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US Army Corps of Engineers
Detroit District

Great Lakes Update

2004 Annual Summary

All of the Great Lakes water levels were higher during 2004 than the previous year. A greater than average snow pack and extremely heavy rain during the spring accounted for the increases in levels. However, even with the level increases, Lakes Superior and Michigan-Huron predominately remained below their respective long term averages throughout 2004. Lake St. Clair rose to near average levels during the summer months, but fell during the fall. Lake Erie had above average water levels beginning in June, while Lake Ontario remained above average most of 2004.

Hydrology

Frigid temperatures in early 2004 allowed significant ice to form on all of the Great Lakes. Ice cover reached its maximum extent in mid February, reducing evaporation and slowing the seasonal decline of the water levels.

The Climate Prediction Center (CPC) of the National Weather Service issues seasonal outlooks for both temperature and precipitation conditions. Based on the continuation of a weak El Nino event in the Pacific Ocean, the CPC's winter forecasts for the Great Lakes region indicates equal chances for above, below or normal temperatures and slightly less than normal precipitation. Strong El Nino conditions usually mean warmer/wetter conditions in the Great Lakes basin; however winter conditions in the Great Lakes usually have wide variability.

The snow pack across the upper Great Lakes basin was 40% higher than average in 2004. During its peak in early to mid March, snow water equivalent (SWE) values were near 11 inches in the major snow belt regions. The Corps contracts with the National Weather Service to conduct snow surveys using low-flying aircraft over the Lake Superior drainage basin each year to help in predictions of water supplies to the Great Lakes. The results of the March 2004 survey are shown in Figure 1. A similar survey will be made in March 2005 to help forecast water levels for the Great Lakes for the 2005 spring-autumn period.

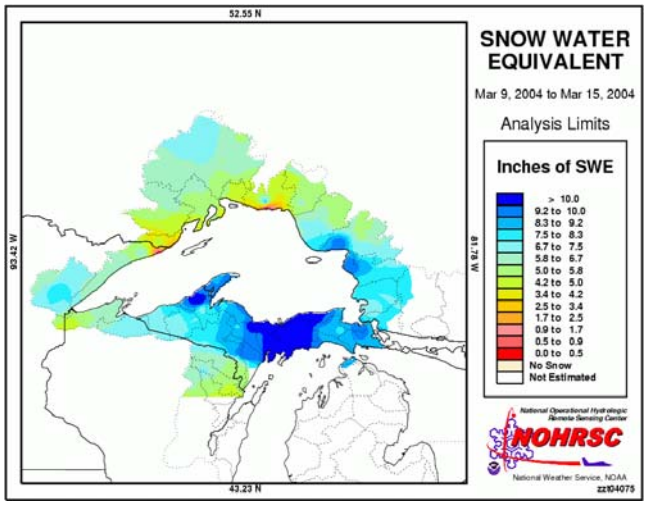

Figure 1

Spring is typically the period of time when the water levels on the Great Lakes begin their seasonal rise. The combination of runoff from melting snow and spring rains bring about the rises. All of the lakes were rising at near normal rates up to the beginning of May, 2004.

May 2004 brought record rainfall to much of the Great Lakes basin. An unusually stagnant weather pattern persisted across the middle of the region, leading to the record-breaking conditions. Several cold fronts stalled over the basin and interacted with warm, muggy air from the Gulf of Mexico. The

result was a series of thunderstorm and heavy rain events. The Lake Michigan-Huron basin was particularly hard hit. There was only one day in May with no recorded precipitation in the Lake Michigan-Huron basin.

The heavy rains during the spring had a significant effect on Great Lakes water levels. Over the month of May, Lake Michigan-Huron rose 9 inches, the largest such rise in the past 10 years. On average, Lake Michigan-Huron rises about 4 inches over the month of May. The other lakes rose between 4 and 9 inches each, which were also above average for that time of year.

A cool summer occurred across most of the Great Lakes basin. Average temperatures during June, July and August, were 2 to 5 degrees below normal. Precipitation on the other hand was slightly above normal in the southern half of the basin and slightly below normal across the north.

Figure 2 compares the monthly deviation of precipitation from long-term-averages (LTA) for each month of the year for 2003 and 2004 over the Great Lakes Basin.

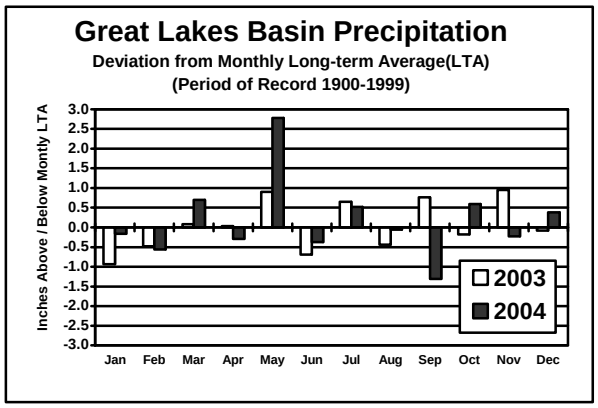

Figure 2

In general, precipitation was slightly above average for the Great Lakes basin in 2004. Evaporation model results show below normal rates for all the lakes. Total supplies for the basin were above average for 2004.

Water Levels

The *Monthly Bulletin of Lake Levels for the Great Lakes* displays water levels on the Great Lakes for the years 2003 and 2004. Figures 3 thru 7 illustrate the water levels for each lake over the past year, comparing 2004 water levels to the 2003 levels and the monthly LTA's.

Lakes Superior and Michigan-Huron water levels began 2004 at January 2003 water levels with Lake Superior being slightly lower. Above average water supplies during most of the year resulted in levels rising above 2003 levels in both basins. Lake Superior ended the year at approximately 3 inches below its monthly LTA while Lakes Michigan-Huron were at 12 inches below the monthly LTA.

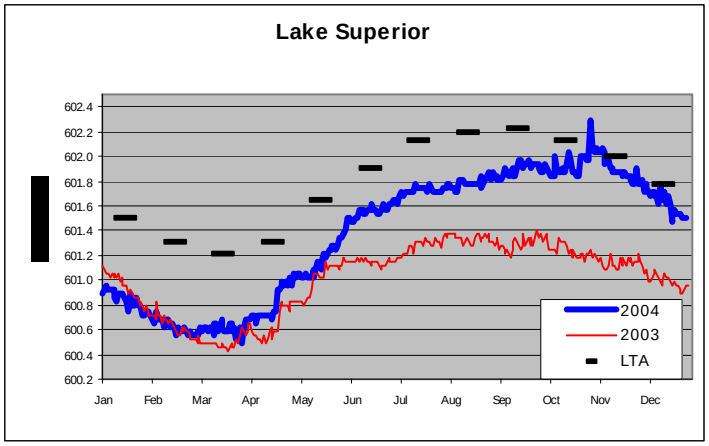

Figure 3

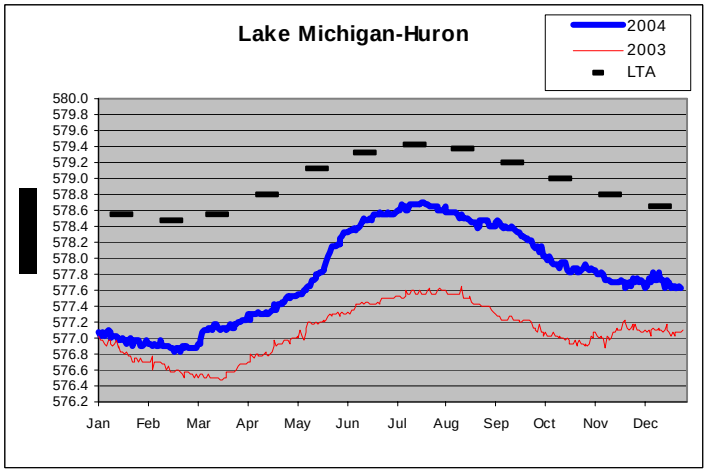

Figure 4

Lake St. Clair water levels started about 6 inches below its January LTA and remained in-between monthly LTA levels and 2003 water levels for most of 2004.

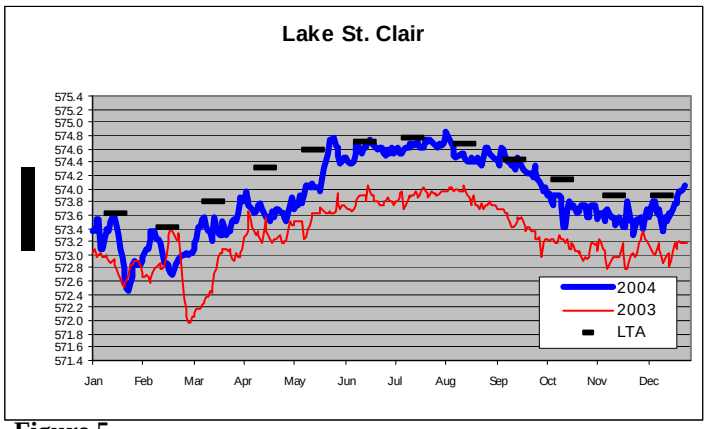

Figure 5

Lake Erie levels started the year 2 inches below its January LTA, and 5 inches above the January 2003 water level. In May 2004, water levels climbed above monthly LTA's and remained at or above average for the most of 2004.

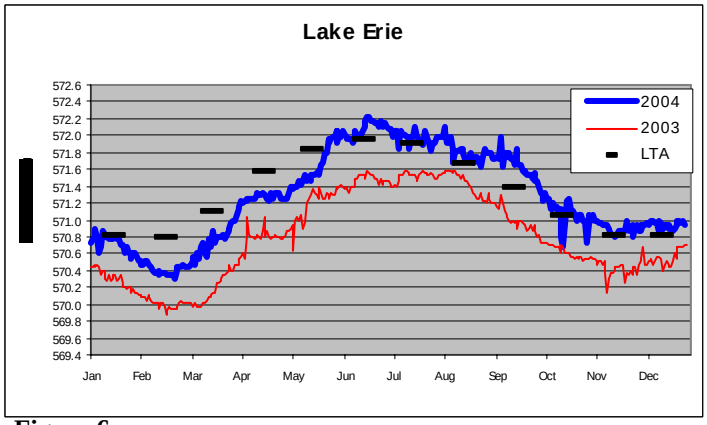

Figure 6

Lake Ontario began the year 11 inches above its January LTA. Water levels remained at or above average until November when the lake fell to 2 inches below its monthly LTA.

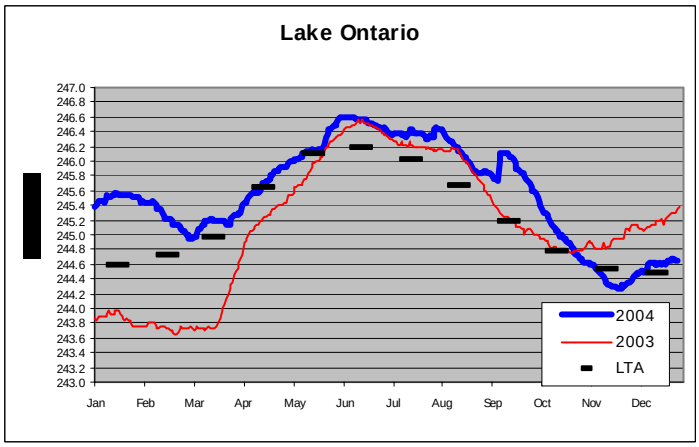

Figure 7

Lake Superior Regulation

During 2004, the International Lake Superior Board of Control (Board) continued to use Regulation Plan 1977-A as the basis for determining Lake Superior outflows. The Board is a bi-national body that reports to the International Joint commission (IJC) on boundary water management issues including the management of Lake Superior outflows. Flow changes resulting from monthly Lake Superior regulation are accomplished by varying the amount of water allocated to hydropower production and, when necessary, opening or closing gates in the compensating Works at the head of the St. Marys Rapids.

Water supplies to Lake Superior were above average in 2004 except for June, July, November and December. Annual precipitation over the Lake Superior basin was near average. In order to maintain minimum flow requirements in the St. Marys Rapids and to support fishery spawning a one-half gate open setting was maintained in the Compensating Works during 2004 except for November when the outflow required a setting of one-gate open.

Flow variations due to peaking and ponding operations by the hydropower plants at Sault Ste. Marie, Michigan and Ontario cause St. Marys River water levels downstream of the plants to fluctuate. When Lake Superior levels and outflows are below average, these fluctuations can be a concern to commercial navigation users. The 2004 Lake Superior water levels and outflows were mainly higher than those of 2003. In May 2004 the IJC renewed the authority to continue peaking and ponding operations by the hydropower companies. The authority was extended to March 20, 2006 and is subject to prior approval by the Board each month.

The Board may suspend ponding operations on weekends and holidays for 8 hours each day if operations are expected to cause sustained weekend levels at the U.S. slip gauge to be below chart datum. The Board suspended weekend and holiday ponding operations for the last two weeks of April because St. Marys River levels at U.S. Slip gauge were expected to be below chart datum. Due to the higher Lake Superior levels and outflows and the higher Lake Huron levels during the shipping season, this was the only time during 2004 that ponding was suspended.

Outflows were 3% below average in 2004, ranging from a low of 59,300 cubic feet per second (cfs) in January to a high of 83,000 cfs in November. Figure 8 compares the monthly Lake Superior outflows in 2004 to monthly long-term average flows for the 1900-1999 period of record. Further information can be found on the Internet at:

http://www.lre.usace.army.mi/glhh

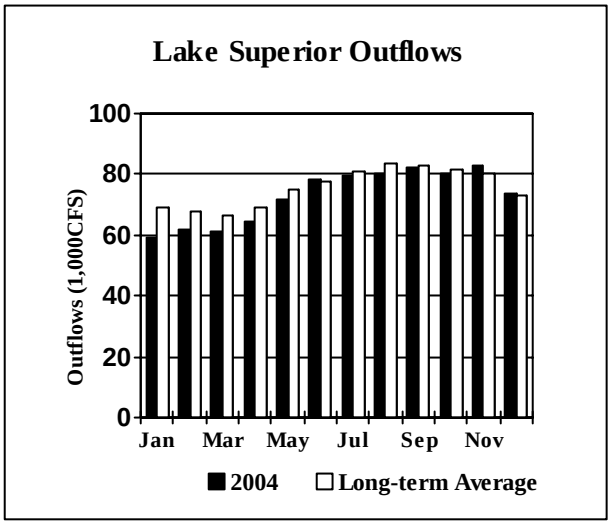

Figure 8

Lake Ontario Regulation

As part of its operations, the International St. Lawrence River Board of Control (Board) periodically assessed the hydrologic conditions in the Lake Ontario - St. Lawrence River system to formulate an outflow regulation strategy.

By teleconference in December 2003, the Board reviewed conditions in the Lake Ontario-St. Lawrence River basin and decided to revise its outflow strategy by reducing the amount of water stored on the Lake. Higher outflows were authorized to reduce the storage on Lake Ontario from 3.6 inches to approximately 1.2 inches. By January 7, 2004 the Lake Ontario level was 0.5 inches higher than the level that would have occurred with Plan 1958-D outflows.

On January 7, 2004, ice formation began in the Beauharnois Canal near Montreal. As part of normal operations, the Board reduces Lake Ontario outflow to promote the formation of a smooth, stable ice cover on the St. Lawrence River. Typically this is done each winter after the navigation season is closed. Rough ice cover increases resistance to water flow, and weak ice cover risks ice jams, which could be problematic for outflow regulation during the winter.

Ice cover began developing in key sections of the International reach on January 13, 2004, proceeding relatively quickly upstream due to continued low temperatures, to completion by January 20. Over-discharges were allowed through January. The Board modified its strategy in February, reducing outflows so that they generally would be in accordance with those specified by Plan 1958-D. Lake Ontario reached a seasonal low level on February 29 of 244.94 feet, 2.8 inches above its long-term average, and 14.6 inches above the level approximately one year earlier.

In March 2004 the Board decided to maintain its February strategy. After slowly falling from mid-January to early March, Lake Ontario began its seasonal rise. Precipitation on the basin was below average, but the total water supply to Lake Ontario was near average. On March 25, 2004, navigation between Lake Ontario and Montreal resumed as the Seaway officially opened.

Lake Ontario's level was expected to remain close to average during the spring and summer, however levels in the Montreal area had fallen well below average and there was a high probability that very low levels could occur in the summer and fall. The Board met and decided to conserve up to 1.6 inches of water on the Lake to meet future critical needs. As a result of this under-discharge strategy, 1.5 inches of water was conserved on Lake Ontario by May 14, 2004. At this time the campaign to conserve water was suspended and outflows would be in accordance with those specified by Plan 1958-D.

Wet conditions on both the Lake Ontario and Lake Erie basins contributed to well above average total supplies to Lake Ontario in late May and early June. Downstream levels had also risen above average and Lake Ontario levels were forecasted to remain above average into the fall. The Board maintained its current strategy, until August 28, 2004 when the flow was increased to aid navigation at the Port of Montreal. Lake Ontario's level slowly declined to 245.73 feet by September 8.

During the second week of September, remnants of Hurricane Frances dropped about 4.7 inches of rain causing high supplies over the Lake Ontario-St. Lawrence River basin and raising Lake Ontario's level to 246.09 feet by September 10, 2004. By September 23, 2004, almost 3.1 inches of the water level rise caused by the storm was removed from the Lake. The high outflows caused the level of Lake St. Lawrence downstream to decline by as much as 12 inches more than it would have if the regulation plan had not increased flows in response to the higher supplies from the remnants of Hurricane Frances. Boaters and shore residents along Lake St. Lawrence were affected by this decline. The Board decided to assist the boating community by authorizing an under-discharge September 25 and 26, temporarily raising the levels on Lake St. Lawrence by 7.1 to 8.3 inches, the equivalent of raising the level on Lake Ontario by about 0.1 inches. With this under-discharge the amount of water conserved on Lake Ontario by September 26 was 1.6 inches. The level of Lake Ontario was 245.76 feet.

By teleconference on October 13, 2004, the board decided to maintain its strategy that outflows generally would be in accordance with those specified by Plan 1958-D, but allowing, as needed, for over-discharges to meet critical hydropower needs, assist navigation at the Port of Montreal, and maintain a level of at least 67.6 feet on Lake St. Louis.

During the month of November 2004, the level of Lake Ontario declined a bit more than normal despite slightly above average total supplies to Lake Ontario due to heavy rains received over the local basin. The inflow from Lake Erie was about average for the month of November.

December 8, 2004, the Board decided by teleconference to maintain its strategy of outflows specified by Plan 1958-D, with provisions to vary outflows in order to assist the ice formation process. Over-discharges were authorized, if necessary, to raise low levels in the Montreal area. As of December 8, the level of Lake Ontario was 244.48 feet, 0.4 inches below its December LTA, and 7.1 inches below the level of one year ago, with a total of 1.5 inches of water conserved on the Lake.

Figure 9 below compares 2004 Lake Ontario outflows with period of record (1900 - 1999) monthly LTA outflows. Further informaiton on ILSBC activities can be found on the internet at: *http://www.islsrbc.org/.*

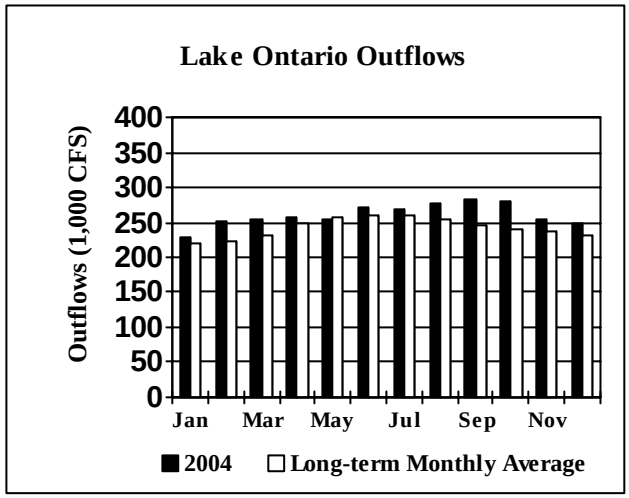

Figure 9

Public Concerns

The public has expressed concerns about the Great Lakes including impacts of low levels, primarily on Lakes Michigan-Huron, isostatic rebound, wetlands, rare and exotic species, shoreline erosion and poor water quality. Climate change and the potential for lower Great Lakes levels were also a concern. In general fewer inquiries regarding lake levels were received by the U.S. Army Corps of Engineers and Environment Canada staff this year. The news media has continued to show interest in lake levels and their effects on the ecology and economics of the region.

Upper Great Lakes Plan of Study

In January 2002, the Upper Great Lakes Plan of Study team, assembled by the IJC in August 2001, submitted a final Plan of Study to review the current regulation of outflows from Lake Superior. The Plan was accepted by the IJC and made public in April 2002. The final Plan can be found at: *http://www.lre.usace.army.mil/Storage/HH/IJC/uglpos/pos.pdf.* Implementation of the Plan of Study will begin when both the United States and Canadian governments appropriate funding.

International Lake Ontario - St. Lawrence River Study Developing Recommendations

This is the last year of the five-year study by the International Lake Ontario-St. Lawrence River Study Board under the International Joint Commission's (IJC) mandate to assess and evaluate the Commission's Order of Approval, which is implemented by the International St. Lawrence River Board of Control. Recommendations to the IJC for alternative criteria and plans to regulate flows from Lake Ontario through the St. Lawrence River will be finalized.

The International Lake Ontario - St. Lawrence River Study was set in motion by the IJC to assess and evaluate the Commission's Order of Approval used to regulate outflows from Lake Ontario through the St. Lawrence River. The Study Board is using a shared vision process to develop recommendations that will contribute to the economic, environmental and social sustainability of the Lake Ontario and St. Lawrence River System. Their goal is to identify flow regulation criteria that best serve the wide range of affected interests and climatic conditions in the basin. The current Order of Approval requires that the St. Lawrence Seaway Power Project be operated to meet certain conditions and criteria to protect the interests in Canada and the United States including domestic, industrial and municipal water uses, commercial navigation, hydropower production, and shoreline flooding. In addition, the Study investigated the impacts of changing water levels on environmental factors, shore erosion, and recreational boating and tourism.

Transparency has been the over arching guideline for the Study since its inception. The volunteer, bi-national Public Interest Advisory Group (PIAG) that the IJC appointed is the link between the public and the Study. PIAG has held over 95 meetings with stakeholder groups and the public to receive input. Over the years PIAG members attended Technical Work Group meetings and relayed input received from their interface with the public to the Study Team. Environmental sustainability, no disproportionate loss, flexibility in management, and adaptability to climate change and future technology are the decision-making guidelines that the Board will be using to weigh different alternatives.

Currently the Plan Formulation and Evaluation Group is facilitating the shared vision process to develop evaluation methods and guidelines. Using a shared vision computer model that holds all of the data gathered by the technical work groups along with the hydrologic models of the system the Board will use their guidelines to evaluate various plans and develop recommendations that will achieve the best balance among all of the interests.

Performance Indicators were developed by the six main technical working groups that represent the main interests of the system in order to assist the Board in measuring the effectiveness of different criteria and plans. These six main groups are: Coastal Processes, Commercial Navigation, Environmental, Hydroelectric Power, Recreational Boating and Water Uses.

The performance indicators measure economic, social and environmental health values related to the impacts of different water levels in Lake Ontario and the St. Lawrence River. With a shared vision computer model different scenarios can be run and results compared to see which plans satisfy the performance indicators. Specific plans can be compared to each other to determine why one plan is better than another. The activities of the technical working groups are summarized as follows:

The Coastal Processes Group investigated the impacts of water level fluctuations on shore property, paying attention to erosion and flood processes in order to develop performance indicators. The group's performance indicators include metrics for road flooding, land flooding quantified by land-use type, expropriated properties, damages due to flooding of residential buildings, the number of flooded residential buildings, the volume of sediment eroded, annual shore protection costs, the area of land lost and the economic value of land lost.

The Commercial Navigation Group evaluated the impacts of water levels on cargo shipping, including tug and barge operations. The group developed a performance indicator for costs of transportation for three geographic reaches: Lake Ontario from Port Weller to Cape Vincent; the Seaway, from Cape Vincent to Montreal; and Montreal to Batiscan.

The Environmental Group developed over 200 different performance indicator metrics for input into

their integrated ecosystem response model. This model was then incorporated into the shared vision model to allow impact assessment. These performance indicators are being aggregated into a smaller subset that will evaluate wetland quantity and quality, and the sustainability, diversity, and productivity of fish, mammals, birds, amphibians, and special interest species to various plans.

The Hydroelectric Power Group performance indicators attempt to maximize megawatts; maximize the value of megawatts; assure flow predictability and stability; provide ice management flexibility and increase awareness of the benefits to the environment and economy of clean, low-cost hydropower.

The Recreational Boating Group developed water level impact relationships from information gathered from marina and yacht club owners, boaters, and charter boat and tour operators. The economic impact of boating activities can be huge and influence the vitality of municipalities and counties, especially during the summer.

The Water Uses Group studied the impacts of water level variations on industrial, municipal, and domestic water intakes and treatment. The costs of adapting a facility and modifying its structure to maintain its design withdrawal and quality treatment at below critical levels were among selected performance indicators.

Additional information and details to supplement the brief discussions above of each of the technical working groups studies can be found on the Study's web site at: http://www.losl.org/twg/techboards-e.html.

The Study Board will make suggestions to the IJC regarding maintenance of the volumes of data gathered by the Study. It is important that the information gathered be accessible for future use. They will also make suggestions regarding implementation of their recommendations and continued public participation during implementation.

Watch the Study's website: www.losl.org for a list of frequently asked questions from the 2004 summer meetings and their responses. The 2005 public meeting schedule is currently available. The summer meetings will provide an opportunity to comment on the Study's draft recommendations before the final report is written. This report will be presented to the International Joint Commission in the winter of 2005. The International Joint Commission will then decide whether to hold their own series of public meetings regarding the implementation of the study's outcomes.

Meetings with the Public

The International Lake Superior Board of Control hosted a multi-city conference call for the public on June 21, 2004 between Duluth, MN; Grand Haven, MI; and Thunder Bay and Parry Sound, Ontario.

The International Niagara Board of Control (INBC) met March 25th and September 23rd to discuss routine matters under the Board's jurisdiction. The Board held its annual meeting with the public on September 22, 2004 in Buffalo, NY. For more information on activities of the INBC visit: *http://www.ijc.org/conseil_board/niagara/en/niagara_home_accueil.htm*.

In 2004, the St. Lawrence River Board of Control held one meeting with the public at Sacketts Harbor, N.Y. on July 21. It also held two Multi-City conference calls for the public. One was held on March 30 between Burlington, Ont.; Kingston, Ont.; Rochester, N.Y.; Watertown, N.Y. and Dorval, Que. The other was held on October 12 between Burlington, Ont.; Rochester, N.Y.; Watertown, N.Y.; Brockville, Ont.; and Dorval, Que.

Commercial Navigation

The Soo Locks opened the 2004 shipping season as scheduled on March 25, 2004. Through November 2004, the estimated tonnage passing through the Soo Locks at Sault Ste. Marie, MI was about 13% above the comparable 2003 tonnage. U.S. and Canadian vessels carried 53.3 and 14.3 million short tons (MST) of cargo respectively, as compared to respective 2003 tonnages of 47.1 and 12.7 MST. Foreign vessels carried about 3.8 MST up about 9.4% from the 2003 tonnage.

Through November 2004, an estimated total of 7,030 vessels had transited the locks as compared to 6,869 vessels the previous year. Cargo vessels totaled 3,626 compared to 3,514 the year before. There were 2,162 U.S. flagged vessels, 1,048 Canadian flagged

vessels and 416 foreign flagged vessels (ocean going or "salties"). Other vessels transiting the locks such as pleasure craft, tour boats, Coast Guard and scientific research vessels numbered 3,404. The U.S. locks will close on January 15, 2005 and reopen on March 25, 2005.

The Canadian lock at Sault Ste. Marie, Ontario opened on May 15, 2004. By season-end on October 15, 2004, a total of 2,589 vessels carrying 84,191 passengers had transited the locks. The vessels were primarily pleasure craft and tour boats, as well as some commercial and government vessels. The lock is expected to reopen in mid-May 2005.

Preliminary figures through November 2004 indicate the tonnage passing through the Lake Ontario-Montreal section of the St. Lawrence Seaway was up about 7.7% from 2003 at about 27.9 million metric tons (MMT). Vessel traffic was up about 1.5% over 2003 at 2,384 (combined lake and ocean vessels).

Preliminary data on the type of cargo transiting the Seaway through November 2004 include iron and steel (up 80.6% to about 3.5 MMT); grain (up 2.0% to about 8.0 MMT); coal (up 211.2% to about 0.58 MMT); general cargo (up 68.6% to about 4.1 MMT); and petroleum products (down 5.1% to about 1.4 MMT). For additional detail on Seaway activities visit their website on the Internet at: *http://www.greatlakes-seaway.com/*. The St. Lawrence Seaway Development Corporation provided these figures.

New Lock

A new "Poe sized" lock is proposed to replace the Davis and Sabin Locks at the Soo Locks complex at Sault Ste. Marie, MI. The purpose is to provide for more efficient movement of waterborne commerce. Headquarters approval of the Limited Re-evaluation Report (LRR), Project Cooperation Agreement (PCA) discussions with the Great Lakes Commission as the non federal sponsor, and authorization of final funding is still required. It is anticipated that approval of the LRR and execution of the PCA will be completed in FY05.

2004 Great Lakes Updates

The following reports were published in 2004:

2003 Annual Summary, Vol. No. 154, January 2004.

Invasive Species Control Efforts, Vol. No. 155, April 2004

Pier Safety, Vol. No. 156, July 2004

Lake Winnebago - An Important Great Lake Resource, Vol. No. 157, October 2004

Previous Great Lakes Update articles are available at: http://www.lre.usace.army.mil/glhh/news.

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 at:

http://www.lre.usace.army.mil/glhh.