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US Army Corps of Engineers
Detroit District

Great Lakes Update

2000 Annual Summary

After a mild '99-'00 "Millennium" winter which resulted in a continuation of low water levels, there may be encouraging news for 2001. Early winter snowfall and U.S. National Weather Service outlooks indicate that the '00-'01 winter may be shaping up to be the first "normal" winter for the last four years. If these conditions persist, snow for skiers in the region may become spring runoff to the Great Lakes, changing the trend toward lower lake levels.

At the end of 2000, Great Lakes water levels were lower than at the end of 1999. The near drought conditions experienced over the Great Lakes region since 1998 still persist in the north but may be easing around the lower lakes.

Hydrology

Heavy rains across the central and southern Great Lakes region in late April 2000 signaled the end of the La Niña climate pattern that had persisted since the fall of 1998. April was also the first month in over a year that air temperatures were below average for many Great Lakes cities. For the next six months, cool, damp weather ruled the heart of the Great Lakes region. Much of this precipitation, however, was absorbed by very dry soils and helped recharge depleted groundwater.

Lake levels remained below their long-term averages throughout the year, except for Lake Ontario. These lakes benefited from above average precipitation in the warm-weather months and into early winter. Much of the northern Lake Michigan and Huron basins, however, received significantly below average rainfall and snowfall. Furthermore, drought conditions have persisted over much of the eastern two-thirds of the Lake Superior basin.

For water levels to return to near normal on the upper lakes, two factors will need to prevail over the next several months. First, above average snowfall is needed on the upper Great Lakes watershed and, second, an early freeze-over of the Great Lakes is needed.

In December 2000, lake-effect snows persisted over much of the northern basins. Much of this snow comes directly from water evaporated off the open lake surface, which has a net negative impact on the water balance. A substantial fraction of this snowfall is also lost to the atmosphere via evaporation and does not runoff and return to the lake. Snowfall generally needs to be provided from air masses, originating in the Pacific Ocean or Gulf of Mexico that bring moisture into the region.

This document is available at http://huron.lre.usace.army.mil/levels/Update142.pdf.

Peak snowpack water content or "snow water equivalency (SWE)" last winter for the Lake Superior basin was substantially below average. Typically snowpack is at its peak in early March around the basin, averaging around 6 inches of SWE. The National Weather Service conducts annual snow surveys from low-flying aircraft across the Lake Superior drainage basin in March of each year. The results of these surveys for 2000 are shown in Figure 1. A similar survey will be made this winter and their results will be used to forecast water levels for the Great Lakes for the spring-autumn period.

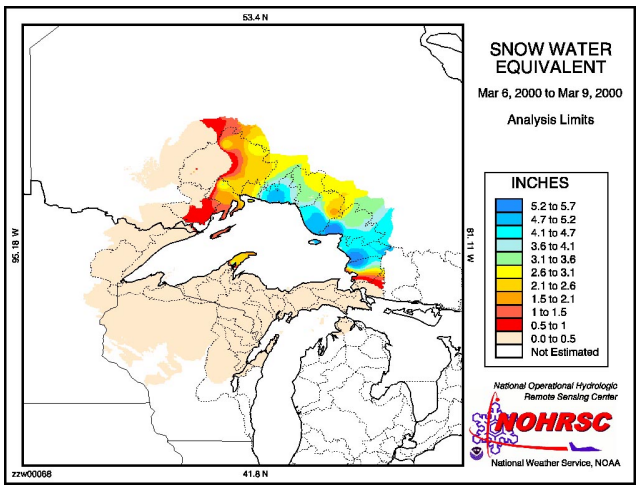

Figure 1

Ice formation near the shore of the Great Lakes is currently ahead of average in timing and thickness. Some offshore areas of the northern lakes are currently ice-free and may not close completely during the winter. This is typical for lakes like Superior, Michigan and Huron. Lakes St. Clair, Erie, and Ontario can become totally ice covered during normal winters.

Large temperature differences between the open lake surfaces and dry Arctic air have caused above average evaporation to occur with corresponding significant quantities of lake-effect snows. If air temperatures remain well below freezing (0-20 degrees Fahrenheit), substantial ice formation on the Great Lakes will likely occur through mid-February, 2001. This would subsequently reduce the amount of water leaving the lake by evaporation.

Precipitation and Net Water Supplies

Based on preliminary data from the U.S. National Weather Service and Canadian Atmospheric Environment Service, precipitation over the Great Lakes basin for 2000 was 34.6 inches, exceeding the long-term basin-wide average of 32.4 inches.

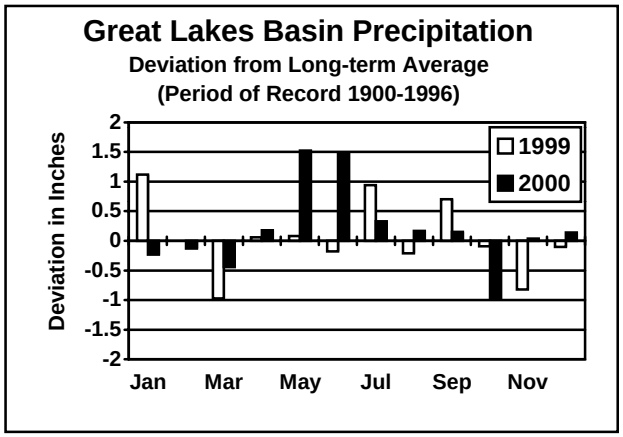

Figure 2

Figure 2 compares the monthly deviation of precipitation from long-term averages for each month of the year for 1999 and 2000 over the Great Lakes basin. This figure shows that over the entire basin precipitation was significantly above average in May and June and below average in October. Precipitation is usually the best single indicator of net water supply to the Great Lakes. It can, however, be misleading at times.

Most of the early summer rains fell only on the lakes Erie and Ontario and extreme southern Michigan and Huron watersheds. Evaporation off of the lake surface has been higher than average for much of the northern latitudes of the Great Lakes for much of the year. Increased evaporation and reduced inflows from upstream lakes and tributary rivers have substantially offset precipitation over lakes Superior, Michigan and Huron and their watersheds. Significantly below average water supplies are continuing to cause near record low water levels on these lakes.

Meteorology

The main storm track in late 2000 remained anchored across the northern Ohio Valley. This track resulted in heavy and recurring snows across the south of the region. Meanwhile, little snow has fallen across the northern Great Lakes inland of lake-effect snowbelt areas.

The U.S. National Weather Service outlook for January 2001 through March 2001 shows a general continuation of the Arctic flow pattern across all of the Great Lakes region and upper Midwest. The outlook also continues the storm track through the Northern Ohio Valley, which would translate into above average snowfalls for the lakes Erie and Ontario basins, while the northern Great Lakes could continue to experience near to below normal precipitation.

Lake Levels

The *Monthly Bulletin of Lake Levels for the Great Lakes* graphically shows the water levels on the Great Lakes for 1999 and 2000. The following discussion uses monthly mean levels.

Lake Superior levels started 2000 at 600.92 feet, about 8 inches below its January long-term average (LTA). Following its normal seasonal pattern, levels started rising in March, peaking in July at 601.48 feet, 8 inches below the July LTA. From July through December levels fell, ending the year at 600.59 feet, 15 inches below its LTA for the month. The lake was 7 inches lower at the end of the year than the year before. Lake Superior's historic range between extreme high and extreme low is about 3.9 feet.

Lakes Michigan-Huron levels began the year at 577.17 feet, 17 inches below its January LTA. These lakes peaked in July at 577.85 feet, 20 inches below the July LTA. Levels then declined through December ending the year at 576.80 feet, 23 inches below the LTA for the month. These lakes were 7 inches lower at the end of the year than the year before. The historic range between extremes is about 6.3 feet.

Lake St. Clair levels started the year at 572.93 feet, 9 inches lower than its January LTA. The seasonal rise peaked in July at 574.31 feet, 6 inches below the LTA. Levels fell through December ending the year at 573.29 feet 8 inches below its LTA for the month. The lake was 8 inches higher at the end of the year than the year before primarily due to an ice blockage in the lower Detroit River in late December. Lake St. Clair's historic range between extreme high and extreme low is about 6.8 feet.

Lake Erie levels began the year at 570.28 feet, 7 inches below its January LTA. The levels peaked in July at 571.75 feet, 2 inches below the July LTA. Levels declined through December, ending the year at 570.34 feet, 6 inches below its December LTA and 2 inches lower than the year before. Lake Erie has a historic range between extremes of 6.1 feet.

Lake Ontario started the year at 244.42 feet, 2 inches below its January LTA. The lake reached a peak in June at 246.92 feet, 9 inches above its July LTA. Levels then declined through December, ending the year at 244.32 feet, 2 inch below its LTA for the month, and at the same level as the year before. Lake Ontario’s historic range between extremes is about 6.6 feet.

Lake Superior Regulation

During 2000, the International Lake Superior Board of Control (ILSBC) continued to use Regulation Plan 1977-A as the basis for determining Lake Superior outflows. The ILSBC is a bi-national body that reports to the International Joint Commission (IJC) on boundary water management issues including the management of outflows from Lake Superior. Flow changes resulting from the monthly regulation of Lake Superior are accomplished by varying the amount of water allocated to hydropower production, and when necessary, by opening or closing gates in the Compensating Works at the head of the St. Marys Rapids.

Water supplies to Lake Superior were generally below average for much of the year. Consequently, the levels remained below average throughout the year. A one-half open gate setting was maintained in the Compensating Works throughout 2000 to support fishery spawning in the St. Marys Rapids.

Outflows ranged from a high of 76,600 cubic feet per second (cfs) in August to a minimum flow of 55,100 cfs during the October through December period. The Great Lakes Power Limited plant at Sault Ste. Marie, ON was unable to use its full July water allocation due to an unexpected transformer failure, which reduced the plant's generating capacity. An under-discharge deviation was approved by the ILSBC for July. The July deviation was largely offset in August by over-discharges that were necessary to conduct surveys of the flow rates through the Compensating Works.

Figure 3 compares the monthly Lake Superior outflows in 2000 with long-term average flows for the 1900 - 1989 period of record. Further information can be found on the Internet at www.lre.usace.army.mil/ijc/superior.html.

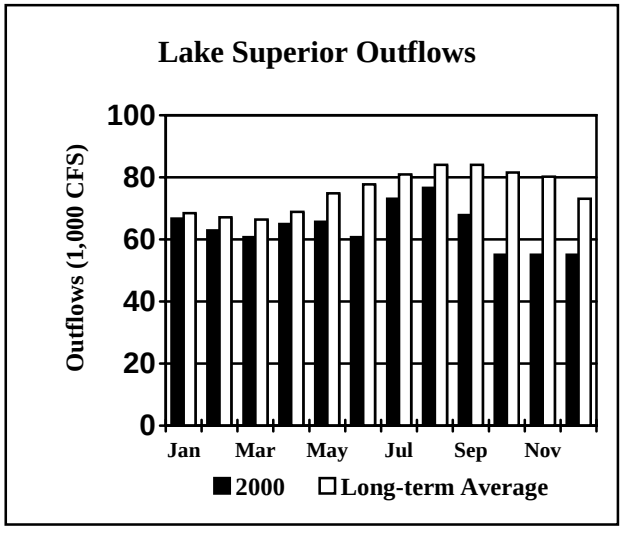

Figure 3

Lake Ontario Regulation

The outflow from Lake Ontario is managed under the auspices of the IJC and its International St. Lawrence River Board of Control (ISLRBC). During late 1999, the ISLRBC decided to conserve some water on Lake Ontario due to dry conditions on its watershed and expected low inflows from upstream lakes. The ISLRBC can conserve water on the lake by releasing outflows below those specified by the Regulation Plan 1958-D.

Ice cover on the International Section of the St. Lawrence River was formed during January and February 2000. By March, most of the snow on the Lake Ontario-St. Lawrence River basin had melted due to warm weather. The annual Ottawa River inflow or “freshet” into the St. Lawrence River near Montreal, QU did not significantly increase water levels at the Port of Montreal. Consequently, Lake Ontario outflows, which are normally reduced in the springtime to accommodate increased Ottawa River inflows and prevent flooding in the lower St. Lawrence River, were not reduced.

Figure 4 below compares the 2000 monthly Lake Ontario outflows with the long term-average flows (1900 - 1989 period of record).

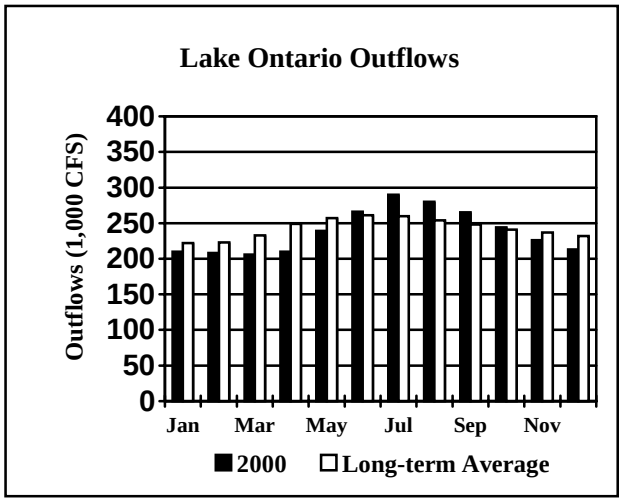

Figure 4

By early May, a total of 4 inches of water was conserved on Lake Ontario. The conservation of water was carried out with some difficulties since excessive flow reductions can adversely affect users in the St. Lawrence River. A pre-release schedule to eliminate 1-1/2 inches from the lake was in place during June through July. Due to above average water supplies from mid-April to June, the level reached the long-term average in late April. It continued a steady rise until it peaked on June 25 at 247.11 feet, 2-3/4 inches from the Criterion "h" level, which is the upper threshold limit for Lake Ontario.

The Lake Ontario water level remained at its peak for about a week. The ISLRBC decided to increase the outflows to reduce the level. About the same time, dry conditions re-emerged. Both factors caused the beginning of a sharp decline. The level reached the long-term average in mid-October and has been below the long-term average since. The December 2000 monthly mean level was 244.32 feet, which is about 3 inches below the long-term average.

Of the 2-1/2 inches retained on Lake Ontario from the summer, about 3/4 inch was used in October, November and early December to provide relief for low levels for navigation at the Port of Montreal. In mid-December, the ISLRBC decided to store another 2 inches of water on Lake Ontario over this winter, bringing this total storage to 3-1/2 inches if conditions allow.

With much of the northern Great Lakes still under very dry conditions, the projection for Lake Ontario into 2001 is for levels to remain slightly below or at average under normal supply conditions. Further information on ILSBC activities can be found on the Internet at www.islrbc.org**.**

Public Concerns

During the year, concerns about lake levels were received by the U.S. Army Corps of Engineers and Environment Canada staff. Most of the complaints were from marina operators and recreational boaters for low water and complaints from riparians on Lake Ontario for high water. Requests for permits for dredging operations and seawall repair have increased substantially under the low water conditions on the upper lakes.

On December 22, 2000 the International Joint Commission (IJC) announced the formation of the Lake Ontario and St. Lawrence River Public Interest Advisory Group (PIAG) to further public participation in a study to evaluate options for regulating levels and flows in the Lake Ontario-St. Lawrence River system. For more informtion about the study visit the IJC's web site at: www.ijc.org.

Meetings with the Public

The ILSBC held its annual public meeting on June 27, 2000 in Marquette, Michigan. The Board plans to hold its 2001 public meeting at The Inn at Christie's Mill, Port Severn, Ontario, on Georgian Bay. The meeting will be held from 7:00 to 9:00 p.m. on June 27, 2001. Further information on this meeting will be posted on the ILSBC's web site at: www.lre.usace.army.mil/ijc/superior.html.

The ISLRBC held one public hearing at Olcott, NY on May 30, 2000. It also held two multi-city public telephone conferences on March 22 and September 7, 2000. The cities involved in the teleconference included Montreal, QU, Toronto,

ON, and Alexander Bay and Rochester, NY. A transcript of this teleconference is available at www.islrbc.org. Click on "Public Meetings".

The INBC held its annual public meeting on September 12, 2000 at Niagara Falls, NY. For information on activities of the International Niagara Board of Control (INBC), visit: www.lre.usace.army.mil/ijc/niagara.html.

The U.S. Army Corps of Engineers (USACE) held two meetings in July 2000, one in Zeeland, MI and the other in Milwaukee, WI on the current progress of the Lake Michigan Potential Damages Study (LMPDS). These meetings were conducted to discuss the implications of extreme high and low water levels on coastal processes, planning and zoning, shoreline management policy development and impacts of coastal structures. For further information on these activities, visit the following Internet site: http://huron.lre.usace.army.mil/coastal/LMPD.

The USACE also conducted a workshop in September 2000 on activities of the Lower Great Lakes Erosion Study (LGLES). The workshop was held in Niagara Falls, NY. Further information on this study is available on the Internet at: www.cjscons.com/LGLES/.

Want to learn more about Recreational Boating on the Great Lakes?

The Great Lakes Commission presents a new Feature Report publication:

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Commercial Navigation

The Soo Locks opened the 2000 shipping season as scheduled on March 25, 2000. Through November 2000, the estimated tonnage passing through the Soo Locks at Sault Ste. Marie, MI was about 4.2% above the comparable 1999 tonnage. U.S. and Canadian vessels carried 55.2 and 14.5 million short tons of cargo respectively, while foreign vessels carried about 6.1 million short tons. Foreign cargo tonnage was up 17.7% over comparable 1999 tonnage.

Through November, an estimated total of 4,322 cargo vessels had transited the locks, as compared to 3,991 passages the previous year. Of these, 2,440 passages were U.S.-flagged vessels, 1,217 were Canadian, and 665 were foreign vessels (ocean going or "salties").

In addition to the cargo vessels, there were 3,964 transits through the Soo Locks by other types of vessels, such as pleasure craft, tour boats, Coast Guard, and scientific research vessels. The USACE has the authority to keep the locks open until January 15, 2001 should shipping interests request it.

The Canadian lock at Sault Ste. Marie, ON reopened on May 15, 2000. By season-end on October 15, 2000, a total of 3,236 vessels (primarily pleasure craft and tour boats) carrying 107,500 passengers had transited the lock. It is expected to reopen in mid-May 2001.

According to Saint Lawrence Seaway Development Corporation's preliminary figures through November 2000, tonnage passing through the Lake Ontario-Montreal section of the Seaway was down about 1% over 1999 at about 32.4 million metric tons (MMT). Vessel traffic was down about 4% over 1999 at 2,754 (combined lake and ocean vessels).

Preliminary data on the type of cargo transiting the Seaway through November 2000 include: iron and steel (up 19.6% to about 4.4 MMT); grain (down 6.4% to about 11.0 MMT); coal (up 23.3% to about 0.33 MMT); and petroleum products (down 7.4% at about 1.0 MMT).

2000 Great Lakes Updates

These reports were published in 2000:

1999 Annual Summary, Vol. No. 138, January 3, 2000.

Water Levels Continue to Decline, Vol. No. 139, April 6, 2000.

A Geologic Perspective on Lake Michigan Water Levels, Vol. No. 140, August 4, 2000.

Great Lakes Data and Information on the Internet, Vol. No. 141, November 7, 1999.

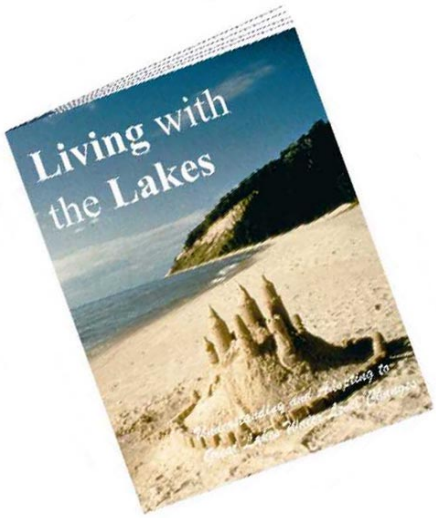
General Notes

All elevations shown in this article are referenced to the IGLD 1985 datum.

Information about the Great Lakes water levels outflows, and weather is available on the Internet. The address for the Detroit District's Home Page is as follows:

www.lre.usace.army.mil

Want to learn more about the ups and downs of the Great Lakes water levels?



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