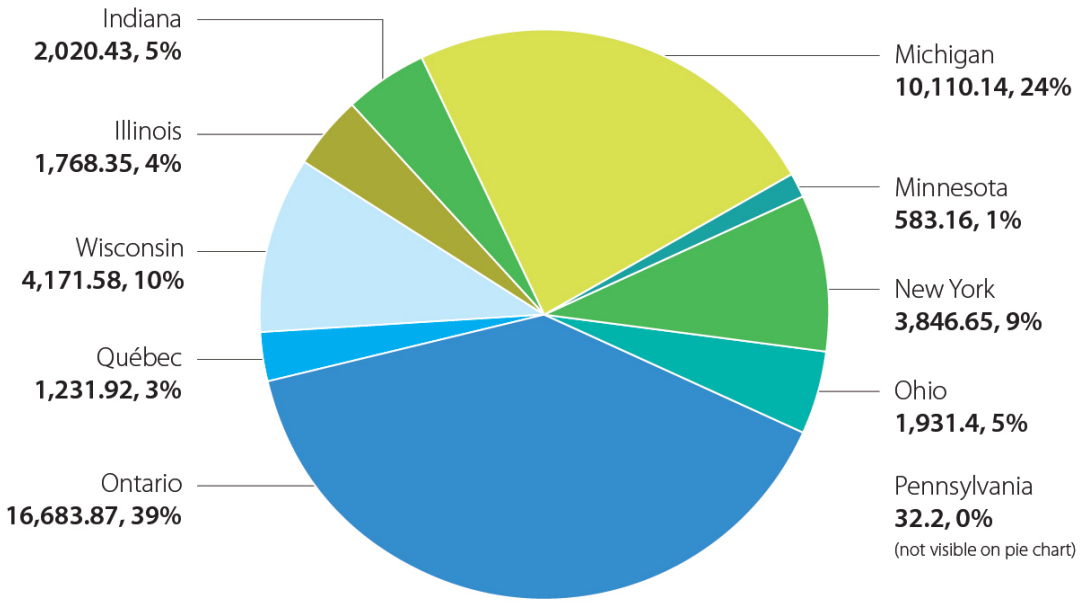

Figure 4.

Hydroelectric Power Generation

In the past years of reporting on annual water use, withdrawals for hydroelectric purposes (both in-stream and off-stream) have been the largest single sector of use, typically representing more than 95 percent of the region's total water withdrawals. In-stream hydroelectric power production continues to be an important 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[4]). However, beginning in 2012, under the 2009 water use data collection and reporting protocols, the reporting of in-stream hydroelectric power production data is optional.

The regional water use database is designed to receive and report on both 1) off-stream hydroelectric power production water withdrawals; and 2) in-stream hydroelectric water use data submitted by the states and provinces. For 2013, the regional database has an incomplete data set related to the in-stream hydroelectric water use sector. Québec and Indiana did not report hydroelectric water use that both jurisdictions have for past reports. Moreover, in-stream hydroelectric power water use is not considered a withdrawal because the water remains in the water body and is not associated with any water consumption.

In contrast, off-stream hydroelectric is considered a withdrawal since the water is removed to a retention area or a reservoir that serves as a pump-storage system. These reservoirs substantially increase the surface area of the water body, and in so doing, they increase the evaporation expected from that body of water,

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

resulting in a consumptive use. After being used, it is then returned to the original water source. Both off-stream and in-stream totals are presented in a chart format in each of the watershed and jurisdiction summaries contained in this report. In 2013, a withdrawal total of 56 mgd was reported for the off-stream hydroelectric power production sector. This withdrawal amount was reported by the state of New York for the Lake Ontario watershed.

Diversions and Consumptive Uses

Diversions and consumptive uses of water are key components of the regional water use database. The Compact and Agreement definitions for diversions and consumptive use are presented in Appendix B. Consumptive uses and diversions (less return flow) reflect water not being returned (e.g., water loss) to the source watershed. These water use data are considered particularly informative for assessing the cumulative hydrologic effects of water use in the region. A more in-depth assessment of the cumulative effects is presented in Appendix D.

Total 2013 diversion from the Great Lakes-St. Lawrence River Basin was 1,278.42 mgd or 4,839.35 mld. The majority (88% or 1,120.34 mgd) 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 is relatively constant with the 2012 reported amount of 1,127.38 mgd. 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 (two incoming diversions from the Hudson Bay watershed into northern Lake Superior) which contributed 3,013.83 mgd (11,408.59 mld) to the Basin in 2013 - a decrease of 786.28 mgd or 20 percent from the 2012 reported amount of 3,800.11 mgd. This decrease is well in the range of flow variability observed from 1944-2013. The flow from these diversions can range from 1,643 to 5,181 mgd[5]. 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, e.g., incoming diversions minus outgoing diversions, is -1,738.08 mgd[6] (-6,579.35 mld), meaning that more water is diverted into the basin than is diverted out of the Basin.

Consumptive use is defined as 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 current database framework documents the consumptive use coefficient used for each water withdrawal record and the percentage of the consumptive use amount that was determined through actual measurement. Total consumptive use for the Basin was 2,332.56 mgd (8,8829.71 mld) - a decrease of 119.87 mgd or 5 percent from the 2012 total consumptive use amount of 2,452.43 mgd. The public water supply at 785.65 mgd and industrial at 715.87 mgd were primary contributors to the total consumptive use amount. At 852.09 mgd (3,225.50 mld), the Lake Michigan watershed had the largest consumptive use total among the five lake watersheds and the St. Lawrence River watershed. Taking in consideration both consumptive use and diversions, the reported water loss to the Basin was 594.48 mgd (2,250.35 mld) for the year 2013. In contrast, 2012 water use data showed a net water gain of 62.05 mgd to the Basin. Tables 1-3 summarize water withdrawals, diversions and consumptive uses at the regional scale.

[5] Information on the flow variability of the Long Lac and Ogoki diversions came from the Ontario Power Generation.
[6] The Great Lakes Regional Water Use Database records all incoming diversions with a negative sign and all outgoing diversions with a positive sign. This sign convention is different from what is used in the interim cumulative impact assessment, Appendix D.

Table 1. Basin 2013 Water Use Data Summary by Watershed

Watershed	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Lake Superior	590.76	39,616.4	19.56	**40,226.72**	0.08	-3,006.04	46.96
Lake Michigan	10,159.44	1,039.23	630.99	**11,829.67**	0.35	1217	852.09
Lake Huron	6,053.12	16,352.27	117.83	**22,523.22**	42.73	0	139.46
Lake Erie	49,869.5	1,490.58	262.85	**51,622.93**	4,936.34	4.51	444.94
Lake Ontario	50,044.83	96,502.42	58.93	**146,606.17**	6.18	40.4	366.19
St. Lawrence River	155,220.69	54,457.178	87.37	**209,765.234**	0	6.04	482.92
Total	**271,938.33**	**209,458.08**	**1,177.52**	**482,573.93**	**4,985.68**	**-1,738.08**	**2,332.56**

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Table 2. Basin 2013 Water Use Data Summary by Sector

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	4,217.1	790.4	457.42	**5,464.92**	49.26	974.16	785.65
Self-Supply Commercial & Institutional	60.23	67.15	13.86	**141.25**	0	2.17	29.12
Self-Supply Irrigation	2.88	124.99	312.17	**440.04**	0	0.17	385.97
Self-Supply Livestock	0.68	83.15	65.58	**149.41**	0	-0.15	20.82
Self-Supply Industrial	3,127.39	1,175.91	312.97	**4,616.27**	0.08	30.74	715.87
Self-Supply Thermoelectric Power Production (Once-through cooling)	2,6249.5	3,276.38	1.52	**2,9527.4**	0	0	259.32
Self-Supply Thermoelectric Power Production (Recirculated cooling)	743.88	27.54	3.02	**774.44**	0	14.72	90.94
Off-Stream Hydroelectric Power Production	0	56	0	**56**	0		0
In-Stream Hydroelectric Water Use	237,284.61	202,909.63	0	**440,194.23**	0	-3,013.83	0
Other Self Supply	252.06	946.92	10.98	**1,209.96**	4,936.34	253.93	44.86
Total	**27,1938.33**	**209,458.08**	**1,177.52**	**482,573.93**	**4,985.68**	**-1,738.08**	**2,332.56**

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Table 3. Basin 2013 Water Use Data Summary by Jurisdiction

Jurisdiction	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Illinois	1,768.23	0	0.12	**1,768.35**	0	1,120.34	0.13
Indiana	1,843.94	70	106.49	**2,020.43**	0	83.41	428.93
Michigan	8,033.96	1,510.6	565.59	**10,110.14**	0.35	0	549.33
Minnesota	320.02	2,166.17	6.51	**2,492.7**	0	7.79	32.56
New York	121,499.21	82,299.62	34.82	**203,833.65**	0	43.54	243.51
Ohio	1,424.79	421.68	84.93	**1,931.4**	0	-2.68	135.6
Ontario	132,651.19	122,138.68	191.68	**254,981.56**	4,985.25	-3,013.83	351.75
Pennsylvania	27.59	1.6	3.01	**32.2**	0	0	5.22
Québec	782.24	390.23	59.45	**1,231.92**	0	2.9	455.9
Wisconsin	3,587.16	459.5	124.93	**4,171.58**	0.08	20.44	129.65
Total	**271,938.33**	**209,458.08**	**1,177.52**	**482573.93**	**4,985.68**	**-1,738.08**	**2,332.56**

In millions of gallons per day; Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Lake Watershed Summaries

Lake Superior

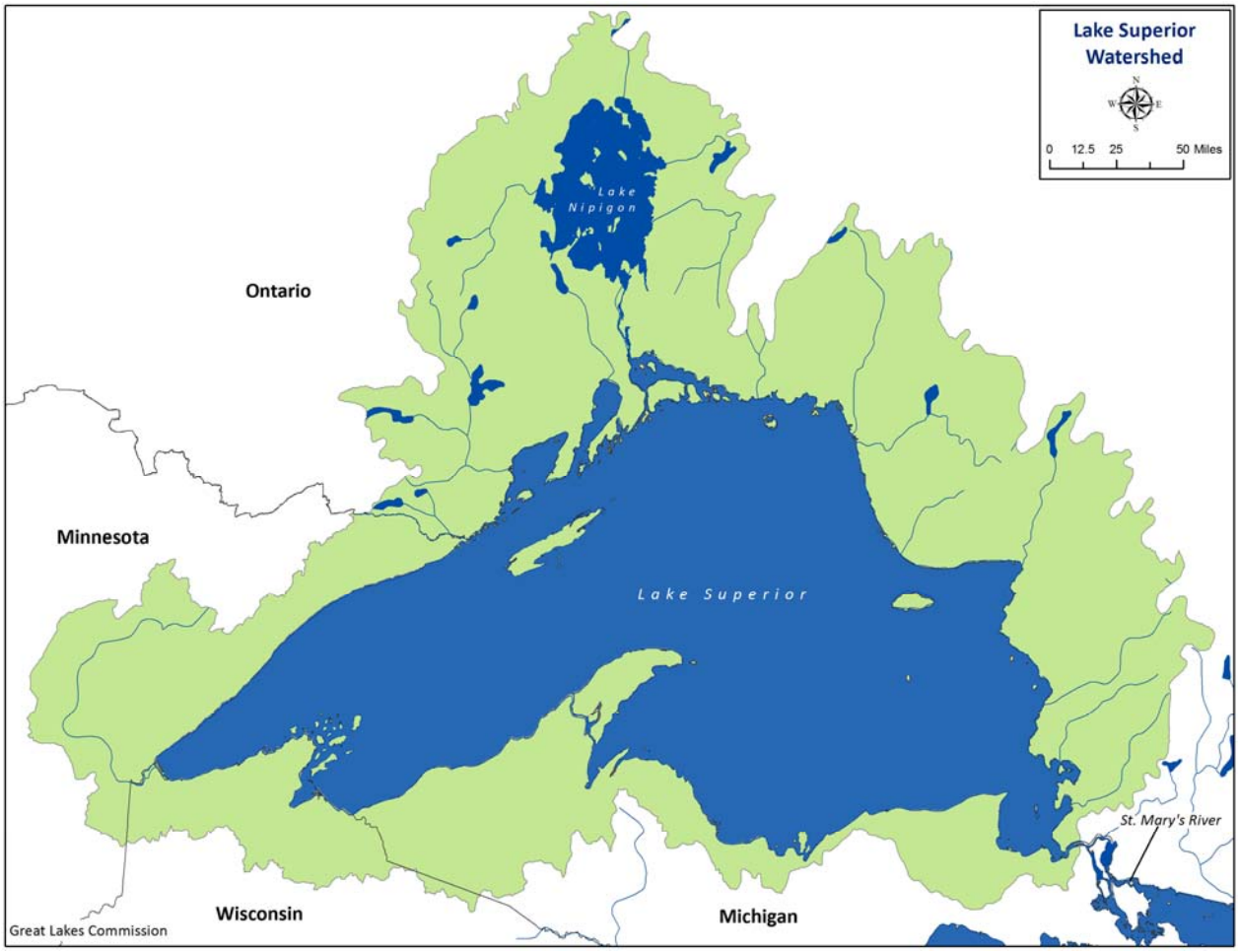

Figure 3. Lake Superior Watershed

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.[7] Its surface area is roughly the size of South Carolina, approximately 31,700 square miles (82,103 square kilometers).

Water Withdrawals

Four jurisdictions share the Lake Superior watershed – Michigan, Minnesota, Ontario and Wisconsin – which

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[1]: 191 years

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

[7]Minnesota Sea Grant. 2012. http://www.seagrant.umn.edu/superior/facts

collectively withdrew 1,003.91 mgd of water, excluding in-stream hydroelectric water use (40,226.72 mgd). Thermoelectric power production, once-through and recirculated cooling (632.2 mgd) and industrial (277.58 mgd) were the major water use sectors

Other surface waters within the Lake Superior watershed were primarily used to generate electricity with in-stream hydroelectric. Excluding in-stream hydroelectric water use, 59 percent (590.76 mgd) of the total withdrawal amount came from Lake Superior. The remaining withdrawals came directly from other surface water of the Lake Superior watershed (39% or 393.6 mgd) and groundwater (2% or 19.56 mgd).

Water Diversions and Consumptive Uses

Water loss in the Lake Superior watershed totaled 54.83 mgd (5 percent of the total withdrawal amount). It was comprised mainly of the aggregated industrial water diversion in Minnesota of 7.78 mgd and the total watershed consumptive use for all four jurisdictions of 46.96 mgd. Industrial use (29.31 mgd), use for thermoelectric power, recirculated cooling (7.57 mgd) and the public water supply (6.99 mgd) sectors were the largest contributors, respectively, to the total consumptive use for the watershed.

Water gain (3,013.83 mgd) in the Lake Superior watershed came from the historic Long Lac and Ogoki diversion in Northern Ontario. On average, these diversions into the basin were about 25 percent larger by volume than the Illinois diversion out of the Basin.

Table 4. Lake Superior Watershed 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	45.98	3.44	14.2	**63.62**	0	0	6.99
Self-Supply Commercial & Institutional	0.52	0.78	0	**1.3**	0	0	0.15
Self-Supply Irrigation	0	0.12	0.97	**1.09**	0	0.01	0.98
Self-Supply Livestock	0.68	25.07	2.38	**28.12**	0	0	1.68
Self-Supply Industrial	142.77	132.93	1.88	**277.58**	0.08	7.78	29.31
Self-Supply Thermoelectric Power Production (Once-through cooling)	372.79	231.24	0.13	**604.16**	0	0	7.57
Self-Supply Thermoelectric Power Production (Recirculated cooling)	28.02	0.02	0	**28.04**	0	0	0.28
Off-Stream Hydroelectric Power Production	0	0	0	**0**	0	-3,013.83	0
In-Stream Hydroelectric Water Use	0	39,222.81	0	**39,222.81**	0	0	0
Other Self Supply	0	0	0	**0**	0	0	0
Total	**590.76**	**39,616.4**	**19.56**	**40,226.72**	**0.08**	**-3,006.04**	**46.96**

In millions of gallons per day
Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Lake Michigan

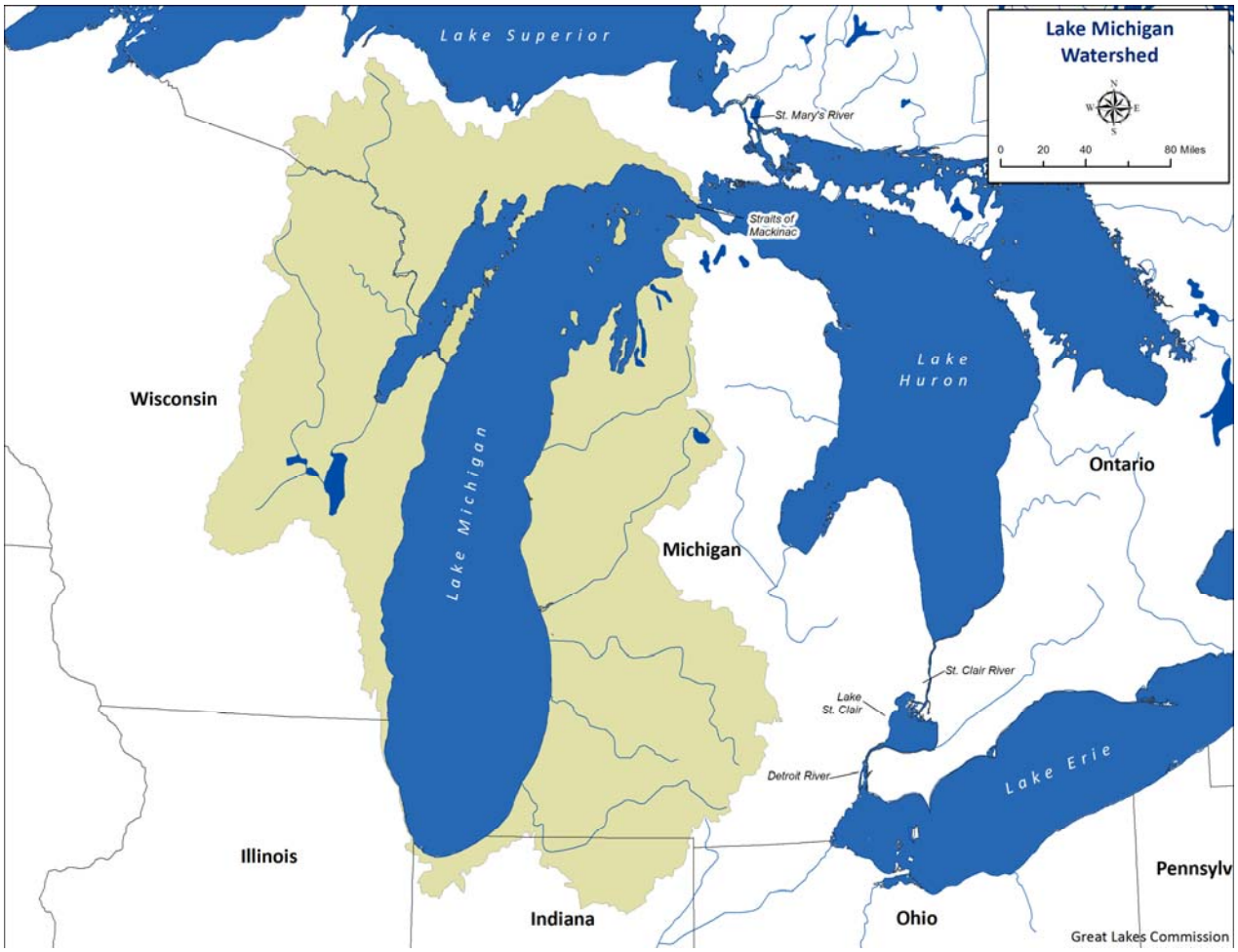

Figure 4. Lake Michigan Watershed

Overview of Watershed Characteristics

Lake Michigan is the only one of the Great Lakes 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 used 11,829.7 mgd. The primary water uses were thermoelectric power, both once-through and recirculated cooling (7,630.89 mgd), industrial

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

(1,947.1mgd) and public water supply (1,594.68 mgd). Lake Michigan (86% of total withdrawals or 10,159.44 mgd) was the primary source of water withdrawals in the watershed.

Water Diversions and Consumptive Uses

Water loss in the Lake Michigan watershed, totaling 2,069.08 mgd and representing 17 percent of total withdrawals, was comprised mainly of the Illinois diversion (1,120.34 mgd for public water supply and other purposes) and the total consumptive use of the four jurisdictions (852.08 mgd). Industrial (378.49 mgd), irrigation (300.19 mgd) and public water supply (80.64 mgd) were the water use sectors that contribute the majority of the consumptive uses in the watershed.

Table 5. Lake Michigan Watershed 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	1,339.92	22.01	232.74	**1,594.68**	0.35	939.04	80.64
Self-Supply Commercial & Institutional	3.89	1.53	10.26	**15.68**	0	2.17	1.60
Self-Supply Irrigation	0.22	64.00	280.21	**344.43**	0	0.16	300.19
Self-Supply Livestock	0	16.76	29.50	**46.26**	0	0	8.07
Self-Supply Industrial	1,593.27	285.14	68.68	**1,947.10**	3	22.96	378.49
Self-Supply Thermoelectric Power Production (Once-through cooling)	6,209.80	621.76	0.99	**6,832.55**	0	0	40.62
Self-Supply Thermoelectric Power Production (Recirculated cooling)	769.46	26.68	2.20	**798.34**	0	14.72	38.82
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	242.88	1.35	6.41	**250.64**	0	237.95	3.62
Total	**10,159.40**	**1,039.23**	**630.99**	**11,829.70**	**0.35**	**1,217.00**	**852.08**

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Lake Huron

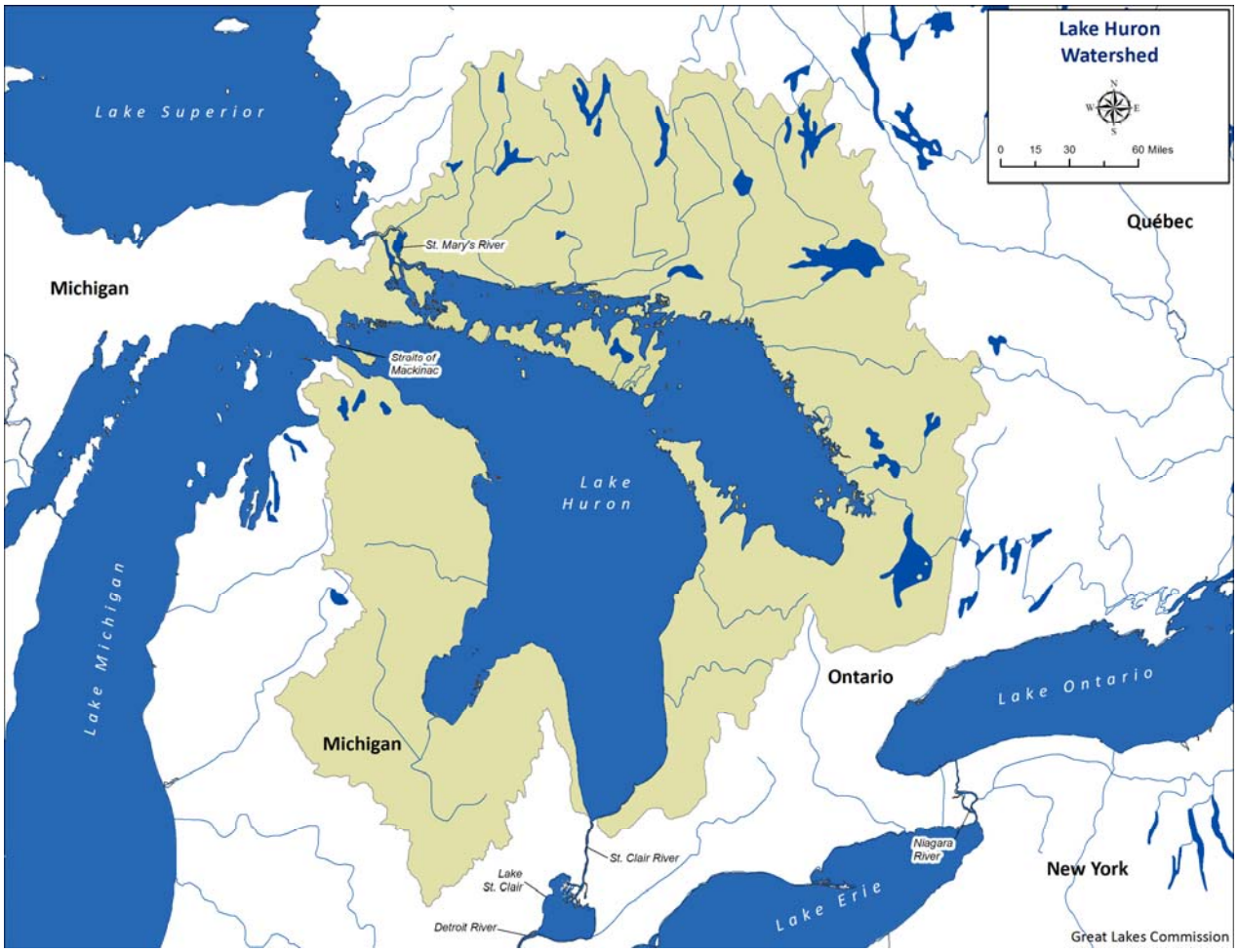

Figure 5. Lake Huron Watershed

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.

Water Withdrawals

Two jurisdictions – Michigan and Ontario – share the watershed and collectively used 8,076.09 mgd of the water, excluding in-stream hydroelectric water use (14,447.12 mgd).

The primary water uses were industrial (388.1 mgd), thermoelectric power, once-through cooling (7,381.47 mgd) and public water supply (231.23 mgd). Excluding in-stream hydroelectric water use, Lake Huron was the source of 75 percent of the total withdrawals in the watershed.

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 Diversions and Consumptive Uses

Water loss to the Lake Huron watershed was 182.2 mgd, which represented nearly 2 percent of the total withdrawal amount. This total includes an intrabasin transfer of 42.73 mgd 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 (28.31 mgd) and thermoelectric power production (62.04 mgd) made up the majority (65%) of the consumptive uses in the watershed.

Table 6. Lake Huron Watershed 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	146.42	42.99	41.81	231.23	42.73	0	28.31
Self-Supply Commercial & Institutional	1.06	2.48	0.98	4.52	0	0	0.61
Self-Supply Irrigation	0.79	9.49	17.00	27.28	0	0	24.52
Self-Supply Livestock	0	7.72	19.72	27.44	0	0	4.71
Self-Supply Industrial	236.56	114.09	37.45	388.10	0	0	19.28
Self-Supply Thermoelectric Power Production (Once-through cooling)	5,667.84	1,713.63	0	7,381.47	0	0	61.6
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0	0	0.82	0.82	0	0	0.44
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	0	14,447.12	0	14,447.12	0	0	0
Other Self Supply	0.45	14.75	0.03	15.23	0	0	0
Total	6,053.12	16,352.27	117.81	22,523.21	42.73	0	139.47

In millions of gallons per day
Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Lake Erie

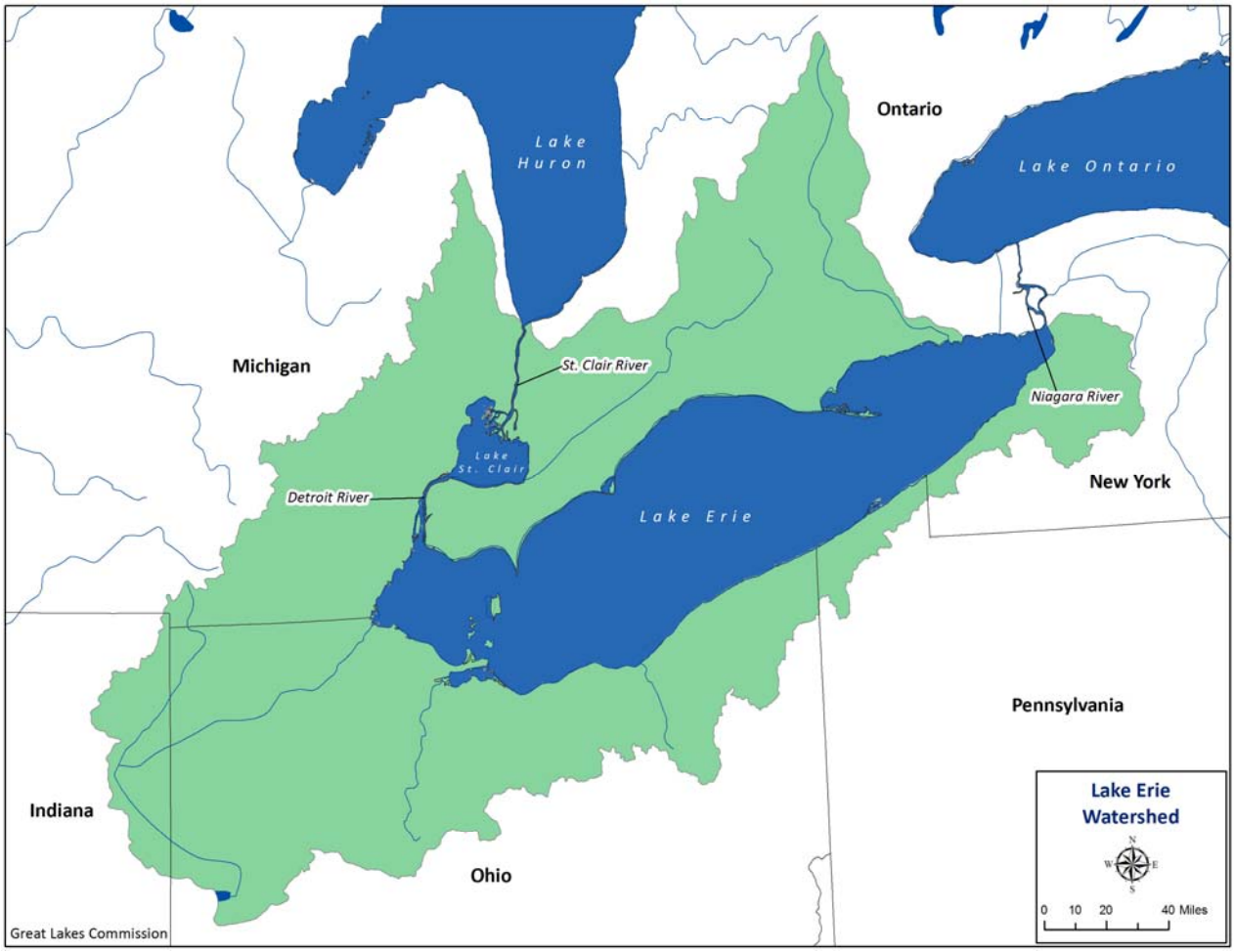

Figure 6. Lake Erie Watershed

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 the greatest depth is 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 also makes it more ecologically sensitive than the other Great Lakes.

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

Water Withdrawals

Six jurisdictions – Indiana, Michigan, New York, Ohio, Ontario and Pennsylvania – share the watershed and

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

collectively used 9,330.64 mgd of the water, excluding in-stream hydroelectric water use, which accounted for 42,292.28 mgd. Aside from water used for hydroelectric power generation purposes, the primary water uses were thermoelectric power, both once-through and recirculated cooling (6,558.97 mgd), public water supply (1,574.93 mgd) and industrial (1,084.4 mgd).

Lake Erie was the source of 84 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

Water loss in the Lake Erie watershed totaled 5,385.79 mgd. This amount includes diversions for public water supply purposes totaling 4.51 mgd, intrabasin transfers totaling 4,936.34 mgd, and a total consumptive use amount of 444.94 mgd. The major consumptive uses were from public water supply (203.22 mgd) and industrial uses (94.47 mgd).

Table 7. Lake Erie Watershed 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	1,286.26	182.08	106.59	1574.93	0	21.64	203.22
Self-Supply Commercial & Institutional	0.30	3.12	1.33	4.75	0	0	0.55
Self-Supply Irrigation	1.49	37.36	12.31	51.16	0	0	45.94
Self-Supply Livestock	0	5.47	5.9	11.37	0	-0.15	3.17
Self-Supply Industrial	658.88	292.21	133.32	1,084.4	0	0	94.47
Self-Supply Thermoelectric Power Production (Once-through cooling)	6,047.31	342.06	0.4	6,389.77	0	0	64.11
Self-Supply Thermoelectric Power Production (Recirculated cooling)	168.64	0.56	0	169.2	0	0	30.97
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use	41,705	587.28	0	42,292.28	0	0	0
Other Self Supply	1.62	40.43	3.01	45.06	4,936.34	-16.02	2.51
Total	49,869.5	1,490.57	262.86	51,622.92	4,936.34	4.51	444.94

In millions of gallons per day
Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Lake Ontario

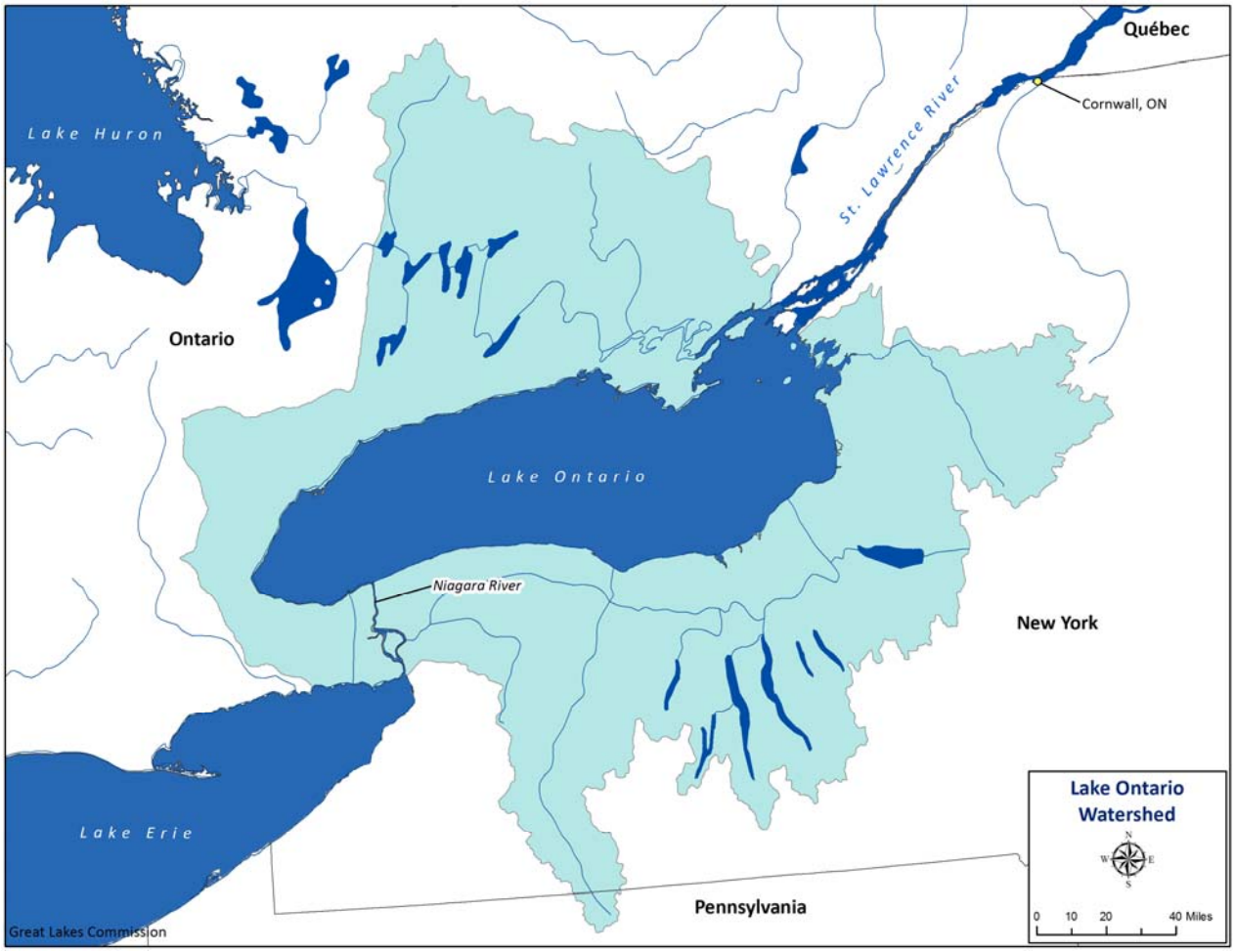

Figure 7. Lake Ontario Watershed

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 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 used 10,518.78 mgd of the water, excluding in-stream hydroelectric water use, which accounted for 136,087.7 mgd. Aside from withdrawals for hydroelectric power generation purposes, the primary water uses were for public water supply (941.89 mgd), other self supply uses (801.55 mgd) and thermoelectric power generation, both once-through and

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

recirculated cooling (8,045.05 mgd).

Lake Ontario was the source for 83 percent of the total withdrawal amount in the watershed. It was the source for most of the water use sectors, except for irrigation and livestock where other surface water in the watershed was the predominant source.

Water Diversions and Consumptive Uses

Water loss in the Lake Ontario watershed totaled 412.76 mgd. This amount includes diversions totaling 32 mgd, an intrabasin diversion of 6.18 mgd and a combined consumptive use amount of 366.18 mgd. The major consumptive uses were from public water supply (116.04 mgd), thermoelectric power production (105.34) and industrial uses (7 mgd).

Table 8. Lake Ontario Watershed 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	733.61	193.69	14.59	941.89	6.18	8.4	116.04
Self-Supply Commercial & Institutional	54.29	49.29	0.36	103.94	0	0	22.12
Self-Supply Irrigation	0	11.27	1.22	12.49	0	0	11.22
Self-Supply Livestock	0	21.15	2.86	24.01	0	0	2.49
Self-Supply Industrial	341.67	153.4	38.78	533.85	0	0	76.11
Self-Supply Thermoelectric Power Production (Once-through cooling)	7,273.65	365.92	0	7,639.57	0	0	84.94
Self-Supply Thermoelectric Power Production (Recirculated cooling)	405.2	0.28	0	405.48	0	0	20.4
Off-Stream Hydroelectric Power Production	0	56	0	56	0	0	0
In-Stream Hydroelectric Water Use	41,234.67	94,852.72	0	136,087.39	0	0	0
Other Self Supply	1.74	798.69	1.11	801.55	0	32	32.86
Total	50,044.83	96,502.41	58.92	146,606.2	6.18	40.4	366.18

In millions of gallons per day
Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

St. Lawrence River

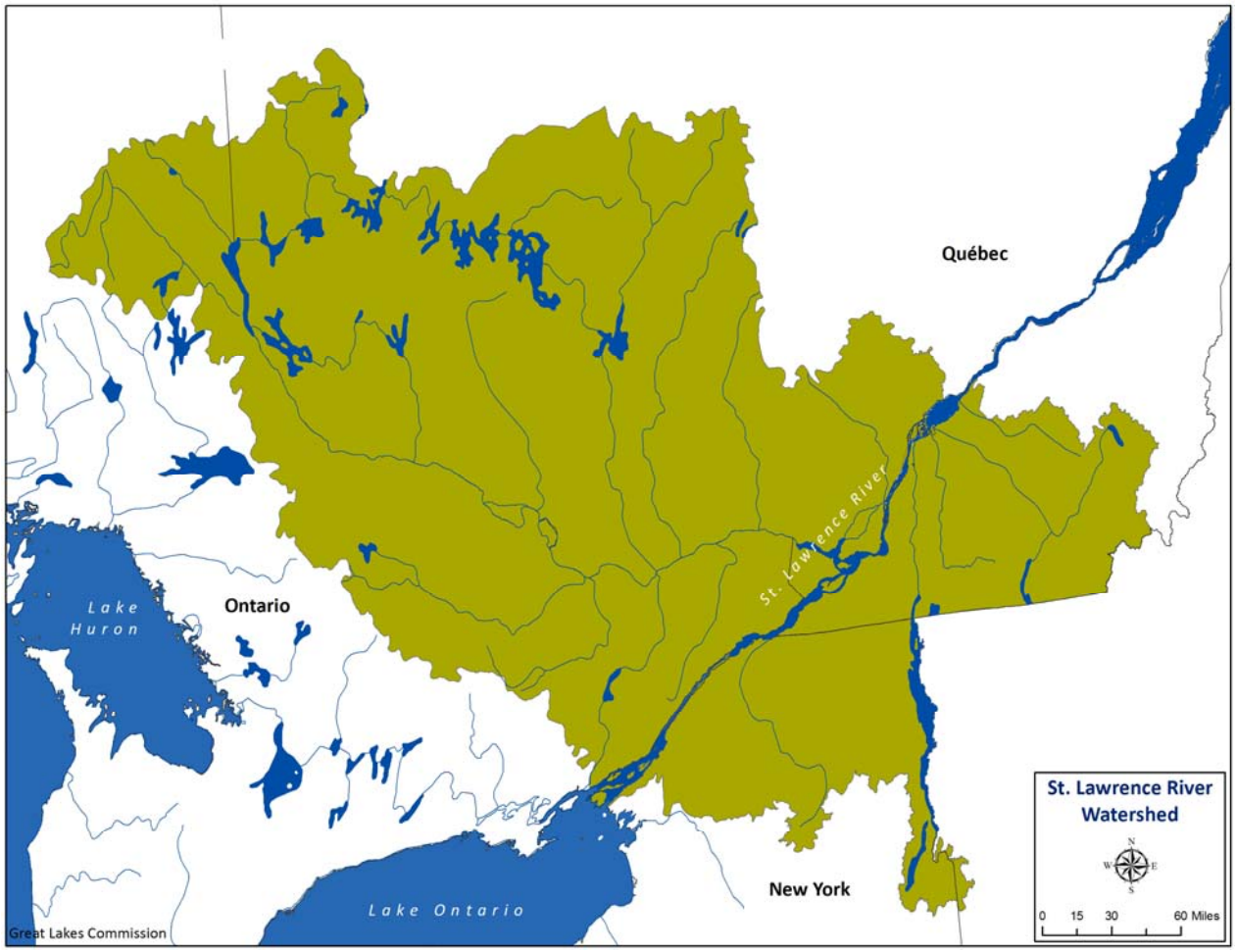

Figure 8. St. Lawrence River Watershed

Overview of Watershed Characteristics

Running 744 miles (1,198 kilometers) in length, the St. Lawrence River is one of the major rivers 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 – New York, Ontario and Québec – share the watershed and collectively used 1,620.6 mgd of the water, excluding in-stream hydroelectric water use, which accounted for 208,144.6 mgd. Aside from hydroelectric, the primary water uses were public water supply (1,058.58 mgd), and industrial (385.24 mgd).

St. Lawrence River was the source for over half (54%) 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%) came from groundwater sources.

Water Diversions and Consumptive Uses

Water loss in the St. Lawrence River watershed totaled 488.97 mgd. This total includes a diversion amount of 6.04 mgd for public supply purposes in New York and Québec and a combined consumptive use amount of 482.93 mgd. The largest consumptive uses were the public water supply sector at 350.45 mgd and industrial at 118.21 mgd.

Table 9. St. Lawrence River Watershed 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	664.91	346.19	47.48	1,058.58	0	6.04	350.45
Self-Supply Commercial & Institutional	0.18	9.95	0.93	11.06	0	0	4.10
Self-Supply Irrigation	0.39	2.75	0.46	3.60	0	0	3.11
Self-Supply Livestock	0	6.98	5.23	12.21	0	0	0.71
Self-Supply Industrial	154.23	198.15	32.86	385.24	0	0	118.21
Self-Supply Thermoelectric Power Production (Once-through cooling)	50.67	1.77	0	52.44	0	0	0.48
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	154,344.94	53,799.70	0	208,144.60	0	0	0
Other Self Supply	5.37	91.69	0.41	97.47	0	0	5.87
Total	155220.70	54,451.18	87.37	209,765.20	0	6.04	482.93

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

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 of Illinois. The Lake Michigan coastline of Illinois is 63 miles long, which is a small fraction of the 1,640 miles that make up the total 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 for Illinois in 2013 was 1,768.35 mgd, an 8 percent decrease from 2012 (1,927.47 mgd). The largest uses of water were public water supply at 880.22 mgd (nearly half of the total withdrawal amount) and thermoelectric power production, once-through cooling at 627.45 mgd (35% 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 into the Mississippi River watershed, is comprised of three elements: public water supply; stormwater runoff; and support for control structures for navigation and discretionary diversion for other purposes such as low flow augmentation and water quality enhancement. The amount of water diverted for public water supply and self-supply commercial and institutional was 882.39 mgd. The diversion amount supporting other uses (i.e., discretionary diversion) was 237.95 mgd.

Data collected for this report came from multiple sources: Illinois Department of Natural Resources, Illinois State Water Survey and the Metropolitan Water Reclamation District of Greater Chicagoland. These data were generated with a 100 percent reporting compliance from permitted water withdrawal facilities.

Table 10. Illinois 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	880.22	0	0	880.22	0	880.22	0
Self-Supply Commercial & Institutional	2.17	0	0	2.17	0	2.17	0
Self-Supply Irrigation	0	0	0.12	0.12	0	0	.12
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	20.44	0	0	20.44	0	0	0.01
Self-Supply Thermoelectric Power Production (Once-through cooling)	627.45	0	0	627.45	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	237.95	0	0	237.95	0	237.95	0
Total	1,768.23	0	0.12	1,768.35	0	1,120.34	0.13

In millions of gallons per day
Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Indiana

The state of Indiana relies on 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 the Lake Michigan watershed, but three of these four counties (Lake, Porter and LaPorte) constitute more than 99.5 percent of the land area. Abundant freshwater from Lake Michigan has promoted the development of an extensive urban and industrial belt along the Indiana coast of Lake Michigan. Water supplies in Indiana's non-coastal counties in the Lake Michigan watershed are drawn primarily from groundwater sources.

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 come from the surface waters of the St. Joseph (a major tributary within the Maumee watershed) and the Maumee River, used for public supply and industrial purposes. Groundwater withdrawals in the Maumee River watershed are used primarily for public and domestic water supply and dewatering for industrial purposes.[8]

In 2013, the total water withdrawal amount for Indiana was 2,020.43 mgd. The largest uses were industrial (1,544.17 mgd), thermoelectric power (249.73mgd) and public water supply (169.14 mgd).

The total diversion amount for Indiana was 83.41mgd. Because a small, 65 square mile 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 (53.65 mgd) were distributed for public supply purposes from Lake Michigan surface water and discharged to the "Illinois Diversion" area, with about 0.93 mgd reported as a diversion from groundwater for public supply. The industrial sector was responsible for about 23.96 mgd of the reported diversion from the Lake Michigan watershed to the Illinois Diversion (about 22.35 mgd from Lake Michigan and 0.61 mgd from other surface water within the Lake Michigan watershed). 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 7.18 mgd 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 totaled 428.92 mgd, with the industrial sector in the Lake Michigan watershed (346.21 mgd or 81%) 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 87 to 100 percent depending on the water use sector.

[8] 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 11. Indiana 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	90.76	32.52	45.86	169.14	0	60.45	20.52
Self-Supply Commercial & Institutional	0	0	1.49	1.49	0	0	0.17
Self-Supply Irrigation	0	7.53	41.48	49	0	0	43.71
Self-Supply Livestock	0	0.25	5.45	5.71	0	0	3.28
Self-Supply Industrial	1,528.97	5.58	9.61	1,544.17	0	22.96	346.21
Self-Supply Thermoelectric Power Production (Once-through cooling)	211.39	0	0.27	211.66	0	0	4.23
Self-Supply Thermoelectric Power Production (Recirculated cooling)	12.82	24.06	1.19	38.07	0	0	10.66
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	0.05	1.14	1.19	0	0	0.14
Total	1,843.94	69.99	106.49	2,020.43	0	83.41	428.92

In millions of gallons per day
Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Michigan

Home to over 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 Lake water area; and
- 3,126 miles of Great Lakes shoreline (more fresh water coastline than any other state).[9]

In 2013, the total water withdrawal amount for Michigan was 10,110.14 mgd, a decrease of 4.7 percent from the 2012 total water withdrawal amount of 10,608.61mgd. The largest use was thermoelectric power production, once-through and recirculated cooling, totaling 8,011.19 mgd or 79 percent of the total withdrawal amount. The Great Lakes proper were the largest source for withdrawals at 79 percent of the total. Nearly half of the total water withdrawal amount (5,012.52 mgd, 50%) came from the Lake Erie watershed, mainly used for thermoelectric power production. Forty percent of total withdrawal amount (3,956.90 mgd) came from the Lake Michigan watershed, followed by the Lake Huron watershed at 898.33 mgd (9%) and the Lake Superior watershed at 242.39 mgd (2%).

Michigan reported no diversions. The total amount of consumptive use was 549.32 mgd (nearly 5% of the total withdrawal amount), with self-supply irrigation being the largest contributor to consumptive use at 263.78 mgd. Two intrabasin transfers were reported, both from the Lake Michigan watershed and both for public supply purposes. One intrabasin transfer (0.28 mgd) discharged to the Lake Superior watershed, and the other (0.07 mgd) discharged to the Lake Erie basin.

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, depending on the water use sector.

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

Table 12. Michigan 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	790.90	19.59	205.13	1,015.63	0.35	0	126.95
Self-Supply Commercial & Institutional	0	0.28	7.15	7.43	0	0	0.93
Self-Supply Irrigation	0.41	68.44	224.24	293.09	0	0	263.78
Self-Supply Livestock	0	22.66	19.3	41.96	0	0	5.8
Self-Supply Industrial	306.43	325	102.27	733.7	0	0	73.37
Self-Supply Thermoelectric Power Production (Once-through cooling)	6,773.14	1,069.33	1.08	7,843.55	0	0	39.78
Self-Supply Thermoelectric Power Production (Recirculated cooling)	162.62	3.18	1.83	167.64	0	0	38.71
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	0.45	2.12	4.58	7.15	0	0	0
Total	8,0233.95	1,510.6	565.58	10,110.15	0.35	0	549.32

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

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.[10]

Excluding in-stream hydroelectric water use (1,909.54 mgd), the total withdrawal amount for Minnesota was 583.16 mgd, a decrease of 40 percent from the total withdrawal amount for 2012 (972.24 mgd). This decrease can be mainly attributed to an off-stream hydroelectric power facility going offline in 2013. The major water use sectors include industrial at 216.8 mgd and thermoelectric power production, once-through cooling at 328.63 mgd. These water use sectors were about equally supplied by Lake Superior and other surface water within the Lake Superior watershed.

The total diversion amount was 7.79 mgd. Nearly the entire amount (7.78 mgd) was for industrial purposes. The remaining 0.01 mgd was for irrigation. Total consumptive use was 32.56 mgd, which is relatively constant compared to the 2012 total consumptive use of 33.23 mgd. The majority of that amount (21.68 mgd) was for industrial purposes.

The water use data was provided by the Minnesota Department of Natural Resources that collected measured water use data from water withdrawal permit holders.

Table 13. Minnesota 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	28.42	1.75	6.01	36.18	0	0	3.62
Self-Supply Commercial & Institutional	0.52	0.35	0	0.87	0	0	0.08
Self-Supply Irrigation	0	0	0	0	0	0.01	0
Self-Supply Livestock	0.68	0	0	0.68	0	0	0.61
Self-Supply Industrial	128.73	87.7	0.37	216.8	0	7.78	21.68
Self-Supply Thermoelectric Power Production (Once-through cooling)	161.67	166.83	0.13	328.63	0	0	6.57
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	1909.54	0	1909.54	0	0	0
Other Self Supply	0	0	0	0	0	0	0
Total	320.02	2,166.17	6.51	2,492.7	0	7.79	32.56

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

[10] 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

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.[11]

Excluding in-stream hydroelectric water use (199,987 mgd), the total withdrawal amount for New York was 3,846.65 mgd, a 4 percent increase from 2012 (3,707.91 mgd[12]). The Lake Ontario watershed was the source of the majority of New York's water withdrawals at 3,093.77 mgd or 80 percent of the total withdrawal amount. Thermoelectric power production (both once-through and recirculated cooling) at 2,177.26 mgd represented nearly 57 percent of the total withdrawal amount; public water supply (454.27 mgd) represented nearly 12 percent of the total; and industrial (307.51 mgd) 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 2013 total diversion amount for New York was 43.54 mgd of which 11.54 mgd was for public supply and 32.98 for other self-supply purposes. The total consumptive use amount was 410.23 mgd. The largest consumptive use was attributed to thermoelectric power recirculated-cooling purposes at 211.23 mgd.

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 vary among the water use sectors from 56 percent for the irrigation sector to 100 percent for the hydroelectric power sector.

[11] 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

[12] This is a corrected water withdrawal total for 2012 which is different from the amount presented in the 2012 Annual Water Use Report. The correct 2012 water use data for the state of New York are available through the Great Lakes Regional Water Use Database at http://projects.glc.org/waterusedata/.

Table 14. New York 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	285.16	154.7	14.42	454.27	0	11.54	55.81
Self-Supply Commercial & Institutional	0	56.99	1.09	58.08	0	0	14.85
Self-Supply Irrigation	0.13	14.38	1.33	15.84	0	0	14.26
Self-Supply Livestock	0	24.36	0.53	24.89	0	0	3.07
Self-Supply Industrial	163.19	128.13	16.18	307.51	0	0	66.7
Self-Supply Thermoelectric Power Production (Once-through cooling)	1,566.53	205.25	0	1,771.78	0	0	35.44
Self-Supply Thermoelectric Power Production (Recirculated cooling)	405.2	0.28	0	405.48	0	0	20.4
Off-Stream Hydroelectric Power Production	0	56	0	56	0	0	0
In-Stream Hydroelectric Water Use	119,079	80,908	0	199,987	0	0	0
Other Self Supply	0	751.54	1.26	752.8	0	32	32.98
Total	121,499.2	82,299.63	34.81	203,833.7	0	43.54	243.51

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Ohio

Ohio's portion of the Lake Erie watershed drains 11,649 square miles and is home to 4.65 million people. Toledo, Sandusky and Cleveland are some of the communities that dot Ohio's 312-mile-long shoreline. 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 were from forested lands and wetlands, combined with pasture land making up 5 percent of total land use.[13]

The 2013 total withdrawal amount for Ohio was 1931.4 mgd, an 18 percent decrease from the total withdrawal amount for 2012 (2,360.05 mgd). Most of this decrease can be attributed to a wetter year and a lower demand for electricity. Primary water use sectors included thermoelectric power production (once-through and recirculated cooling) at 1166.42 mgd, representing 60 percent of total withdrawal amount; public water supply (515.34 mgd), representing 27 percent; and industrial (210.82 mgd), representing 11 percent. The source for 74 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 91 percent and 50 percent of the total withdrawal amount, respectively.

Overall, 13.49 mgd was diverted out of the Lake Erie watershed, all for public water supply proposes, of which 11.63 mgd was returned to the watershed after use, resulting in a net diversion of 1.86 mgd.-This was offset by incoming diversions totaling 16.17 mgd, primarily for other self-supply purposes, resulting in a net diversion of 14.31mgd into the Lake Erie watershed. Total consumptive use was 135.6 mgd. Over half (57%) of the total consumptive use was attributed to the public water supply sector.

Table 15. Ohio 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	389.17	99.5	26.67	515.34	0	1.86	77.31
Self-Supply Commercial & Institutional	0.3	0.02	0	0.32	0	0	0.06
Self-Supply Irrigation	0.42	27.65	2.32	30.39	0	0	27.36
Self-Supply Livestock	0	0	0.98	0.98	0	-0.15	0.78
Self-Supply Industrial	50.93	105.54	54.35	210.82	0	0	5.19
Self-Supply Thermoelectric Power Production (Once-through cooling)	862.26	183.67	0	1,045.93	0	0	10.45
Self-Supply Thermoelectric Power Production (Recirculated cooling)	120.49	0	0	120.49	0	0	12.05
Off-Stream Hydroelectric Power Production	0	0	0	0	0	0	0
In-Stream Hydroelectric Water Use							
Other Self Supply	1.22	5.3	0.61	7.13	0	-16.02	2.4
Total	1,424.79	421.68	84.93	1,931.4	0	-14.31	135.6

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

[13] 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

Ontario

More than 98 percent of Ontario residents (more than 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.[14] Ontario's portion of the Great Lakes forms the longest freshwater coastline in the world stretching more than 6,800 miles (11,000 kilometers)[15] 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.

2012 data was used for this report for most all water use sectors except for the diversion amounts related to the public water supply sector for which 2009 data were used. Excluding in-stream hydroelectric water use (reported amount of 238,297.69 mgd, or 902,054.89 million liters per day [mld]), the total water withdrawal amount was approximately 16,683.86 mgd (63,155.30 mld). The three largest water use categories were thermoelectric power (once-through cooling) at 14,143.53 mgd (53,539.10 mld) or 85 percent of the total withdrawal amount; public supply at 1,145.05 mgd (4,334.5 mld); and industrial at 1,103.68 mgd (4,177.88 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 from the Great Lakes-St. Lawrence River Basin were reported for Ontario in 2013, while diversions into the basin were approximately 3,013.83 mgd (11,408.59 mld). The total consumptive use amount was approximately 358.12 mgd (1,331.5 mld). Three water use sectors, representing the largest consumptive uses, included thermoelectric power at 133.67 mgd (481.9 mld), public water supply at 137.5 mgd (520.49 mld) and industrial at 76.06 mgd (287.92 mld). Ontario reported intrabasin transfers totaling 4,985.25 mgd (18,871.22 mld).

These data 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 71.1 percent for the industrial sector to 91.4 percent for in-stream hydroelectric water use.

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

Table 16. Ontario 2013[16] Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	841.31	235.77	67.97	1,145.05	48.91[17]	0	137.5
Self-Supply Commercial & Institutional	55.34	3.83	1.08	60.26	0	0	8.9
Self-Supply Irrigation	1.53	0.34	0	1.88	0	0	1.59
Self-Supply Livestock	0	19.02	22.77	41.79	0	0	0.4
Self-Supply Industrial	793.92	212	97.77	1,103.68	0	0	76.06
Self-Supply Thermoelectric Power Production (Once-through cooling)	12,751.35	1,392.19	0	14,143.53	0	0	127.30
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	118,205.61	120,092.09	0	238,297.69	0	0	0
Other Self Supply	2.14	183.44	2.09	187.67	4,936.34	-3,013.83	0
Total	132,651.20	122,138.70	191.68	254,981.60	4,985.25	-3,013.83	351.75

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

[16] 2012 water use data was used for the 2013 report.
[17] Re-reported 2009 water use data.

Pennsylvania

The Pennsylvania Lake Erie watershed spans 508 square miles. The largest land uses in Pennsylvania's portion of the Basin are agriculture and forest.[18] While it is the smallest watershed in the state, it is home to more than 240,000 people with the majority concentrated along the 76.6 miles of Lake Erie coastline.

The total withdrawal amount for Pennsylvania was 32.21 mgd. The majority (26.62 mgd or 83% of the total withdrawal amount) was used for public water supply purposes.

No diversions were reported in 2013. The total consumptive use was 5.21 mgd. The public water supply sector made up the majority (51%) of the total consumptive use amount.

The water use data were provided by the Pennsylvania Department of Environmental Protection. Reporting compliance varied among water use sectors from 17 percent for the irrigation sector to 87 percent for the public water supply sector.

Table 17. Pennsylvania 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	24.85	0.09	1.67	26.62	0	0	2.66
Self-Supply Commercial & Institutional	0	0.002	0	0.002	0	0	0.0002
Self-Supply Irrigation	0	0.07	0	0.08	0	0	0.07
Self-Supply Livestock	0	1.43	1.34	2.77	0	0	2.21
Self-Supply Industrial	2.74	0	0	2.74	0	0	0.27
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	27.59	1.59	3.01	32.21	0	0	5.21

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

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

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 Montreal metropolitan area that represents nearly 50 percent of the 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 for Québec was 1,231.91 mgd (4,663.33 mld). The majority (74%) of this amount was used for public water supply purposes at 910.02 mgd (3,444.81 mld). The next major water use, industrial sector, made up a quarter of the total withdrawals at 305.03 mgd (1,154.65 mld).

The total diversion amount was 2.9 mgd (10.99 mld) for public supply purposes. The total consumptive use amount was 455.9 mgd (1,725.78 mld), representing 37 percent of the total withdrawal amount. The primary water use sectors contributing to the total consumptive use were public supply at 330.23 mgd (1,250.07 mld) and industrial at 113.44 mgd (429.41 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.

Table 18. Québec 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	644.39	224.46	41.17	910.02	0	2.9	330.23
Self-Supply Commercial & Institutional	0.18	4.32	0.2	4.7	0	0	3.46
Self-Supply Irrigation	0.39	2.65	0.35	3.38	0	0	2.92
Self-Supply Livestock	0	0	0	0	0	0	0
Self-Supply Industrial	131.91	155.63	17.48	305.03	0	0	113.44
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	5.37	3.17	0.25	8.78	0	0	5.85
Total	782.24	390.23	59.45	1,231.91	0	2.9	455.9

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

Wisconsin

About 10,000 square miles of lakes Michigan and Superior lie within Wisconsin's borders.[19] 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.[20]

The total water withdrawal amount for Wisconsin was 4,171.58 mgd, a five percent decrease from the 2012 water withdrawal total of 4,388.71 mgd. The majority (99%) of the withdrawals came from the Lake Michigan watershed. The primary water use sectors were thermoelectric power production (once-through and recirculated cooling) at 3,597.63 mgd (86% of the total withdrawal amount), public water supply at 312.45 mgd, and industrial at 171.38 mgd.

The total diversion was 20.44 mgd from the Lake Michigan watershed, mainly for thermoelectric power production (recirculated cooling) purposes. The total consumptive use was 129.64 mgd, an 11 decrease from the 2012 consumptive use total of 145.25 mgd. The primary consumptive uses came from the thermoelectric power (44.66 mgd), irrigation (32.17 mgd) and public water supply (31.03 mgd) sectors.

The water use data were provided by the Wisconsin Department of Natural Resources. Reporting compliance varied among water use sectors from 78 percent for the thermoelectric power (once-through cooling) sector to 100 percent for the commercial and institutional sector.

Table 19. Wisconsin 2013 Water Use Data Summary

Sector	Withdrawals				Diversions		Consumptive Use
	GLWS	OSW	GW	TOTAL	Intrabasin	Interbasin	
Public Water Supply	241.92	22.01	48.52	312.45	0	5.56	31.03
Self-Supply Commercial & Institutional	1.72	1.36	2.85	5.92	0	0	0.67
Self-Supply Irrigation	0	3.94	42.33	46.27	0	0.16	32.17
Self-Supply Livestock	0	15.42	15.21	30.63	0	0	4.67
Self-Supply Industrial	0.13	156.33	14.92	171.38	0.08	0	12.95
Self-Supply Thermoelectric Power Production (Once-through cooling)	3,295.72	259.12	0.03	3,554.87	0	0	35.55
Self-Supply Thermoelectric Power Production (Recirculated cooling)	42.74	0.02	0	42.76	0	14.72	9.11
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	4.93	1.3	1.06	7.29	0	0	3.49
Total	3,587.16	459.5	124.92	4,171.57	0.08	20.44	129.64

In millions of gallons per day

Water Sources: Great Lakes surface water (GLSW), other surface water (OSW) and groundwater (GW)

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

Appendices

Appendix A. Revised protocols for the collection and reporting of water use data

The 2013 regional water use data set is the first to be completed under the new data reporting protocols. The new database and this annual report are expanded and enhanced with the inclusion of new and reformatted water use data and information. Summarized below are the main changes to the database, which are reflected in this report.

1. Water use sectors – The number of sectors increased from 9 to 10. The Self-Supply Domestic sector is replaced with Self-Supply Commercial and Institutional. The Hydroelectric Power sector is broken down into Off-stream Hydroelectric Power Production and In-stream Hydroelectric Water Use.
2. Diversions - Three new fields (diversion return flow, net diversion change and diversion return) were added to meet the standards set forth in the new protocols.
3. Intrabasin transfers – Two additional fields, intrabasin return flow and intrabasin consumptive use, were added to meet the standards set forth in the protocols.
4. Two new consumptive use (CU) data fields – These fields now more accurately describe how the CU amounts are calculated. The first field documents the percentage of reported consumptive uses that were determined through actual measurement. The second field documents the coefficient or the range of coefficients used to calculate CU. Under the old database regime, a summary chart of the range of CU coefficients was inserted in the annual reports for reference.
5. Aggregation – The level of aggregation of data was dropped since the protocols do not call for such a field. In its place a “methods” field describes the method used to determine withdrawal amount.

Appendix B. 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 C. 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[21]" 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.

[21] 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.

Appendix D. Interim Cumulative Impact Assessment

Introduction

Under the Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement (Agreement) and the companion Great Lakes-St. Lawrence River Basin Water Resources Compact (Compact), the Great Lakes and St. Lawrence River states and provinces commit to periodically assess the cumulative impacts of withdrawals, consumptive uses and diversions of water from the Great Lakes—St. Lawrence River Basin (Basin). As required by the Agreement and Compact, the cumulative impact assessments will be conducted for each Lake and St. Lawrence River watershed and for the entire Basin.

According to the data submitted to the Great Lakes-St. Lawrence Regional Water Use Database, incremental water loss[22] to the Basin increased over the years 2010 to 2012. From 2010 to 2011, the total water loss for the Basin increased by 280 mgd; from 2011 to 2012, total water loss increased by 348 mgd[23]. The annual increase from 2010 to 2011, and from 2011 to 2012, in total water loss exceeded the threshold for conducting the regional cumulative impact assessment[24]. This interim cumulative impact assessment covering the years 2011-2012 fulfills the requirements of the Agreement and the Compact.

The first cumulative impact assessment, published in 2013, covered five years from 2006 to 2010. This first assessment used the Basin water budget as an accounting of water flows into and out of the Basin. For comparative purposes, longer data sets for flows were presented to provide a historical context for the 2006-2010 data. The longer data sets are 1948-2010. The inflows included precipitation on the surface of the Great Lakes, surface water runoff to the Great Lakes or the St. Lawrence River, diversions into some Lake watersheds, and connecting channel flows into each of the Great Lakes or the St. Lawrence River, except for Lake Superior which does not have an inflowing connecting channel. Outflows included evaporation from the surface of the Great Lakes, diversions from some Lake watersheds, connecting channel flows out of each of the Lakes, and consumptive uses. The St. Lawrence River is the outflow for Lake Ontario and the entire Basin. Although withdrawals are a component of the water budget, the first assessment considered only the hydrologic effect of consumptive uses and diversions. The hydrologic effect is defined as the consumptive uses plus net diversions. Consumptive use is defined as the portion of water withdrawn but not returned due to evaporation, incorporation into products, and other processes.

The following observations were made in the first assessment:

- *Diversions and consumptive use were very small relative to inflows.*
  The cumulative hydrologic effect of consumptive uses and diversions were small relative to inflows. While inflows fluctuated from 2006-2010, the cumulative hydrologic effect of consumptive uses and diversions was fairly constant for this time period. The net effect of consumptive uses and diversions was positive for the Basin's water budget. In other words, more water was diverted into the Basin than the total combined amount of water diverted out of the Basin or withdrawn and not returned.
- *The uncertainty associated with estimated inflow and outflow data was significantly larger than total consumptive use for the Basin.*

[22] Incremental water loss is defined as new or increased outgoing diversions plus consumptive uses.
[1]The implementation of the 2009 Water Use Data Protocols and the corresponding jurisdictional data collection and reporting programs began with the collection of 2012 water use data. Therefore, the increase of water loss between 2011 and 2012 may reflect the improvements in data collection and reporting among other factors which are described in Appendix E of the 2013 Annual Water Use Report.
[24] The Agreement and the Compact require an assessment of the cumulative impacts to be done upon the earlier of a) every 5 years; b) each time the incremental losses to the Basin reach 50 mgd (190 mld) average in any 90-day period in excess of the quantity at the time of the last assessment; or c) at the request of one or more the states or provinces.

> It is difficult to assess the cumulative impact of diversions and consumptive uses apart from the natural variability of inflows and outflows of the Great Lakes-St. Lawrence River system. Uncertainty in the Basin water budget components was much larger than total consumptive uses. For example, total runoff to the Basin in 2008 was 259,888 cubic feet per second (cfs). Assuming a 15 percent uncertainty, the amount of calculated runoff may be off by over 38,000 cfs. In comparison, consumptive use in 2008 was only 3,016 cfs. As a result of this, the hydrologic effects of consumptive uses on flows and water levels are difficult to discern relative to uncertainties in the natural inflows and outflows.

The 2006-2010 cumulative impact assessment includes detailed information on the definitions, methodology, assumptions, uncertainty, data sources used as well as specific factors affecting each watershed. Please refer to that assessment for clarification of the methods used in this assessment. The full report, *Cumulative Impact Assessment of Withdrawals, Consumptive Uses and Diversions, 2006-2010,* is available at http://glslregionalbody.org/ or http://www.glslcompactcouncil.org/.

Approach

This interim cumulative impact assessment follows a similar approach to that of the first assessment. The interim assessment focuses on the hydrologic effects of consumptive uses and diversions on water supply and flow at watershed and Basin scales. These hydrologic effects are presented in the context of watershed and Basin water budgets. This interim assessment focuses on the consumptive uses and diversions components of the water budget, instead of describing and analyzing all components of the water budget as was done in the first assessment. Annual estimates of inflows and outflows are not provided for the years 2011-2012.

For the interim assessment, diversions and consumptive uses reported for 2006-2012 are compared for each watershed and the entire Basin. Supplemental inflow data (e.g., runoff and precipitation) presented in the first cumulative impact assessment report are provided for each watershed and the Basin for comparative purposes.

Following standard scientific procedures, inflows are presented as positive numbers and outflows are presented as negative numbers. This convention is used to help relate different flows to one another and to supply. It is not intended to communicate a value judgment on whether these flows are good or bad for the Basin. All flows are given in cubic feet per second (cfs).

Great Lakes-St. Lawrence River Basin

Figure 1 shows diversions and consumptive uses for the Basin by year for 2006-2012. The net diversion are shown as positive (or incoming) flows into the Basin, mainly due to the Long Lac and Okoki diversions which divert water from the Hudson Bay watershed into Lake Superior for power generation purposes. These diversions have offset the consumptive uses (displayed as negative numbers in Figure 2) and outgoing diversions.

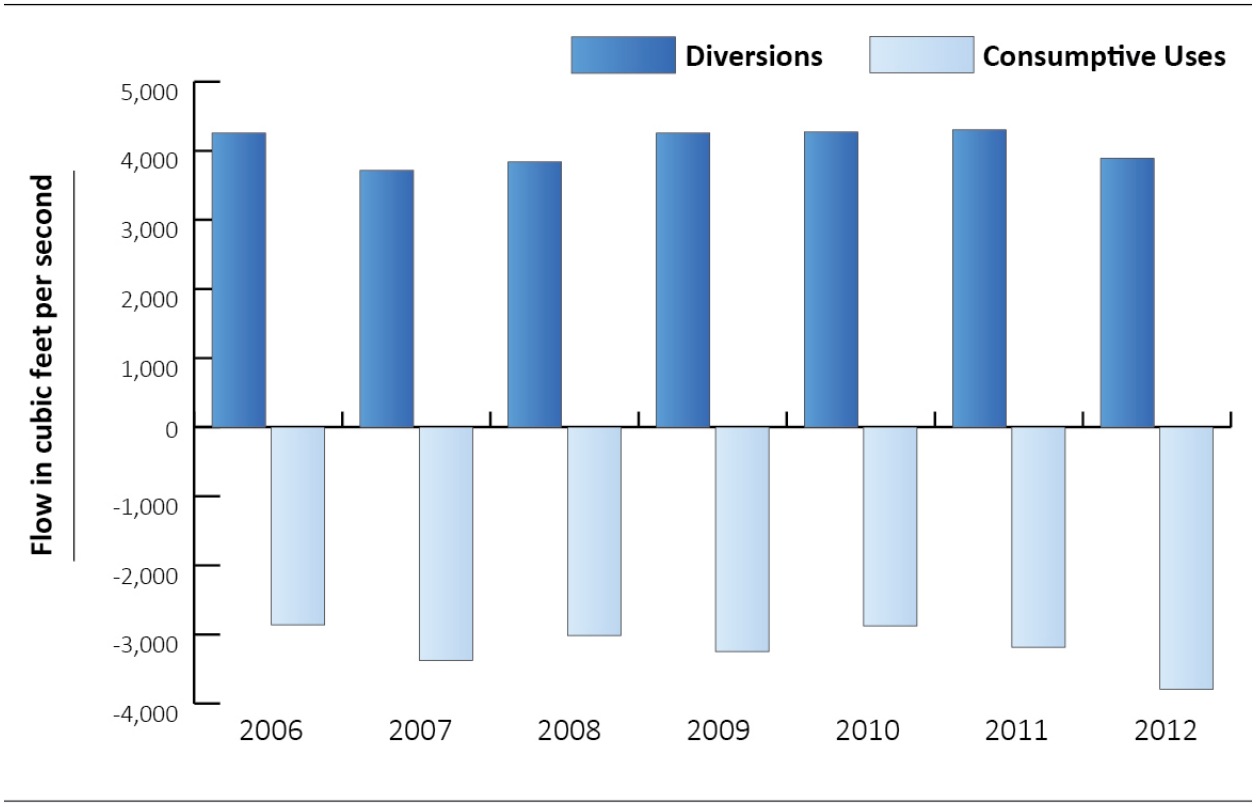

Figure 1. Diversions and Consumptive Uses for the Great Lakes – St. Lawrence Basin

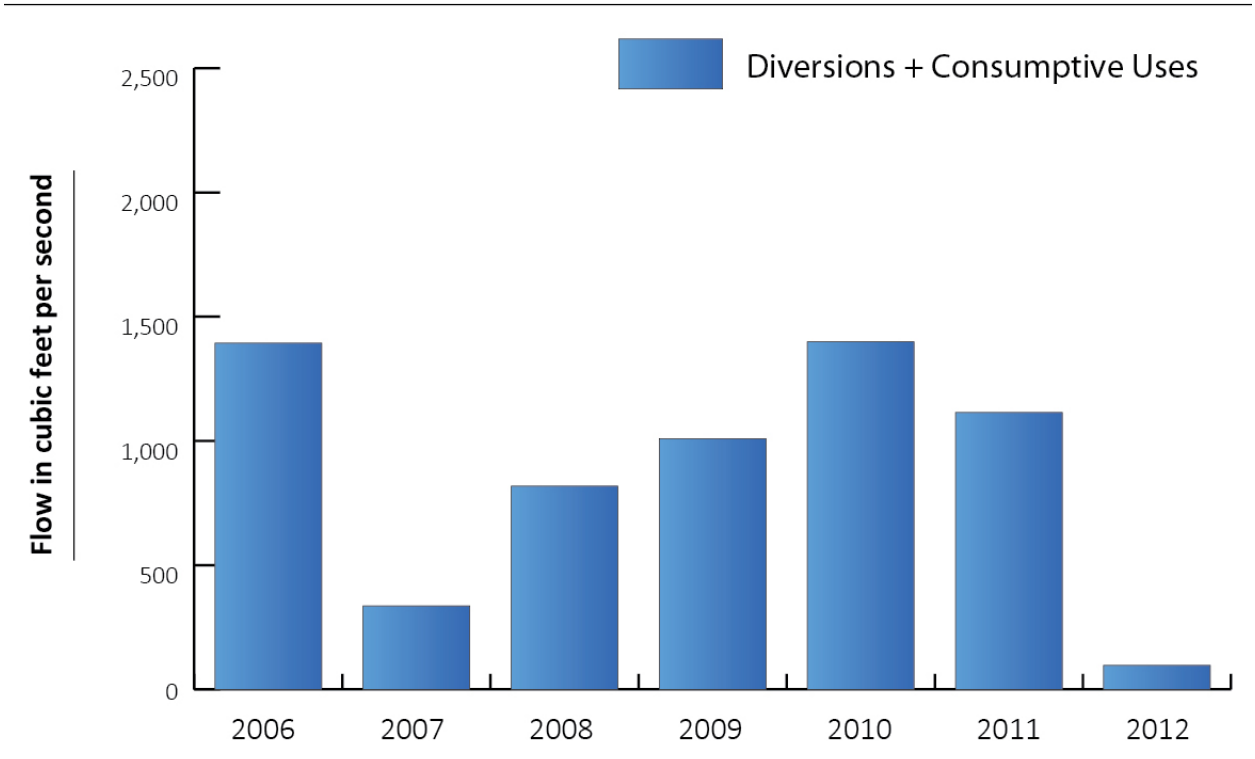

Figure 2. Net Diversions and Consumptive Uses for the Great Lakes – St. Lawrence River Basin.

As illustrated in Table A (used in Figure 2), for the Great Lakes-St. Lawrence River Basin the cumulative hydrologic effect of consumptive uses and diversions (annual averages) are small relative to inflows (runoff plus precipitation). Inflow estimates were provided on an annual basis for the years 2006-2010. However, for the interim assessment, the 62-year inflow average (1948-2010) was used for the years 2011-2012. In general, the cumulative hydrologic effect of consumptive uses and diversions is fairly constant for these annual inflow averages. For 2006-2012, the net effect of consumptive uses and diversions was positive for the Basin. In other words, more water was diverted into the Basin than the total combined amount of water diverted out of the Basin or withdrawn and not returned.

Year	Runoff + Precipitation	Consumptive Uses + Diversions
2006	456,180	1,393
2007	406,936	336
2008	515,788	818
2009	453,916	1,009
2010	374,252	1,399
2011	434,161*	1,114
2012	434,161*	96

Table A. Water budget values in cubic feet per second for the Great Lakes-St. Lawrence River Basin, 2006-2012. *62-year flow average

Lake Superior Watershed

The data in Figure 3 and Table B summarize the hydrologic effects of consumptive uses and diversions for the Lake Superior watershed water budget. For purposes of comparison, Figure 3 depicts the other components of the water budget (e.g., runoff, precipitation, evaporation and the St. Marys River) using the 62-year average for 1948-2010. Consumptive uses in the Lake Superior watershed have remained relatively constant over the years from 2006-2012. Diversions, mainly comprised of the Long Lac and Ogoki Diversions, fluctuate with the weather conditions of the watersheds. 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.

Water Budget Component	1948-2010 62-year Flow	2006-2010 5-year Flow	2011	2012
Diversions	5,950	6,209	6,189	5,863
Consumptive Uses	-117	-110	-99	-70

Table B. Diversions and consumptive uses for Lake Superior, comparing 2011-2013 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

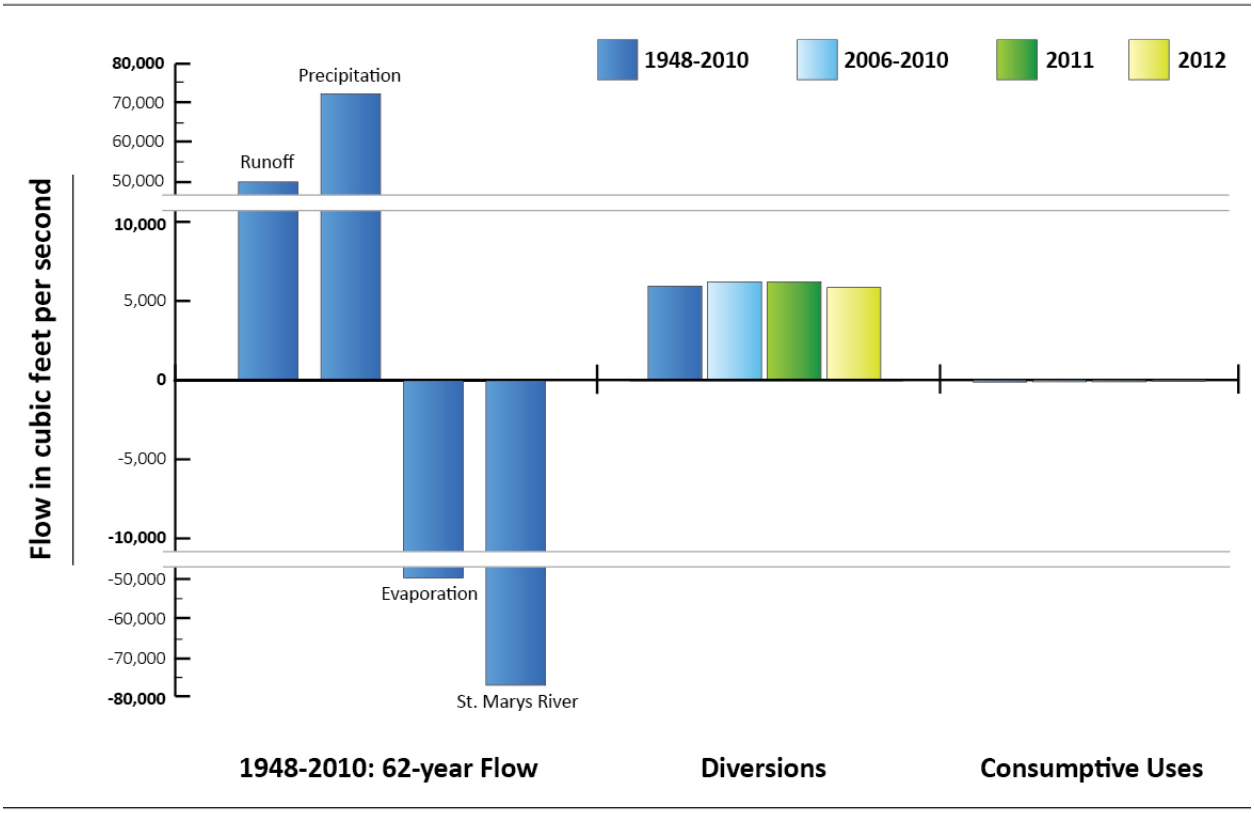

Figure 3. Water budget average flows for Lake Superior, comparing 2011-2012 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

As illustrated in Table C below, for the Lake Superior watershed the hydrologic effect of consumptive uses and diversions (annual averages) are small relative to inflows. While the estimated net volume of consumptive uses and diversions increased from 2010 to 2011, it remained a small percentage (about 6%) of the 62-year average for inflows into the watershed.

Year	Total Inflow	Consumptive Uses +Diversions	Consumptive Uses + Diversions (as a percentage of total inflow)
2006	91,892	6,091	6.63%
2007	112,680	6,071	5.39%
2008	121,063	6,112	5.05%
2009	108,398	6,082	5.61%
2010	90,176	6,094	6.76%
2011	122,218*	7,314	5.98%
2012	122,218*	6,957	5.69%

Table C. Water budget values in cubic feet per second for Lake Superior, 2006-2012. (in cfs)
*62-year flow average

Lakes Michigan-Huron Watershed

The data in Table D and used in Figure 4 summarize the hydrologic effects of the consumptive use and diversion components of the Lakes Michigan-Huron watershed water budget. For purposes of comparison, Figure 4 depicts the other components of the water budget using the 62-year average for 1948-2010. Both diversions and consumptives use flows have fluctuated over the years from 2006-2012. Diversions, mainly

comprised of the Illinois Diversion which diverts water from Lake Michigan to the Chicago Sanitary and Ship Canal and the Illinois River and Des Plaines Rivers, contributed to the flows out of the watershed.

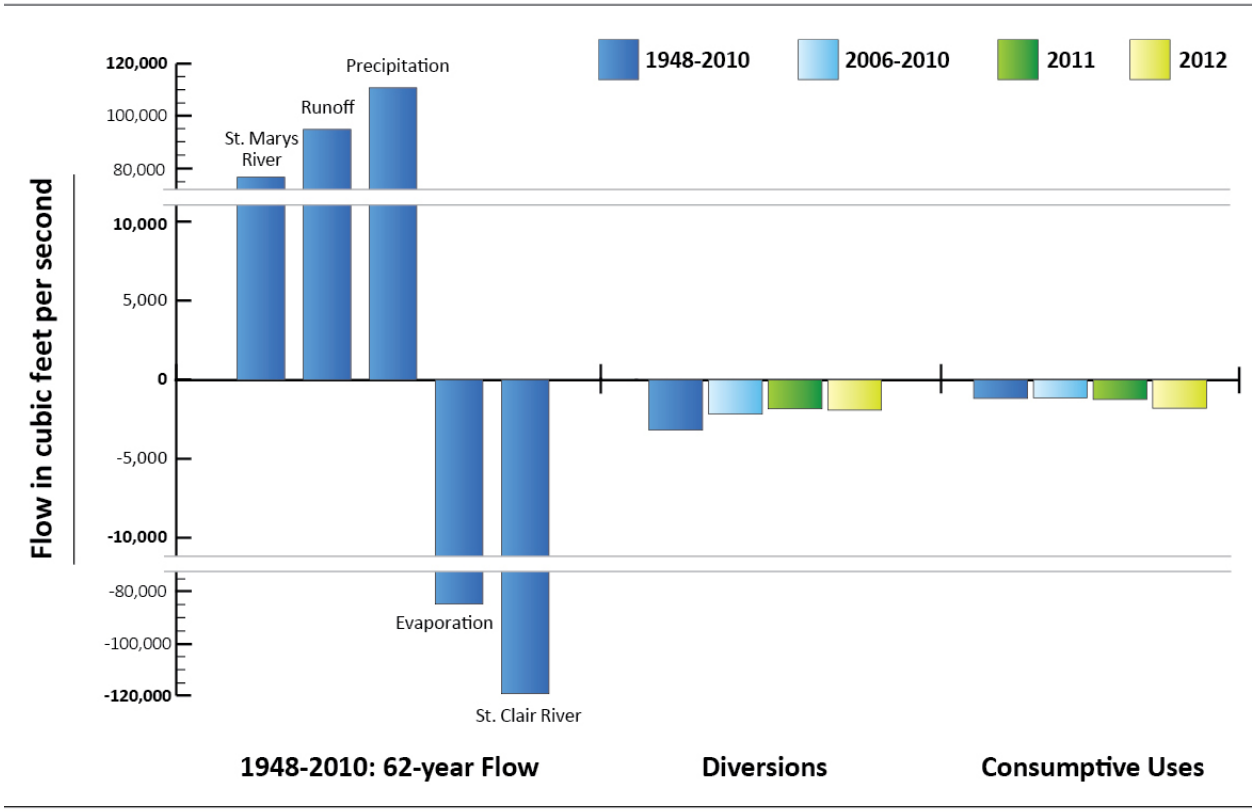

Figure 4. Water budget average flows for Lakes Michigan-Huron, comparing 2011-2012 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

Water Budget Component	62-year Flow	5-year Flow	2011	2012
Diversions	-3,171	-2,149	-1,823	-1,894
Consumptive Uses	-1,166	-1,117	-1,223	-1,779

Table D. Diversions and consumptive uses for Lakes Michigan-Huron, comparing 2011-2012 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

As illustrated in Table E, for the Lakes Michigan-Huron watershed the hydrologic effect of consumptive uses and diversions (annual averages) were small relative to inflows. While the estimated net volume of diversions and consumptive uses increased each year from 2010 to 2012, it still made up a small percentage (between 1.25-1.56%) of the 62-year average for inflows into the watershed.

Year	Total Inflow	Consumptive Uses +Diversions	Consumptive Uses + Diversions (as a percentage of total inflow)
2006	295,087	-2,505	0.85%
2007	236,860	-4,063	1.72%
2008	323,688	-3,680	1.14%
2009	295,201	-3,406	1.15%
2010	237,979	-2,979	1.25%
2011	282,054*	-3,659	1.30%
2012	282,054*	-4,413	1.56%

Table E. Water budget values in cubic feet per second for Lakes Michigan-Huron, 2006-2012. (in cfs)
*62-year flow average

Lake Erie Watershed

The data in Table F and used in Figure 5 summarize the hydrologic effect of the consumptive use and diversion components of the Lake Erie watershed water budget. For purposes of comparison, Figure E depicts the other components of the water budget using the 62-year average for 1948-2010 Diversions[25] have contributed to the overall flows out of the watershed. In 2011, these diversion and consumptive use flows appeared to be greater than the 5-year and 62-year average flows. However, diversions appear to have decreased from 2011 to 2012.

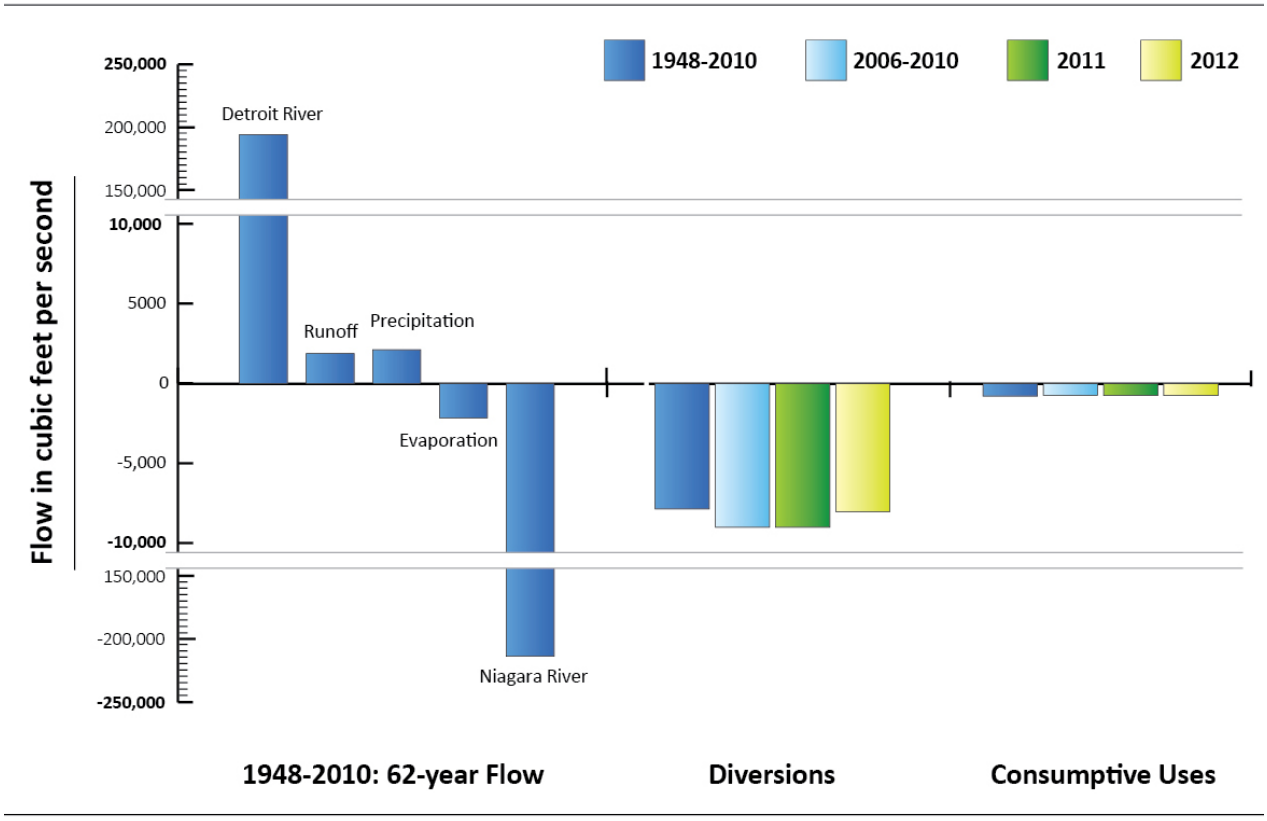

Figure 5. Water budget average flows for Lake Erie, comparing 2011-2012 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

[25] Diversion data for the Lake Erie watershed include an intrabasin diversion at Welland Canal.

Water Budget Component	62-year Flow	5-year Flow	2011	2012
Diversions	-7,851	-8,994	-8,994	-8,017
Consumptive Uses	-763	-728	-742	-736

Table F. Diversions and consumptive uses for Lake Erie, comparing 2011-2012 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

As illustrated in Table G, for the Lake Erie watershed the hydrologic effect of consumptive uses and diversions (annual averages) was small relative to inflows. The estimated net volume of consumptive uses and diversions appeared to have increased from 2010 to 2011, and then decreased from 2011 to 2012.

Year	Total Inflow	Consumptive Uses +Diversions	Consumptive Uses + Diversions (as a percentage of total inflow)
2006	241,660	-9,486.5	3.93%
2007	226,724	-9,800.4	4.32%
2008	243,728	-9,759.0	4.00%
2009	244,349	-9,766.8	4.00%
2010	227,871	-9,793.5	4.30%
2011	244,739*	-11,690	4.78%
2012	244,739*	-10,511	4.29%

Table G. Water budget values in cubic feet per second for Lake Erie, 2006-2012. (in cfs)
*62-year flow average

Lake Ontario Watershed

The data in Table H and used in Figure 6 summarize the hydrologic effects of the consumptive use and diversion components of the Lake Ontario watershed water budget. For purposes of comparison, Figure 6 depicts the other components of the water budget using the 62-year average for 1948-2010. Although there was a notable increase in diversion and consumptive use flows between the 5-year flow average and the 2011 reported amount, these flows appear to have decreased from 2011 to 2012.

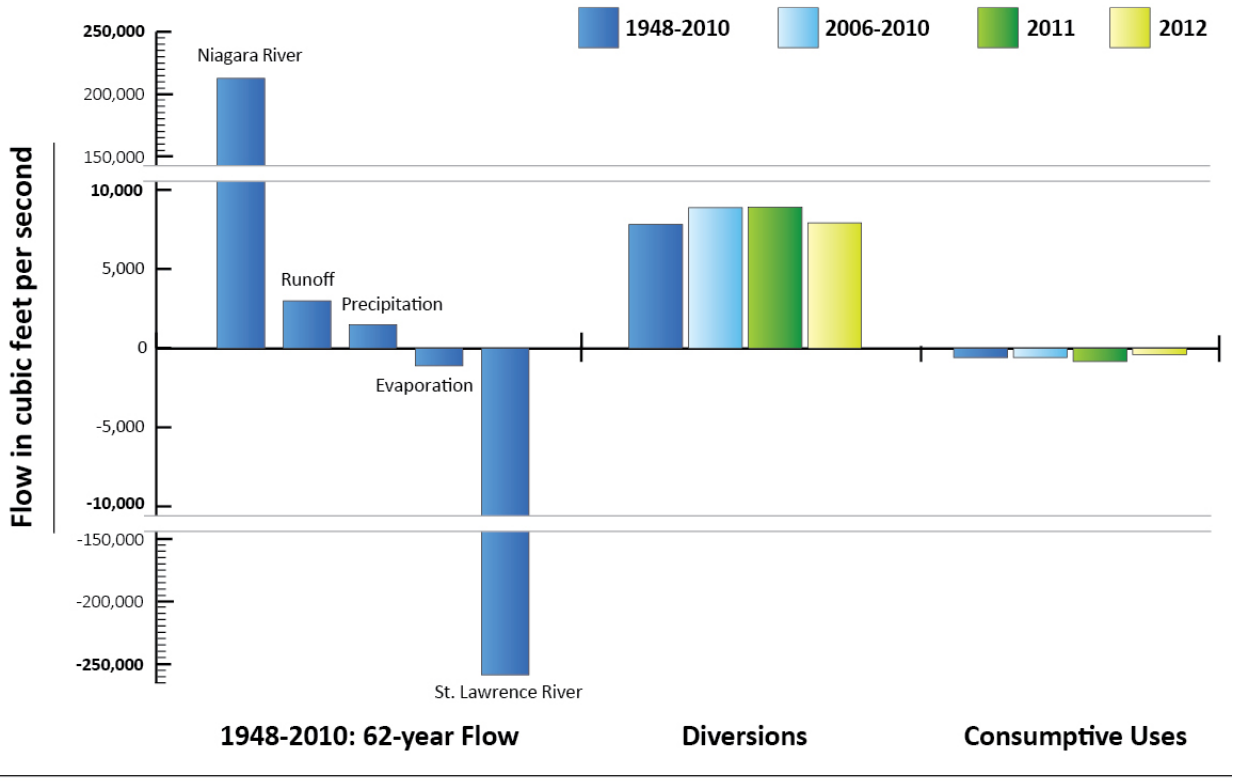

Figure 6. Water budget average flows for Lake Ontario, comparing 2011-2012 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

Water Budget Component	62-year Flow	5-year Flow	2011	2012
Diversions	7,851	8,914	8,935	7,942
Consumptive Uses	-561	-564	-822	-375

Table H. Diversions and consumptive uses for Lake Ontario, comparing 2011-2012 to a 5-year period (2006-2010) and a historical 62-year period (1948-2010). (in cfs)

As illustrated in Table I, for the Lake Ontario watershed the cumulative hydrologic effect of consumptive uses and diversions (annual averages) were small relative to inflows. The estimated net volume of diversions and consumptive uses fluctuated from 2006 to 2012, but still remained a small percentage (between 3.28-3.64%) of the 62-year average for inflows into the watershed.

Year	Total Inflow	Consumptive Uses +Diversions	Consumptive Uses + Diversions (as a percentage of total inflow)
2006	283,502	9,441	3.33%
2007	264,902	9,468	3.57%
2008	285,508	9,456	3.31%
2009	280,261	9,505	3.39%
2010	259,688	9,523	3.67%
2011	269,041*	9,795	3.64%
2012	269,041*	8,828	3.28%

Table I. Water budget values in cubic feet per second for Lake Ontario, 2006-2012. (in cfs)

*62-year flow average

St. Lawrence River Watershed

The water budget for the St. Lawrence River watershed is different than those for the Lakes. Inflow consists of the St. Lawrence River flow measured at Cornwall, Ontario. Outflow mainly consists of the river's flow modeled at Trois Rivieres, Québec and consumptive uses throughout the watershed. For the years 2006-2011, no diversions were reported by the states and provinces for the watershed. In 2012, both Québec and New York reported diversions totaling of 3.74 cfs for public supply purposes.

As illustrated in Table J and Figure 7, for the St. Lawrence River watershed the hydrologic effect of consumptive use and diversions was small relative to inflows. From 2011 to 2012, the net estimated volume of consumptive uses and diversions nearly doubled from 362 cfs to 632 cfs[26].

St. Lawrence River Watershed

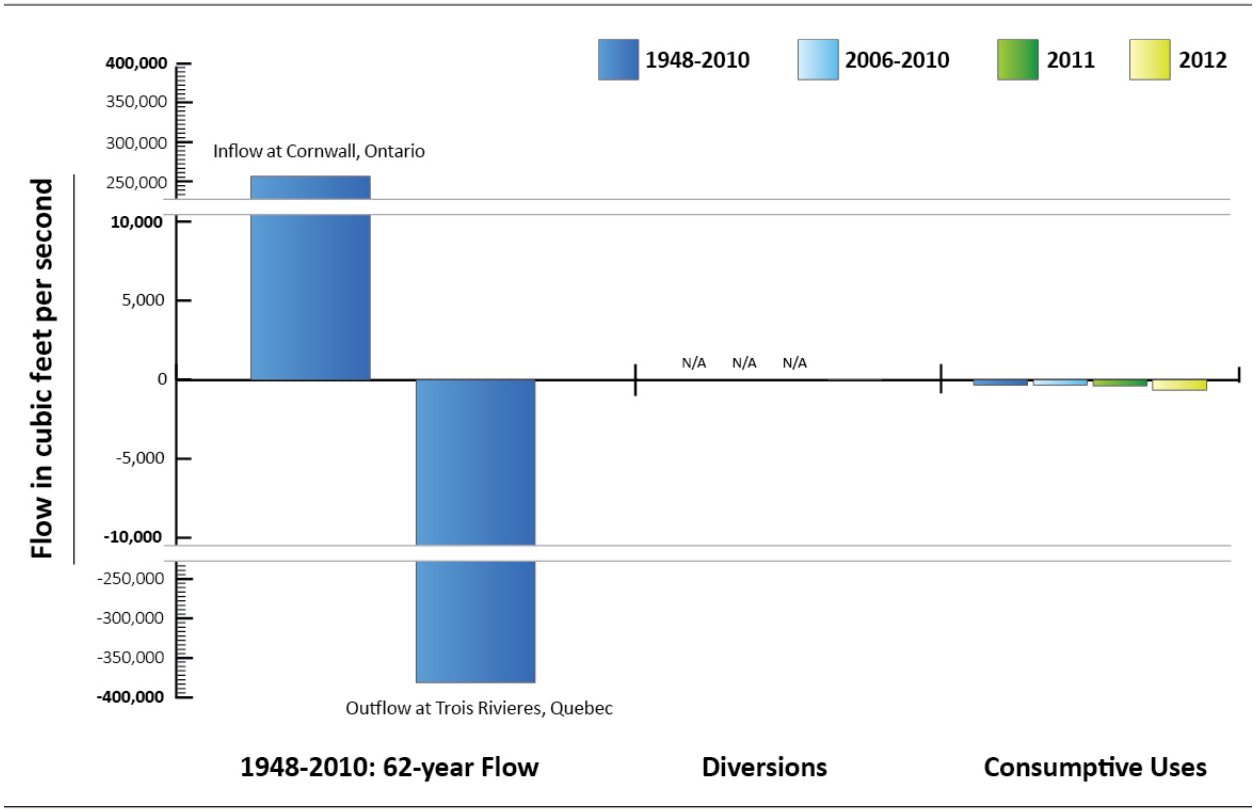

Table J. Water budget values in cubic feet per second for the St. Lawrence River, 2006-2013. (in cfs)
*5-year flow average (2006-2010)

[26] The implementation of the 2009 Water Use Data Protocols and the corresponding jurisdictional data collection and reporting programs began with the collection of 2012 water use data. Therefore, the increase of the net estimated volume of consumptive uses and diversions between 2011 and 2012 may reflect the improvements in data collection and reporting among other factors which are described in Appendix E of the 2013 Annual Water Use Report.

Year	Total Inflow	Consumptive uses +Diversions	Consumptive Uses + Diversions (as a percentage of total inflow)
2006	253,307	-302	0.12%
2007	248,777	-324	0.13%
2008	259,043	-323	0.12%
2009	265,691	-324	0.12%
2010	239,481	-327	0.14%
2011	253,259*	-302	0.14%
2012	253,259*	-632	0.25%

Table J. Water budget values in cubic feet per second for the St. Lawrence River, 2006-2013. (in cfs)
*5-year flow average (2006-2010)

Appendix E. A Preliminary Analysis of Consumptive Use Trends for the Years 2010-2012

According to the data submitted to the Great Lakes-St. Lawrence Regional Water Use Database, overall consumptive use has increased over the past three years of water use data collection. From 2010 to 2011, total reported consumptive use for the Great Lakes-St. Lawrence River basin increased by 200 mgd, and from 2011 to 2012, total reported consumptive use increased by 397 mgd[27] (See Table 1, page 54). These increases are four times and eight times, respectively the threshold for conducting the regional cumulative impact assessment as called for under the Great Lakes-St. Lawrence River Basin Water Resources Compact and Agreement[28]. In order to discern why reported consumptive use increased over these three years, the Great Lakes Commission (GLC) staff made a request of the state and provincial water use data managers to reexamine these data and identify why there are "significant changes," if any to the reported consumptive use amounts.

In conducting this exercise and reviewing the results, the following factors were identified to be associated with the increased reported consumptive use in the Basin.

1. Errors: This exercise helped identify errors in the data for 2010, 2011 and 2012. Below are examples:

   NY The water that passes through the Barge Canal is estimated to be 711 mgd. In 2012, the state mistakenly reported this as a consumptive loss, but it is now corrected. It will be reported as a withdrawal from the Lake Ontario watershed with a zero percent consumptive loss since the water is used for navigational purposes, and it does not leave the Basin.

   MI A data entry error for the fossil fuel power consumptive use amount was found in the 2011 dataset. Corrected data (i.e., 68.42 MGD – a decrease of 50 mgd from the originally reported consumptive use amount of 119.09 MGD) has been submitted to the GLC.

2. Climate: The drought during the summers of 2011 and 2012 contributed to an increase in reported irrigation water withdrawals. Many jurisdictions including Wisconsin, Michigan and Ohio reported a commensurate increase in consumptive use.

3. New consumptive use calculation methods: Some jurisdictions used different consumptive use calculation methods. The following are examples of the application of new calculation methods:

   NY In reporting the 2012 data, the consumptive use coefficient used for one of the nuclear power plants changed from 50 percent to 5 percent, based on information gathered from a detailed engineering report. New York updated their data for 2009 and 2010 to reflect this change in the consumptive use coefficient.

[27] This figure includes corrected 2012 consumptive use data which resulted from conducting the consumptive use comparison analysis. The 2010 and 2011 data are pulled from the Annual Water Use Reports for those years. Some jurisdictions have submitted corrected data for 2010 and 2011. However, GLC staff were not be able to include those corrected data in this report.

[28] 50 MGD average in any 90-day period in excess of the quantity at the time of the most recent assessment is the threshold for conducting a regional cumulative impact assessment.

OH For the industrial sector, the consumptive use calculation applied in 2012 was different from previous years, and therefore the older reported consumptive use data appear to be lower.

MI In reporting 2011 data, Michigan switched from using the standard consumptive use coefficients for the nuclear power sector to using facility-specific reported consumptive use rates. Each nuclear facility reported a lower consumptive use in 2011 versus what was reported in 2010.

4. Large time gaps in reporting new data: Ontario and Québec both updated their water use datasets with new data. For 2012, both jurisdictions implemented new data collection methodologies. The large time gaps from when data were collected may be a factor as to why there is a jump in reported consumptive use from 2011 and 2012.

   ON For 10 years, Ontario resubmitted existing data generated from 2000-2001 for all sectors except hydropower and thermoelectric nuclear power sectors and intra-basin transfers. Updated 2009 data were submitted for the hydropower and thermoelectric nuclear power sectors and intra-basin transfers. For 2012, Ontario submitted the latest data collected which occurred in 2011.

   QC Between 1993 and 2011, the water use data annually submitted by Québec were overall estimates by sector made in 1993 – a gap of 19 years. In accordance with the agreement, Quebec adopted a regulation in 2011 that requires users to report water withdrawals. Starting with the 2012 Annual Water User Report, Québec has submitted updated data.

5. Improved reporting compliance: For many jurisdictions, reporting compliance has improved the data quality over time, resulting in the perceived increase in consumptive use.

6. Reflection of actual water use changes: Some facilities have been decommissioned, and some facilities' water use reached the regulation threshold for reporting.[29]

   OH For 2012, four additional facilities in the irrigation and other self-supplied sectors that have reached the regulation threshold level reported their water use to the state program, and therefore the water withdrawal amounts and associated consumptive use amounts appear to increase for those sectors. In 2011, there was a greater demand for electricity resulting in an increased consumptive use. In the following year, 2012, electricity demand was lower, and therefore, consumptive use was lower for the power sector.

   NY In 2012, one power plant shut down and four others reduced their water use, resulting in lower consumptive use amounts reported for New York.

Table 1 below summarizes the consumptive use amounts over the span of 2010, 2011 and 2012. The consumptive use figures have been corrected for 2012, resulting in the overall consumptive use total of 2.457 billion gallons per day (bgd). For the most recently submitted 2013 water use data, the total consumptive use amount was 2.338 bgd, a decrease of 119 mgd from the 2012 consumptive use total. In light of this consumptive use analysis, the GLC staff made following observations:

[29] A "threshold facility" is defined as a facility withdrawing in excess of the Great Lakes-St. Lawrence Compact/Agreement uniform trigger level of 100,000 U.S. gallons/day (380,000 liters/day) averaged over a 30day period. A threshold facility is determined by the total withdrawal (or consumption) of all sources combined (Great Lakes-St. Lawrence surface water, other surface water, and groundwater) rather than a single source.

1. How each factor contributes to the overall increase in reported consumptive use over the span of 2010, 2011 and 2012 has not been fully studied and would require some additional staff effort to fully analyze. Nevertheless, this exercise was valuable in identifying data errors which helps improve the data quality for 2010, 2011 and 2012. Many jurisdictions submitted corrected data for these years.
2. Since the data quality has improved since implementing the 2009 Water Use Protocols (which began with the 2012 report), comparing the old data (1987-2011) to the new data (2012 to present) is difficult.
3. For data collected using 2009 Water Use Protocols (2012 to present) and using the metadata provided by the jurisdictions, it will be interesting to track the consumptive use amounts from year to year to more fully understand how each factor may contribute to the fluctuations in consumptive use.
4. The water use data managers and GLC staff believe that the reported consumptive use amounts to the regional water use database and actual consumptive use maybe very different. Historically, the jurisdictions have relied on coefficients to estimate consumptive use amounts simply because in most cases consumptive use cannot be measured. As a result, there is limited knowledge regarding actual (measured) consumptive use by sector and how this relates to the estimated consumptive use figures provided to the database.

Sector	2010	2011	Change (2010-2011)	% Change (2010-2011	2012	Change (2010-2011)	% Change (2010-2011
Public Water Supply	0.56	0.57	0.01	1.79%	0.739	0.169	29.65%
Self-Supply Commercial & Institutional	0.06	0.04	-0.02	-33.33%	0.024	-0.016	-40.00%
Self-Supply Irrigation	0.32	0.38	0.06	18.75%	0.533	0.153	40.26%
Self-Supply Livestock	0.1	0.07	-0.03	-30.00%	0.015	-0.055	-78.57%
Self-Supply Industrial	0.36	0.36	0	0.00%	0.71	0.35	97.22%
Self-Supply Thermoelectric Power Production (Once-through cooling)	0.17	0.25	0.08	47.06%	0.292	0.042	16.80%
Self-Supply Thermoelectric Power Production (Recirculated cooling)	0.24	0.39	0.15	62.50%	0.097	-0.293	-75.13%
Off-Stream Hydroelectric Power Production	0	0	0	-	0	0	-
Other Self Supply	**0.04**	**0.01**	-0.03	-75.00%	0.047	0.037	370.00%
Total	1.86	2.06	**0.2**	**10.75%**	**2.457**	**0.397**	**19.27%**

Table 1. Consumptive Use Totals for the Great Lakes-St. Lawrence River Basin (in billions of gallons per day)