US Army Corps
of Engineers
North Central Division

GREAT LAKES LEVELS

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THE SAINT MARYS RIVER ICE BOOM

The December 1990 Update featured an article on ice booms in the Lower Great Lakes Connecting Channels. This month's topic is on the St. Marys River ice boom, located in the outlet channel from Lake Superior, the uppermost lake in the Great Lakes chain. The St. Marys River is one of the key connectors in the Great Lakes- St. Lawrence Seaway transportation system. From Whitefish Bay on Lake Superior, the St. Marys River (shown in Figure 1) flows in a general southeast direction a distance of about 60 miles to Lake Huron and falls about 22 feet.

The upper portion of the river extends about 15 miles from Point Iroquois, Michigan, to the head of the St. Marys Rapids at Sault Ste. Marie, Michigan (Soo). Navigation locks are located at this point in the river to allow ships to traverse the rapids area. Three hydropower plants are also at the Soo to take advantage of the 20-foot drop in the river.

Directly below the Rapids is Soo Harbor. Soo Harbor marks the beginning of the 45-mile-long lower reach of the St. Marys River. Leaving Soo Harbor, the river divides around islands into several channels before it flows into Lake Huron. The first split occurs around Sugar Island. The river flows around the east side of the island through the Lake George Channel. Flow in the west channel is through Little Rapids Cut and Lake Nicolet. Little Rapids Cut is a 600-foot wide navigation channel, which conveys about 70 percent of the total river flow during the open-water, or ice- free season. Below Sugar Island the channel splits around Neebish Island, flows into Lake Munuscong, past Round and Lime Islands, and then through DeTour Passage between DeTour Point and Drummond Island, into Lake Huron.

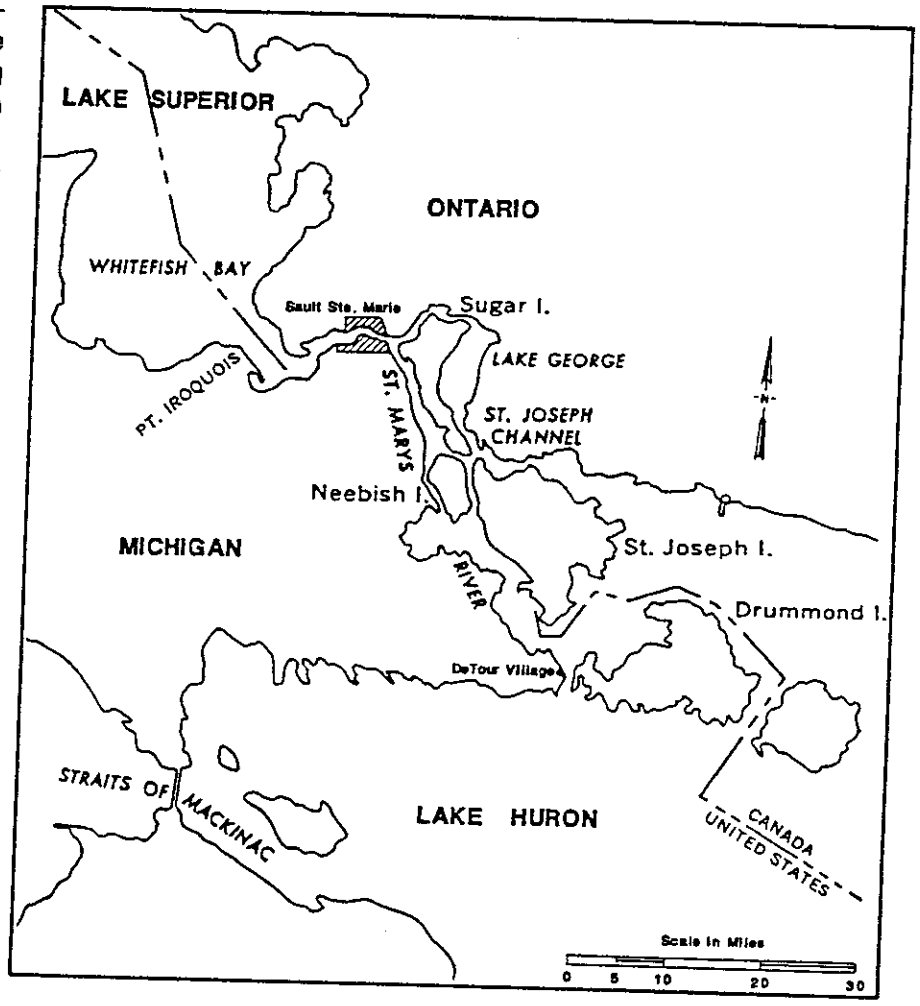

Figure 1 St. Marys River

Under normal winter conditions, sufficient ice cover develops in Soo Harbor by late December to form an ice bridge at the head of Little Rapids Cut (Cut). Unfortunately, the ice bridge is occasionally disturbed by adverse storm conditions or by local

vessel traffic. These events can destabilize the ice field in Soo Harbor, allowing large amounts of broken ice to float downstream into the Cut area. This has often halted or interfered with ongoing ferry operations between Sugar Island and the mainland. In the past, these ice jams also raised water levels in Soo Harbor resulting in flooding in the powerhouse tailraces which disrupted the operation of the hydropower plants.

Figure 2 View of the St. Marys River Ice Boom Location

During the period 1971-1979, the Corps of Engineers was involved in a study known as the Great Lakes-St. Lawrence Seaway Navigation Season Extension Program. The study was intended to investigate the feasibility of year-round navigation on the Great Lakes-St. Lawrence River System. As part of the demonstration portion of the program, an ice boom was installed in the lower Soo Harbor to help stabilize the ice cover.

Its purpose was to moderate ice problems in the Cut, and to act as an aid to winter navigation. The boom, composed of a series of interconnected floating timbers, was positioned upstream of the Sugar Island ferry crossing (see Figure 2). It should be noted that the boom was located entirely within U.S. waters.

The boom consisted of two parts: an east arm which extended out from Sugar Island about 1,000 feet into the river, and a shorter west arm which extended 120 feet out from the mainland. A 250- foot wide opening between the arms allowed navigation to pass through the boom.

Because of the overall effectiveness of the boom during the winter of 1975-1976, the boom continued to be deployed throughout the demonstration program which concluded after the 1978-1979 winter season. An assessment of the Navigation Season Extension Program showed that among other things, the ice boom system had minimized ice jams in Little Rapids Cut, thus reducing the possibility of flooding in Soo Harbor and power reductions in the hydropower plants. It also maintained an open-water channel between Sugar Island and the mainland, allowing ferry service to continue year round. This resulted in the decision to reinstall the system each winter thereafter.

Authority was given to the Soo Area Office of the Detroit District, U.S. Army Corps of Engineers, to make the installation a part of its regular winter operations. Since it was first installed, several changes have been made in the boom configuration. To stabilize the ice sheet behind the west arm of the boom, three permanent rock islands were constructed, the first two in 1981, and the third in 1989. Ships traversing the river late in the navigation season often found it difficult to maneuver through the 250-foot opening in the boom. For this reason, in 1989, the layout of the boom was changed to increase the opening to 375 feet. The present configuration is shown in Figure 3.

An extensive environmental impact study (EIS) was completed during the Navigation Season Extension Program. The study found that there were no significant environmental impacts upon the Great Lakes system due to the installation and use of the boom and its ice stabilization islands. The shipping season can be extended beyond December 15 by the Commander of the North Central Division, U.S. Army Corps of Engineers, to meet the reasonable demands of commerce to the extent that weather and ice conditions permit. Brigadier General Jude W.P. Patin, as Commander of the North Central Division, also has the authority to close the Soo Locks at any time in an environmental emergency, vessel disaster, or other extraordinary circumstances, as currently provided for in the Code of Federal Regulations.

Extending the navigation season past December 15 is often needed and requested by commercial navigation. The EIS established a

procedure of measuring accumulated freezing degree days at the Soo. If severe cold temperatures occur, the extended season can be terminated. For example, on December 28, 1989, severe temperatures and ice conditions led to an early closing of the Soo Locks for the 1989 season. Favorable conditions the beginning of this winter allowed the 1990 shipping season to end with the closure of the Soo Locks on January 15, 1991. The commercial cargo load passing through the Soo Locks during the extended 1990 shipping season (December 16 - January 15) was 4.8 million tons, about 5 percent of the entire season's 87.9 million tons.

In general, the ice boom continues to be invaluable in stabilizing the Soo Harbor ice cover, reducing the extent of ice accumulation in Little Rapids Cut and the amount of ice in the Sugar Island ferry crossing. By reducing the possibility of ice jams in the cut, the ice boom has lessened the likelihood of emergency cutbacks in outflow from Lake Superior, which would result in power generation losses at the hydropower plants. In reducing the adverse effects of natural ice conditions on the Sugar Island ferry, the ice boom has contributed to more reliable winter transportation between Sugar Island and the mainland.

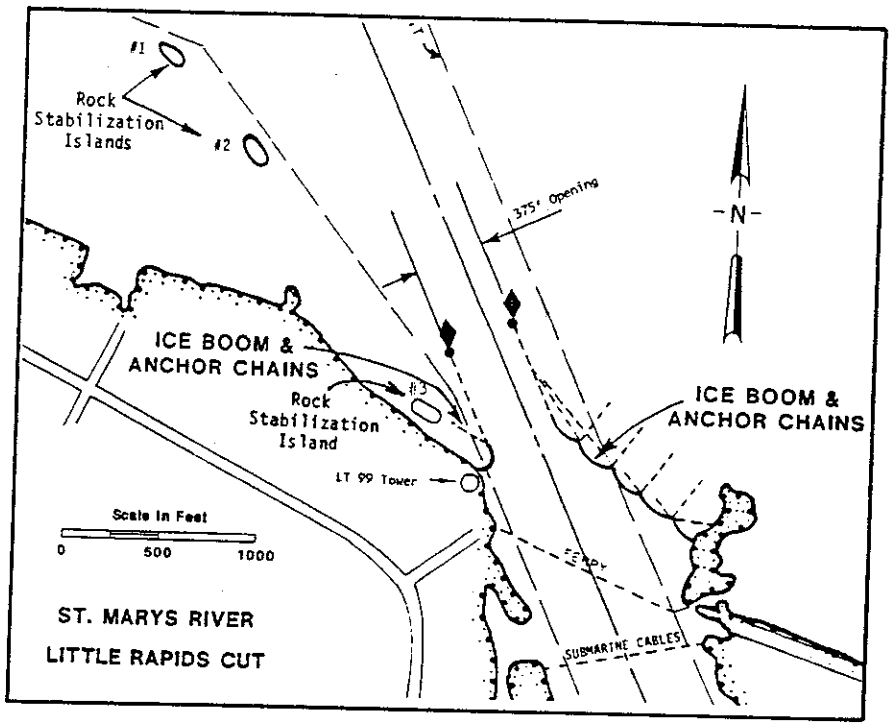

Figure 3 Present Configuration of the Ice Boom

Lake Levels

Lake Superior was about 5 inches below average in February, while Lakes Michigan-Huron were about 2.5 inches below average for the month. Lakes St. Clair, Erie, and Ontario were about 15, 18, and 16 inches, respectively, above their February averages. The February seasonal trend was seen in all the lakes.

Precipitation

The Great Lakes basin received below average precipitation in February (see Table 1). Above average temperatures across the basin in February caused some early snowmelt and runoff. The combination of low precipitation and warm temperatures has resulted in a below average snowpack on the basin for this time of year. Though precipitation during the past 12 months (March 1990 through February 1991) has totaled about 14 percent above average, the relative lack of snow on the basin may cause a less than normal spring rise.

The National Weather Service is forecasting average precipitation for the Great Lakes basin in March. Temperatures are also expected to be near average in March.

Regulation

February's Lake Superior outflow was in accordance with Plan 1977-A at a rate of 56,000 cubic feet per

Table 1 Great Lakes Basin Precipitation

Basin	February				Year-to-date			
	1991*	Average**	Diff.	% of Average	1991*	Average	Diff.	% of Average
Superior	1.0	1.4	-0.4	71	3.0	3.3	-0.3	91
Michigan-Huron	1.0	1.7	-0.7	59	3.2	3.8	-0.6	84
Erie	1.7	2.0	-0.3	85	2.6	4.4	-1.8	59
Ontario	1.4	2.4	-1.0	58	3.7	5.0	-1.3	74
Great Lakes	1.1	1.8	-0.7	61	2.9	3.9	-1.0	74

* Estimated (inches) ** 1900-1989 Average (inches)

second (cfs). The St. Lawrence River Board of Control implemented a program of Lake Ontario outflows in February that is aimed at reducing the probability of exceeding the criterion level of 246.77 feet. This resulted in accumulating some overdischarges to reduce the Lake Ontario level. This program is expected to continue into March and is being reassessed weekly by the Board.

IJC Water Levels Reference, Phase II Study

Significant progress has been made on the study in the past month. The Study Board and the Citizens Advisory Committee met in Windsor, Ontario, on February 25 and 26 to review (and in three cases approve) the revised work plans of the four Working Committees who will be performing the technical analyses and public coordination for the Phase II study. A public session was held the morning of February 25th at the Cleary Convention Center in Windsor, Ontario, to provide information on the study and to hear from local officials of their problems and concerns related to water level extremes in the St. Clair River-Lake St. Clair- Detroit River and western Lake Erie portions of the Great Lakes- St. Lawrence River Basin. A site visit was arranged by the Essex Region Conservation Authority to examine shore protection works and shoreline characteristics of the Canadian side of Lake St. Clair, the Detroit River, and western Lake Erie. The next significant study event will be a symposium, to be held in Toronto, Ontario, on March 18th, on the subject of study objectives, study principles, and the evaluation criteria to be applied in the conduct of the Phase II Study.

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