US Army Corps
of Engineers
North Central Division

GREAT LAKES LEVELS
UPDATE NO. 61
AUGUST 2, 1990

Great Lakes basin precipitation was well above average in July. The following tables show estimated precipitation for July and for the year to date.

Provisional
Great Lakes Precipitation (inches)

I. July

Basin	1990*	1900-89 Average	Diff.	% of Ave.
Superior	3.2	3.2	0.0	100%
Mich-Huron	3.7	2.9	+0.8	128%
Erie	4.5	3.2	+1.3	140%
Ontario	4.0	3.1	+0.9	129%
Great Lakes	3.7	3.1	+0.6	119%

II. Year to Date (January - July)

Basin	1990*	1900-89 Average	Diff.	% of Ave.
Superior	17.7	16.2	+1.5	109%
Mich-Huron	21.1	17.4	+3.7	121%
Erie	25.6	20.1	+5.5	127%
Ontario	24.2	19.6	+4.6	123%
Great Lakes	21.2	17.7	+3.5	120%

* Estimated

During the past 12 months, total precipitation on the Great Lakes basin has been above average. Lake Superior has accumulated about 0.1 inch above-average precipitation. Lakes Michigan-Huron, Erie, and Ontario have had total precipitation about 2.1 inches (7 percent), 4.7 inches (14 percent), and 6.3 inches (18 percent), respectively, above average.

The National Weather Service is forecasting precipitation to be below average, with temperatures above average, during August.

The water levels of Lakes Superior and Michigan-Huron continue to be well below average for this time of year. Lakes St. Clair and Erie continue above average, while Lake Ontario is now below average. Lake Ontario has peaked, while Lakes Michigan-Huron, Erie, and St. Clair held steady in July.

Actions in July related to Phase II of the Great Lakes Fluctuating Levels Reference Study included meetings of the Study Board and Citizens Advisory Committee with the IJC to finalize the Plan of Study (POS). The POS was approved by the IJC on July 19th. The Board has established four Working Committees (WC) as follows:

- WC 1 - Public Participation and Information
- WC 2 - Land Use and Management
- WC 3 - Existing Lake Regulation, System-Wide Regulation and Crises Conditions
- WC 4 - Principles, Measures Evaluation, Integration and Implementation

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As most of you are aware, the Great Lakes have experienced dramatic water level fluctuations in the past few years. An extended cool, wet period of about two decades resulted in record high water levels on the four upper Great Lakes in the 1985 through 1987 period. This wet climatic regime was immediately followed by a period of drought and near-drought conditions, prompting a swift decline in lake levels. Because of the dramatic change in water levels, many have inquired about the causes of these fluctuations. Also of interest are areas where mankind has some control, such as the regulation of Lakes Superior and Ontario outflows, and the diversions of water into, out of, and between the Great Lakes. To dispel

myths and place things in perspective, a series of articles will be related in this forum. The order in which these articles will appear basically follows the Great Lakes system from the upper end (Lake Superior) to the lower end (St. Lawrence River). This month's topic is the regulation of Lake Superior's outflow.

Lake Superior's outflow passes through the 63-mile-long St. Marys River to Lake Huron, 23 feet below Lake Superior. Most of this drop occurs at the St. Marys Rapids. The natural regime of the St. Marys Rapids has undergone continuous changes since 1822 when the United States Army built a raceway and sawmill. Subsequent changes which affected outflows included the construction of navigation locks and hydroelectric power canals. The amount of water that could be discharged from Lake Superior increased as a result. It was recognized that it was necessary to construct control works across the head of the rapids to compensate for the increase in the outflow capacity and to maintain flows near what they would have been prior to construction of these works. The Lake Superior outflow was not yet regulated.

The natural supply of water to Lake Superior is augmented by two diversions from the Albany River Basin in Canada. These diversions, the Long Lac and Ogoki projects, have been in effect since 1939 and 1943, respectively. (See the location diagram on the following page.)

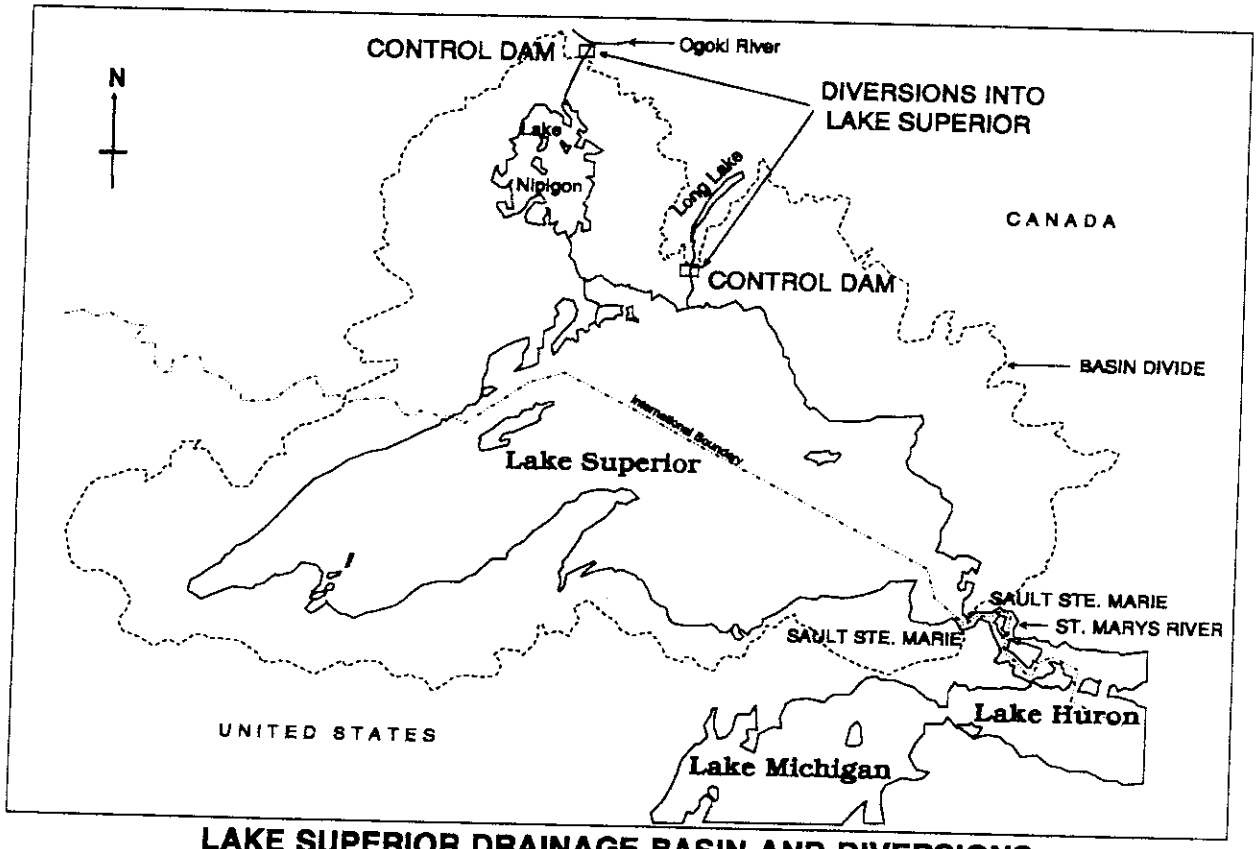
In 1914, the Algoma Steel Corporation Limited of the Province of Ontario and the Michigan Northern Power Company of the State of Michigan applied to the International Joint Commission (IJC) for approval to build control works at the head of the St. Marys Rapids. Construction and operation of the control works was approved by the IJC in its first Orders of Approval dated May 26 and 27, 1914. The control structure consists of masonry piers and 16 hand-operated sluice gates and was completed in 1921. A location diagram of the control structures in the St. Marys River is given on the following page.

The first outflow priority is to meet the needs of navigation; second priority is to meet the needs of the St. Marys Rapids; the balance of the outflow goes to hydropower, and is shared equally between the U.S. and Canada. Great Lakes Power Limited in Canada, Edison Sault Electric Company (ESELCO) in the U.S., and a plant owned by the U.S. Government have a combined capacity of about 82,000 cubic feet per second (cfs). The minimum amount shared is about 50,000 cfs. The capacity of the various plants is as follows:

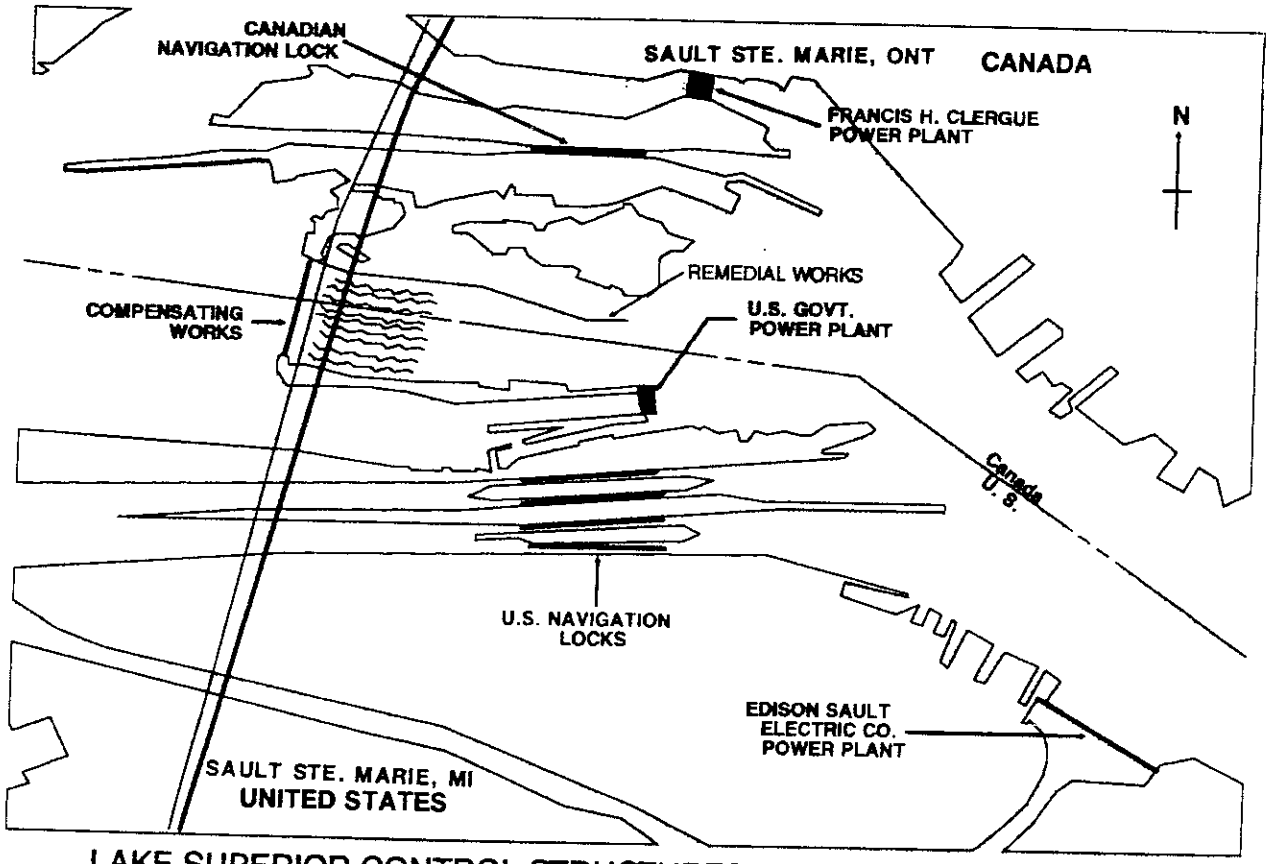
Great Lakes Power, Ltd.	39,000 cfs
ESELCO Plant	30,500 cfs
U.S. Government Plant	12,700 cfs

The IJC's 1914 Orders, as amended, provide that the compensating works and power canals be operated so as to maintain the level of Lake Superior "as nearly as may be" between elevations 598.4 feet and 602.0 feet (IGLD 1955) and in such a manner as not to interfere with navigation. To guard against unduly high stages of water in the lower St. Marys River, the orders require that the discharge from Lake Superior be restricted so that the elevation of the water surface below the locks is not greater than 582.9 feet.

The IJC's 1914 Orders also established the International Lake Superior Board of Control (Lake Superior Board) to supervise the operation of all canals, control works, headgates, and bypasses and to formulate rules for their operation. The orders state that the U.S. Member of this two-person board shall be from the Corps of Engineers. By virtue of being in charge of the U.S. Government-owned works and holding the office of Commanding General of the North Central Division, Brigadier General Jude W. P. Patin is the current U.S. Board Member. The Canadian Board Member is Mr.Tony Wagner, Regional Director, Inland Waters Directorate, of



LAKE SUPERIOR DRAINAGE BASIN AND DIVERSIONS



LAKE SUPERIOR CONTROL STRUCTURES ON THE ST. MARYS RIVER

Environment Canada, located in Burlington, Ontario.

In keeping with IJC requirements, the Lake Superior Board has devised several regulation plans over the years to determine Lake Superior outflows. Previous regulation plans were as follows:

- Sabin Rule, prepared in 1916 but not utilized until 1928, due to a sequence of low water supplies.
- Rule P-5, utilized in 1941.
- 1949 Rule, developed in recognition of increased water supply from the Long Lac and Ogoki diversions, was utilized in 1951.
- 1949 Rule, as modified in 1955, to provide better flow distribution for power generation.
- Plan SO-901, utilized as a guide in 1973, gave consideration to conditions on the lower lakes as well as on Lake Superior.
- Plan 1977, adopted October 1979, is an improvement to Plan SO-901.

Plan 1977 incorporates all provisions of the IJC Orders of Approval, as amended, and uses the concept of systemic regulation. All of the plans prior to SO-901 were one-lake regulation, where outflows were adjusted only in consideration of Lake Superior conditions. Systemic regulation considers conditions on Lakes Michigan-Huron and Erie and tries to benefit these lakes as well.

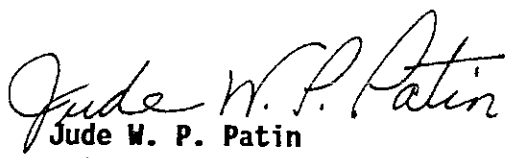
The basic goal of Plan 1977 is to regulate the outflow from Lake Superior to balance the levels of Lakes Superior and Michigan-Huron with respect to their long-term average levels. For example, if Lake Superior's level is much higher than average and Lakes Michigan-Huron are at a level only slightly above their average, the Lake Superior outflow will increase to ease Lake Superior's high water condition. Plan 1977 tries to balance lake levels while still considering the limitations on outflow set by the IJC and by the physical limitations of the system. Outflows are adjusted monthly.

Once the plan flow is determined, the water usage at the various facilities is determined by the Lake Superior Board. For example, the August plan flow is 65,000 cfs, to be used as follows:

Hydropower production:	60,550 cfs
Fishery remedial works:	500 cfs
Leakage + 1/2 gate open in the Compensating Works:	3,200 cfs
Navigation:	750 cfs

In April of this year, the IJC gave approval, on a test basis, to incorporating several modifications to Plan 1977. These changes were incorporated as Plan 1977-A. The modifications include changes in the capacity and operation of the control facilities, updating of the data base, and utilization of an improved forecast procedure. Commencing in June 1990, the Lake Superior outflow has been prescribed by Plan 1977-A. Further improvements are being pursued as part of Phase II of the IJC's Reference Study.

Information on the regulation of Lake Superior's outflow and on the role of the IJC in Great Lakes regulation can be found in the forthcoming publication, "Great Lakes - St. Lawrence River Regulation What It Means and How It Works". This will be available free upon request from Environment Canada, Water Planning and Management Branch, Ontario Region, P.O. Box 5050, Burlington, Ontario L7R 4A6; or North Central Division, U.S. Army Corps of Engineers, ATTN: CENCD-PA, 536 South Clark Street, Chicago, Illinois 60605-1592.



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