Levels Reference Study Board
International Joint Commission
Issue 6

UPDATE

Public Forums to Explain Study Results

This expanded issue of **UPDATE** marks a major milestone in the Study: Results of the Study's major investigations, together with a range of options for Government actions, are now available for public review. They are summarized in the following pages.

In our public forums, from November 30 to December 3, in locations around the Great Lakes-St. Lawrence River Basin, we will be seeking your comments on the options for action. See the schedule (page 2) and map for the site nearest you.

A full-length version of the Study's Options Document, the paper from which these summaries are taken, is available from either of the contact points listed on Page 6. Feel free to contact either of these with your comments, or for further details about the forums.

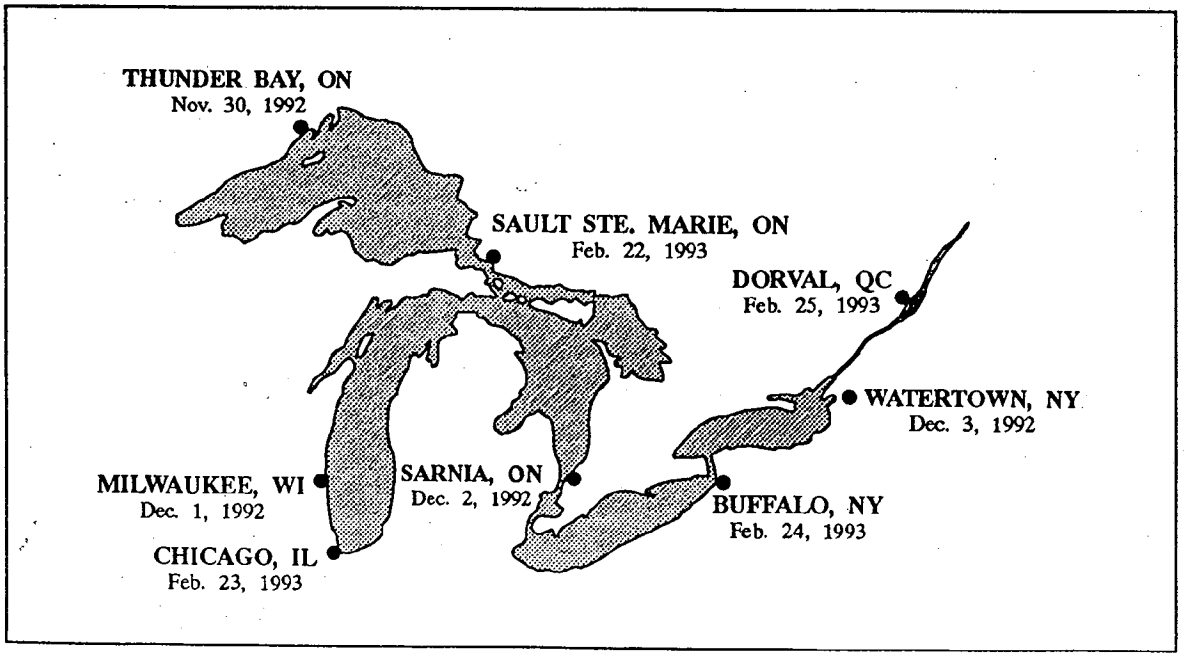
Once the results and options have been fully discussed, the Study's draft recommendations will be prepared for review at a second set of forums from February 22 to 25.

"These two sets of public forums mark the culmination of the Study's efforts," says Tony Wagner, Canadian Co-chair of the Study Board. "All of our research and public involvement efforts are coming together, and we are beginning to prepare our final report."

John D'Aniello, the U.S. Co-chair of the Study Board, emphasizes the importance of citizen involvement in these forums: "These meetings will be the last opportunities for people to have a look at the Study's results and recommendations before they are presented to the International Joint Commission in March. If citizens or interest groups are looking for opportunities to influence the Study before it is finalized, these forums are their chance."

Plan to attend one of the following four forums on the Study's results. Please note that the location for the December 3 forum will be Watertown, New York, and not Oswego as previously advertised. (The next issue of **UPDATE** will give the exact times and locations for the February forums on the Study's draft recommendations.)

See you there! ☐



Options for Measures
To Reduce The Adverse Impacts Of Fluctuating Water Levels And Flows

In Issue 1, we explained the 18 types of measures under consideration in this Study. Since then, detailed research was conducted to determine the impacts of these measures, and an evaluation process was carried out to narrow the measures down still further.

The evaluation process rated the measures against four major criteria: 1) Economic and Social; 2) Environmental; 3) Impact Distribution among Interests and Regions; and 4) Technical, Operational, Legal and Public Policy Feasibility. All 140 members of the Study Team -- including government staff, interest groups, and individual citizens -- were asked to rate the measures according to how well they met the four criteria.

Then, in a late September workshop attended by more than 70 Study members, tabulations of these ratings were discussed. Agreement was reached upon which measures should be carried forward as options for further examination and possible Government action, and which ones should be dropped from further consideration. Some of the options are modifications or combinations of measures originally considered. Everyone who participated in the rating process worked from a 250-page compendium of data on each measure. Titled "Impacts of Measures for Evaluation: Summary", this book will be further updated and made available upon request early in 1993.

Participants in the workshop agreed on several points that led to the revised list of measures presented as possible "options" for government action:

- Water level regulation plans for all five of the Great Lakes and the St. Lawrence River which would involve significant dredging of the St. Clair and Detroit Rivers, would be too costly, both from economic (more than $10 billion) and environmental (negative effects on wetlands and fish habitat) perspectives.

- Some regulation plans involving control structures at the outlets of three of the Great Lakes (Superior, Erie and Ontario) that would affect the entire system have been carried forward as "options", but five-lake regulation plans have been dropped from consideration.

- All regulation plans which have been developed to date have caused shifts in benefits and impacts among interests and regions.

- Workshop participants agreed that many of the possible measures for land use and management practices lend themselves well to being combined.

The result of the workshop is a possible range of options for government action that fall into three broad categories:

1. **Remedial Measures** that would, principally, reduce damages to structures that already exist. See Chart 1 for details.

2. **Preventive Measures** that would, principally, reduce the probability of activities that could increase future damages. See Chart 2 for details.

3. **Compensatory Measures** that would compensate for damages incurred as a result of flooding and erosion damages due to fluctuating levels and flows. See Chart 3 for details.

BE SURE TO ATTEND THE PUBLIC FORUMS

Thunder Bay, Ontario
Monday, November 30, 1992
Landmark Inn,
1010 Dawson Road
Tel. (807) 767-1681
Registration 6:30 p.m.

Milwaukee, Wisconsin
Tuesday, December 1, 1992
Milwaukee County War Memorial Center,
750 North Lincoln Memorial Drive
Tel. (414) 273-5533
Registration 6:30 p.m.

Sarnia, Ontario
Wednesday, December 2, 1992
Drawbridge Inn,
283 North Christina Street
Tel. (519) 337-7571
Registration 6:30 p.m.

Watertown, New York
Thursday, December 3, 1992
Holiday Inn,
300 Washington Street
Tel. (315) 782-8000
Registration 6:30 p.m.

Chart 1

OPTIONS FOR REMEDIAL MEASURES

Lake Level Regulation

SEO* -- Three Lake Expanded Regulation

This measure would use existing structures in the St. Mary's and St. Lawrence Rivers and add a control structure in the Niagara River. The Niagara would be dredged to increase its capacity to handle higher flows. Dikes and weirs placed in the Detroit River to offset the impact of prior dredging would be removed. Additional works would be required in the St. Lawrence River.

This plan would affect all five lakes by reducing Lake Superior's long-term mean level by 15 centimetres (1/2 foot); reducing the frequency of high levels on Lakes Michigan-Huron; raising Lake Erie's level during low supplies and lowering its level during high supplies; maintaining Lake Ontario's current regime and balancing upstream and downstream requirements during extreme water supply periods; and, maintaining the St. Lawrence River's current regime by adding additional structures.

The object of this plan would be to reduce the range of water level fluctuations as much as possible on Lakes Michigan, Huron and Erie.

SEO -- Three-Lake Combined Regulation

This possible regulation plan would also affect all five lakes. It differs from SEO Expanded in that it would be operated to achieve maximum benefits for a number of interest groups: Riparian, Recreational Boating, Hydro Power, Navigation and the Environment. This measure would require addition of a control structure in the Niagara River, together with dredging and other modifications in the Niagara and St. Lawrence Rivers. This measure considers interests only as far downstream as Montreal. It does not include objectives for interests below Montreal to Trois Rivieres, Quebec.

SO -- Lake Ontario Combined, Including Environment

This plan would use only the existing regulation structures on Lakes Superior and Ontario. Lake Superior's regulation plan would be unchanged, while Lake Ontario's regulation plan would be modified to operate without current International Joint Commission constraints. It would reflect the preferred ranges of levels and flows for riparians, recreational boating, hydropower, commercial navigation and environmental interests, within the present capacities of the regulation structures and the St. Lawrence River.

SO -- Two Lake Combined, Superior 1/2 ft., Ontario Plan 1958D*, Modification 35K* with Deviation

This plan would reduce the mean and target minimum levels (while increasing the range of fluctuation) of Lake Superior by 15 centimetres (1/2 foot) in order to reduce the range of fluctuation of Lakes Michigan-Huron. No new structures would be required, but Lake Superior harbours, channels and tributary mouths would require dredging to allow for the 15 centimetre lowering of the minimum lake level. Among other things, Modification 35K would modify seasonal outflow adjustments from Lake Ontario to better balance the needs of upstream recreational boaters with downstream commercial navigation and recreational boating. The reference to "with deviation" means that this plan would retain its current allowances for discretionary departures from the prescribed outflows, under extreme conditions.

SO -- Superior Plan 1977A* Modified With Ontario Plan 1958D Modification 28B*

This plan would call for fine-tuning of existing regulation plans to increase the maximum winter outflow from Lake Superior and modify the equation that balances Lake Superior and Lakes Michigan-Huron Levels. It would also include modifications to Lake Ontario's regulation plan to better satisfy upstream recreational boaters with some negative impacts downstream for recreational boaters and commercial navigation. This modification would also reduce spring flooding in the Montreal area (See Plan 1958D With Modification 28B).

Plan 1977A Without Criterion C -- This measure would modify current regulation to Lake Superior to allow more flexibility in the balancing of levels between Lake Superior and Lakes Michigan and Huron. Criterion C requires that once Lake Superior's level falls below 183.0 metres (600.5 feet), the outflow from the lake must be no greater than it would have been prior to the addition of structures in the St. Mary's River. Elimination of Criterion C would allow flows higher than those currently specified for low Lake Superior levels. The amount of flow would depend upon upstream and downstream conditions.

Plan 1958D With Modification 28B -- This modification would change the current Lake Ontario regulation plan to consider all interests. Seasonal adjustments to flows would better meet the needs of recreational boaters upstream of Cornwall-Massena in the St. Lawrence River, with some detriment to recreation and commercial navigation downstream. This plan would also incorporate discharge of more water in times of high winter supplies, when ice conditions permit. As well, the plan limits Lake Ontario outflows to reduce spring flooding in the Montreal area.

Plan 1958D With Modification 35K* -- This plan differs from Modification 28B in that it has different seasonal adjustments, and modified minimum flow limits in the fall months. These tend to improve upon Modification 28B in terms of improving the balance in upstream and downstream levels for recreational boating and commercial navigation, while they maintain 28B's other characteristics.

**The following conventions are used in describing lake level regulation plans:*

SEO -- Refers to regulation on Lakes Superior, Erie and Ontario

SO -- Refers to regulation on Lakes Superior and Ontario

Plan 1977A -- Refers to the current plan for regulating Lake Superior

Plan 1958D -- Refers to the current plan for regulating Lake Ontario

Modifications 28B and 35K -- Two of many possible modifications that have been modelled for Lake Ontario's regulation plan. The numbers, 28B and 35K, indicate the sequence in which they were developed.

BOC -- Refers to the "basis of comparison", which is a set of "current condition" water levels and flows that are used as a reference for assessing the impacts of modified lake regulation and crisis management plans. The BOC is calculated for the 90-year period from 1900-1989, and it gives the water levels and flows that would have occurred each month of that period if all current regulation plans, current channels and existing diversions had been in effect over the period. Water supplies used to calculate the BOC are the supplies that actually occurred (historic supplies) during the 90 years.

Land Based Measures

Acquisition Of Developed Lands in Hazard Zones -- to prevent, or reduce, future property damages and losses, and to encourage communities or agencies to purchase developed property in hazard areas.

Relocation Of Dwellings -- to reduce or avoid flooding or erosion damage by relocating existing structures from hazard areas. Some dwellings could be designed for temporary relocation during extreme conditions.

Flood Proofing Of Existing Structures -- by raising structures above the flood level, by cementing over basement windows, or removing items from the flood-prone area of the structure (i.e., the basement).

Structural Shore Protection To Prevent Flooding -- by constructing dikes and levees as permanent or temporary measures.

Structural Shore Protection To Prevent Erosion -- by constructing breakwaters, barrier islands, sea walls, groins and jetties, revetments, or artificial headlands that would dissipate wave energy or trap sand.

Non-Structural Shore Protection -- by artificial beach nourishment or vegetation to stabilize shoreline areas.

Results From Detailed Research:

- Climate change (the Greenhouse Effect) could reduce water supplies to the Great Lakes-St. Lawrence River Basin to the extent that, in the next century, outflows from the five Great Lakes would be diminished as follows: Lake Superior, by 13%; Lakes Michigan-Huron, by 33%; Lake Erie, by 40%; and, Lake Ontario by 39%.

- With existing lake regulation plans, this could translate to a lowering of lake levels in the range of one-third of a metre (about one foot) on Lake Superior to 1.5 metres (about 5 feet) on the other lakes. (It should be noted that these figures are based upon computer models and are not precise predictions.)

- No lake level regulation plan can completely eliminate shoreline flooding damage. While lake regulation modifies the still water level, flood damage is primarily caused by surges in water levels brought about by storms.

- Similarly, no lake level regulation plan can completely eliminate shoreline erosion. While some types of shoreline will erode less with compressed ranges of water levels, other types of shoreline will continue to erode regardless of water levels.

- Great Lakes-St. Lawrence River marinas and the recreational boating industry are adversely affected when levels fall below thresholds that vary according to location.

- The commercial shipping industry incurs additional transportation costs when levels in the controlling lake route are too low to allow carrying of maximum cargoes. However, shipping may benefit when levels in the controlling route are raised, even if other levels are low.

- Hydro power production is most efficient when water flows are relatively uniform. Production of power in the connecting channels and St. Lawrence River would be affected by changes in current lake level regulation plans. Hydro plants powered by the Long Lac-Ogoki and Chicago Diversions would be affected by emergency actions in response to high or low water crises. Low water levels could affect cooling water intakes for thermal power plants.

- The wetlands of the Great Lakes and St. Lawrence River depend upon fluctuations in water levels to maintain a healthy diversity of plant and animal life. Many fish species depend upon healthy wetlands for reproduction. These wetlands have already been adversely affected by regulation of Lake Ontario, which has compressed the range of fluctuations on that Lake.

- An emergency plan could use existing diversions and lake level regulation structures, together with land based measures, to respond to high or low water level crises. Although such a plan would require little or no additional capital costs, it would require coordination among the relevant federal, provincial, state and municipal agencies, together with hydro power entities.

- Regardless of which measures governments decide to implement, a process for implementation that is coordinated among the many responsible federal, provincial, state and local government and other agencies will be necessary to ensure their success.

- The number of agencies with responsibility for various types of water level and flows issues makes it difficult for the general public to find consistent and pertinent information in forms suited to individual needs. ❐

Chart 2

OPTIONS FOR PREVENTIVE MEASURES

Setback Requirements -- that specify location of structures outside flood or erosion prone areas.

Flood Elevation Requirements -- that specify construction of new structures above the flood elevation.

Shoreline Alteration Requirements -- that prevent changes to the shoreline that could interfere with shore processes in neighbouring properties.

Real Estate Disclosure Requirements -- that require notice to prospective buyers of property in potential flood and erosion hazard areas.

Development Controls For Public Infrastructure -- that require design and location of public infrastructure (roads, sewer and water lines) outside of hazard areas, in order to avoid or minimize future damage by discouraging development in such areas.

Acquisition Of Undeveloped Land And Habitat Protection -- to prevent future development of hazard lands by allowing government purchase of such land for public access space or protected natural habitat.

Chart 3

OPTIONS FOR COMPENSATORY MEASURES

Disaster Aid -- that would provide financial relief to assist with repair of damages caused by extreme water levels.

Tax Relief -- that would lessen the tax burden on those who have suffered damage or loss of property due to extreme water levels.

Insurance -- that, upon purchase, would provide coverage for losses incurred due to extreme water levels.

Options for Emergency Actions

In Response To Crisis Conditions

There are many possible emergency actions that could be taken to reduce the effects of future high or low water crises. Some of these could involve little or no additional capital costs, but might involve a transfer of benefits from one interest or geographic area to another.

Hydraulic measures would include a series of controlled deviations from the flows currently prescribed in the regulation plans of Lakes Superior and Ontario, and at four other sites: the Long Lac and Ogoki Diversions into Lakes Superior, the Lake Michigan Diversion at Chicago, the Welland Canal and the Black Rock Lock in the Niagara River. A series of threshold water levels would call for incremental flow deviations, which would increase with the magnitude of the crisis.

Various land-based measures might also be brought into affect, along with possible capital cost measures. Included among these would be emergency sandbagging; emergency preparedness plans; storm and water level forecasting and warning networks; disaster assistance; shore protection alternatives; drought assistance; and, temporary land and water use restrictions. ❐

Options for Guiding Principles

For Management Of Water Level And Flow Issues

The following set of guiding principles could improve understanding, cooperation, coordination, and flexibility in decision making on issues related to Great Lakes-St. Lawrence River levels and flows. These principles are being considered for recommendation to the International Joint Commission.

- Existing and future beneficial uses will be considered, and the fundamental character of the System will not be adversely affected.
- Actions will be environmentally sustainable and respect the integrity of the ecosystem.
- Actions will be beneficial to the System and not result in undue hardship to any particular group.
- Coordinated management needs to respect and accommodate the dynamic nature of the entire System.
- Management of the Great Lakes-St. Lawrence River Basin System should be done in full awareness of the potential for reduced water supplies as a result of climate change.
- Decision making with respect to management of the System will be open, respecting the full range of interests affected by decisions, and facilitating their participation in the policy process.
- Management of the Great Lakes-St. Lawrence River Basin System will be based on coordination of actions relating to levels and flows.
- Management of the Great Lakes-St. Lawrence River Basin System will be based on continued improvement in the understanding of the processes and impacts of fluctuating water levels and flows.
- Management of the Great Lakes-St. Lawrence River Basin System requires ongoing communication and public awareness. ❐

Options for Communications Practices

That Would Improve Public Knowledge Of Water Level Issues

The results of a survey of 65 users of water level information reveal that certain user groups (coastal engineers, government emergency workers, recreational boaters and marina operators, and shoreline property owners) find deficiencies in the information services they currently receive.

These results suggest a strategy for improving the quality and communication of water level information that involves:
1) developing better decision making tools for action in extreme water level conditions;
2) small changes to water level bulletins distributed by the Canadian and U.S. governments to make them more understandable; and,
3) tailoring existing information to users' needs.

Such a strategy could be undertaken in concert with a Water Level Communications Clearinghouse. This clearinghouse would co-ordinate and promote information about Great Lakes-St. Lawrence River water levels to specific interest groups and to the general public.

Options for establishing such a clearinghouse include locating it at the International Joint Commission's regional office in Windsor, Ontario; making it a bi-national effort by universities or governments; or making it a bi-national project of an agency that is not directly accountable to governments. ❐

Options for Incentives to Implement Measures

Several types of taxation or tax assessment practices could be used to encourage individuals to calculate the advantages or disadvantages of locating in a hazard area. Other incentives would be loans and grants to encourage particular courses of action. These incentives would not be implemented as measures in their own right; rather, they would be used as incentives to the implementation of other measures. ❐

Options for Institutional Arrangements

To Facilitate Implementation Of Measures

Nearly all of the options for government actions require some form of arrangements between or among the many agencies and institutions that currently deal with water level issues.

For example, water level regulation plans -- or modifications to plans -- would require International Joint Commission approval, as well as agreement of the parties responsible for various aspects of the current lake level regulation process. A coordinated effort would also be required to ensure that their continued responsiveness to users' needs.

Land based measures might require legislation, bylaws, and coordinated planning among federal state/provincial and local governments.

Plans to respond to high or low water level crises would require coordination among various agencies as well.

Meanwhile, strategies to implement improved communications practices with the general public would also require a considerable amount of inter-agency cooperation.

Several options are presented for changes to the existing structure of International Joint Commission Boards. The object of these options is to allow improved communication among the boards, and increased responsiveness to the various interests. One means of improving responsiveness would be involving citizens as members of the boards. These options are presented to stimulate discussion and should not be viewed as the only options available. ❐

Full Details on Options Available from Contacts

If you would like to study in more detail the options that have been outlined here, get in touch with one of the contacts listed below. The complete, 75-page "Options Document" is available on request. ❐

Direct your comments and enquiries to:

In Canada:

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Levels Reference Study Board UPDATE is published periodically by the Public Participation and Information Working Committee (Working Committee 1) of the Levels Reference Study.

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Levels Reference Study Board
International Joint Commission
Issue 8

UPDATE

Final Report Transmitted To IJC

42 Recommendations For Actions On Water Levels

After 2 1/2 years of intense study activity and public involvement, the Levels Reference Study Board has presented its final report to the International Joint Commission.

If you have received this issue of UPDATE in the mail, you will also receive the final report, when it is ready for distribution some time in May. If you are not on the UPDATE mailing list, please request your copy of the report from one of the International Joint Commission offices listed on page 6.

"We have worked hard to develop 42 recommendations that we believe are practical and will serve the Great Lakes-St. Lawrence River System well into the future," said Tony Wagner, Canadian Co-chair of the Study Board.

"We hope these recommendations will be acted upon quickly -- particularly those dealing with emergency preparedness," added U.S. Board Co-chair John D'Aniello.

The report concludes that the installation costs of major engineering works to further regulate the levels and flows of the Great Lakes and St. Lawrence River would exceed the benefits provided . In addition, these works would have negative environmental impacts. Instead, the report recommends comprehensive and coordinated land use and shoreline management programs throughout the basin that would help reduce vulnerability to flood and erosion damages.

The report concludes that, regardless of whether lake levels and flows are regulated, damage to shoreline properties, public infrastructure and water dependent businesses will continue without land-based action to curb such damage.

Coordinated land use and shoreline management programs would have to be instituted at the local level, using decision processes that take into account the needs of those affected.

While the Study Board recognizes that it may be impossible to implement such programs uniformly throughout the basin, the recommendations aim at uniformity to the maximum extent possible. This would help ensure consistency in the application of these measures along the full length of the Great Lakes-St. Lawrence River shoreline. The Board recommends that Governments budget $10 to $20 million annually for these purposes. Suggested cost sharing is 1/3 federal, 1/3 state/provincial, and 1/3 local.

In addition to recommendations for long-term planning, the Study Board urges Governments to begin as soon as possible developing coordinated and comprehensive Emergency Preparedness Planning.

Two of the Great Lakes (Superior and Ontario) already have structures at their outlets that control outflows. The report recommends improvements to make the existing regulation plans more responsive to the current needs of the interests affected by them.

The report also recommends removal of some fills in the Niagara River, which over the years, have impeded the River's outflow and slightly raised the level of Lake Erie. The recommended removal of fills would lower Lake Erie's long-term average level by 0.03 to 0.06 meters (0.1 to 0.2 feet). Action is recommended to prevent future fills in the connecting channels that could have similar effects upon lake levels.

Management of problems associated with fluctuating water levels does not appear to be guided by clear or consistent policies among the many respnsible government agencies. The Study Board recommends all levels of government adopt principles to guide future decisions and enhance coordinated, system-wide management. The same principles were used to guide the study.

The final phase of the Levels Reference Study relied extensively on citizen input, through its 18-member Citizens Advisory Committee, citizen membership on its working committees, the openness of its proceedings, its newsletter, and through 17 public events around the Great Lakes-St. Lawrence River Basin in the final phase of the Study. This process convinced the Board that future resolution of water level issues will depend, not only upon coordination and cooperation, but upon the continued involvement of the people who are most directly affected.

The Board recommends establishment of a Great Lakes-St. Lawrence River Advisory Board, with citizen as well as agency representation, to advise the Commission and to coordinate responses to water levels issues. Another recommendation calls for increased citizen membership on the International Lake Superior and St. Lawrence River Boards of Control.

The study looked at both high and low water levels. The potential lowering effects of climate change on the Great Lakes and St. Lawrence River could be dramatic. The Board recommends that these possible effects be taken into account in future management of water levels and flows.

While this study succeeded in examining the engineering, economic, environmental and social issues implicit in Great Lakes-St. Lawrence River management, it identified areas in which data gathering efforts, information storage, interpretation and communication could be improved. A number of actions are recommended to update hydrologic and hydraulic models, improve forecasting and statistical methodologies, improve communication of water level and flow information, and improve data collection -- including monitoring of shoreline flooding and erosion and mapping of hazard areas. ❐

42 Recommendations for Action

Guiding Principles

1. The Board recommends that federal, state and provincial governments adopt the eleven Guiding Principles (below) and that these principles be used as guidelines for the management of issues related to water levels and flows within the Great Lakes-St. Lawrence River System.

1. Existing and future beneficial uses will be considered, and the fundamental character of the Great Lakes-St. Lawrence River System will not be adversely affected.
2. Actions approved or taken will be environmentally sustainable and respect the integrity of the Great Lakes-St. Lawrence River System ecosystem.
3. Actions approved or taken will be beneficial to the Great Lakes-St. Lawrence River System and not result in undue hardship to any particular group.
4. Coordinated management of the System needs to respect and accommodate the dynamic nature of the entire Great Lakes-St. Lawrence River System.
5. Reduction of damages to existing development from fluctuating water levels in the Great Lakes-St. Lawrence River System will be based on the use of both non-structural and structural measures at various locations throughout the Basin.
6. Prevention of damages to future development from fluctuating water levels in the Great Lakes-St. Lawrence River System will include the implementation of land use measures that will discourage construction in areas subject to damage from fluctuating water levels and storms.
7. Management of the Great Lakes-St. Lawrence River System will be done in full awareness of the potential for reduced water supply as a result of climate change.
8. Decision-making with respect to the management of the Great Lakes-St. Lawrence River System will be open, respecting the full range of interests affected by any decisions, and facilitating their participation in the policy process.
9. Management of the Great Lakes-St. Lawrence River System will be based on coordination of actions relating to levels and flows.
10. Management of the Great Lakes-St. Lawrence River System will be based on continued improvement in the collection of data and the understanding of the processes and impacts of fluctuating water levels and flows.
11. Management of the Great Lakes-St. Lawrence River System requires ongoing communications and public awareness.

Measures - Lake Level Regulation

2. The Board recommends that Governments give no further consideration to five-lake regulation.

3. The Board recommends that Governments give no further consideration to three-lake regulation.

4. The Board recommends that the regulation plans of Lakes Superior and Ontario be modified to achieve water levels and flows similar to those described in Measure 1.21 (in the Final Report).

5. The Board recommends that the Orders of Approval for the Regulation of Lake Superior be reviewed to determine if the current criteria are consistent with the current uses and needs of the users and interests of the System.

6. The Board recommends that the International Lake Superior Board of Control be authorized to use its discretion in regulating the outflows from Lake Superior subject to conditions similar to those which authorize discretionary action by the International St. Lawrence River Board of Control.

7. The Board recommends that the criteria of the Orders of approval for the Regulation of Lake Ontario be revised to better reflect the current needs of the users and interests of the System. In particular, the Board recommends that Criterion (d) of these orders be amended as follows:

Criterion (d): The regulated outflow from Lake Ontario during the annual flood discharge from the Ottawa River shall not be greater than would have occurred assuming supplies from the past as adjusted. *When Lake Ontario levels and supply allow, consideration should be given to reducing outflows from Lake Ontario during the annual flood discharge from the Ottawa River.*

8. The Board recommends that the Orders of Approval for the Regulation of Lake Ontario be modified by adding the following criteria:

Criterion ( ): Consistent with other requirements, the outflows of Lake Ontario shall be regulated to minimize the occurrence of low water levels on Lake Ontario and the St. Lawrence River downstream as far as Trois Rivires during the recreational boating season.

Criteria that take into consideration the environmental interest on Lake Ontario and the St. Lawrence River downstream as far as Trois Rivires.

9. The Board recommends the initiation of negotiations for the purpose of removing fills upstream of the International Rail-

way Bridge on the Niagara River and lowering the mean level of Lake Erie by 0.03 to 0.06 metre (0.1 to 0.2 foot).

10. The Board further recommends that first priority for fill removal be Nicholl's Marine.

Measures - Land Use and Shoreline Management

11. The Board recommends that any comprehensive approach to management of the adverse impacts of fluctuating water levels and flows should be multi-objective in focus and coordinated in application.

12. The Board recommends that consideration be given to the establishment of multi-level government funding of $10 to $20 million per year, for planning and implementing land use and shoreline management projects.

13. The Board recommends that areas requiring land use and shoreline management measures be prioritized through a comprehensive shoreline management program in developed and undeveloped areas.

14. The Board recommends that consideration be given to implementing remedial measures when appropriate to the local conditions. The following measures are recommended for implementation, as appropriate:

- Relocation of structures from hazard areas.
- Flood proofing of existing structures.
- Non-structural shore protection.
- Structural shore protection, where other alternatives are not appropriate, only if well designed and engineered, and only if impacts are not shifted to adjacent areas.

15. The Board recommends that the following preventive land use and shoreline management measures be implemented and applied consistently and uniformly around the Great Lakes and St. Lawrence River:

- Erosion setbacks that include minimum requirements for a 30 years erosion zone for movable structures and a 60 to 100 year erosion zone for permanent structures plus an adequate distance to assure a stable slope. A provision for variance should be provided for areas where the slope has been, or is proposed to be, stabilized by a well engineered structure.
- Flood setbacks and elevation requirements that include minimum requirements for a 1% flood risk line plus allowance for wave uprush and freeboard.
- Shoreline alteration requirements established in the context of a comprehensive plan. The environmental and updrift and downdrift impacts of shoreline alterations must be considered, along with hydraulic impacts on the connecting channels.
- Regulations in Canada to control fills and other obstructions in connecting channels. The most effective means of achieving this would be through amendment of the International Rivers Improvement Act.
- Real estate disclosure requirements within which the seller should be required to disclose to prospective buyers that the property is within a mapped or known flood or erosion hazard area.
- The buyer should sign an acknowledgment that he or she has been informed of the risk.

16. The Board recommends that acquisition of undeveloped and developed land and habitat protection areas be considered in areas where it is appropriate.

17. The Board recommends that where hazard insurance exists or is implemented in the future that the following elements be included.

- A hazard insurance program should use historic shoreline change methods coupled with recession rate studies to identify and map long term erosion hazards on Flood Insurance Rate Maps.
- A hazard insurance program should encourage community-based erosion management by establishing setbacks for new construction.
- The program should deny subsidized flood insurance for new or substantially improved construction within the erosion hazard zone and should require that any structure substantially damaged during a storm be reconstructed landward of the hazard zone. The program should also deny subsidized insurance for recurring claims.
- A hazard insurance program should provide eligibility for mitigation assistance when the aggregate of damage claims exceed 50% of the fair market value of the insured property and provide mitigation assistance for structures imminently threatened by erosion with an emphasis on relocation of structures out of the hazard area, not demolition.

Emergency Preparedness

18. The Board recommends that the two federal governments, in cooperation with provincial and state governments, begin preparation of a joint and cooperative Emergency Operations Plan for the Great Lakes-St. Lawrence River as soon as possible.

19. The Board recommends as a priority that investigations continue into methods of alleviating high or low water crises on the lower St. Lawrence River; and, further, that investigations continue into avoiding increased damages as a result of crisis actions taken upstream.

20. The Board further recommends that the following be implemented in the near future:

- The authority necessary for deviation from the Lake Superior and Lake Ontario Regulation plans during an emergency.
- The installation of an ice boom at the head of the St. Clair River to reduce the risk of ice jams and flooding.
- An increase in the flow capacity of the Black Rock Lock, such that the flow through the lock may be increased in emergency situations by an additional 340 cms (12,000 cfs).
- The manipulation of the four major Great Lakes diversions, Long Lac, Ogoki, Lake Michigan at Chicago, and the Welland Canal, during crisis situations when conditions permit.

21. Further, the Board recommends that prior to the implementation of the manipulations, the potential impacts within and outside the Great Lakes-St. Lawrence River System of changes to the Long Lac, Ogoki and Lake Michigan at Chicago Diversions be determined.

22. The Board recommends post crises action reports to evaluate the effectiveness of emergency preparedness plans and to recommend areas for improvement.

23. The Board recommends that comprehensive emergency preparedness planning be undertaken immediately at the provincial, state and local government levels. The preparations should include public information programs, stockpiling of emergency materials, active monitoring of water levels and flows, and identification of areas where community-based shore protection can be implemented immediately.

Institutions

24. The Board recommends that the membership of the Lake Superior Board of Control be expanded to include representation from citizens, the states and provinces.

25. The Board recommends that the membership of the International St. Lawrence River Board of Control be expanded to include citizen representation from Lake Ontario, the upper St. Lawrence River and the lower St. Lawrence River.

26. The Board recommends that the functions of the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data be formalized and that the Committee report to the Commission.

27. The Board recommends that a Great Lakes-St. Lawrence River Advisory Board be created to coordinate, review, and provide assistance to the Commission on, issues relating to the water levels and flows of the Great Lakes and St. Lawrence River.

Communications

28. The Board recommends that a Great Lakes-St. Lawrence Water Level Communications Clearinghouse be established as a bi-national effort by the United States and Canadian Governments, with the responsibility to communicate with the public, to facilitate communication between the public and governments, and to facilitate coordination of agency communication activities related to the water levels and flows of the Great Lakes and St. Lawrence River.

29. The Board recommends that the Clearinghouse be established under major federal agencies such as Environment Canada and the U.S. Army Corps of Engineers, which currently carry the main responsibilities in this area; and that it be linked to larger units within these agencies that can act as information resources and provide staff support in water level crisis periods.

30. The Board recommends that the Clearinghouse establish and coordinate a network of agencies and groups that communicate about water level issues.

Management and Operational Improvements

31. The Board recommends that action be taken to improve the information base used to manage the Great Lakes-St. Lawrence River resource in the following ways:

- That the identified deficiencies in the precipitation and snowpack network be remedied.
- That a risk analysis model be developed that takes into account the uncertainties of water supply to Lake Ontario, storm surge on Lake Ontario, variations of tributary inflows to the St. Lawrence River downstream of Cornwall and updated stage-damage data in the Lake Ontario-St. Lawrence River system to assist in equitably managing outflows during high- and low-water supply periods. If discretionary authority is provided to the Lake Superior Board of Control, as recommended elsewhere in this report, this model should be implemented for Lake Superior as well.
- That efforts be made to improve long-range precipitation and temperature forecasts.
- That new technologies such as satellite, airborne and ground-based radar be developed for use in the monitoring of lake evaporation, overlake precipitation and basin-wide snow conditions.
- That work continue on upgrading models used for simulation, forecasting and regulation to formulate a comprehensive water supply and routing model that includes the whole basin through Trois Rivires, Quebec.
- That efforts continue to improve the forecasting and statistical information that all users throughout the system can utilize to make decisions and that this be coupled with upgraded system-wide supply and routing model.
- That the efforts referenced in Chapter 8 to improve communication be implemented.

32. The Board recommends that efforts be initiated to standardize hazard mapping methodologies across the Great Lakes-St. Lawrence River region and that efforts continue in identifying and mapping all flood and erosion hazard areas in the system.

33. The Board further recommends that procedures be developed for allowing broad access to such maps for general use.

34. The Board recommends that long term monitoring of shoreline erosion and bluff recession be undertaken and that future erosion damage assessments consider or be based on information and methodologies developed under this study to improve these approaches.

35. The Board recommends that the U.S. and Canadian land use mapping systems be updated on a periodic basis and that they be designed and developed in cooperation to promote uniformity.

36. The Board recommends that a potential damage sample survey should be undertaken in the future to improve flood damage estimates.

37. The Board further recommends that the first priority for the potential damage sample survey be Lake Ontario and the St. Lawrence River.

38. The Board recommends that a comprehensive wetlands inventory be completed and that long term assessments of the effects on wetlands of variations in levels and flows be continued.

39. The Board recommends that refinement of Global Climate Models be continued to improve their predictive capability and use as a planning tool.

40. The Board further recommends that efforts continue to develop a bi-national assessment of the potential impacts on the

Great Lakes-St. Lawrence River Basin System and to coordinate a response to the expected climate changes.

41. The Board recommends that the following data elements be incorporated into Geographic Information System databases:

- All land use information for the entire shoreline.
- All hazard areas along the Great Lakes-St. Lawrence R.
- All coastal wetlands.

42. The Board further recommends that cooperative bi-national coordination and planning of Geographic Information System development and use be considered to increase the usability of the information stored in Geographic Information Systems relating to the Great Lakes St. Lawrence River System, and that national and international standards for data transfer be established. ❐

Thank You For Your Interest In The Water Levels Study

In its 2 1/2 years of investigations, the Levels Reference Study Board visited 17 Great Lakes-St. Lawrence River communities to learn first-hand about local issues.

Eight of these communities hosted public forums during which the Study Board heard citizens' opinions about the recommendations that it was considering for inclusion in its final report.

The last four public forums discussed a draft of the final report. They were held from February 22 to 25 in Sault Ste. Marie, Ontario; Chicago, Illinois; Buffalo, New York; and Dorval Quebec. More than 350 people attended the forums, with the largest turnout -- 140 -- in Buffalo. Reactions to the Board's draft report ranged from anger at the recommendations against additional regulation of the Great Lakes and St. Lawrence River to support for the recommendations, and for the land use and shoreline management measures also recommended.

In addition to comments at the forums, the Study Board received 249 letters commenting on the draft final report. Ninety-five per cent of these letters were from people who live in the U.S. Five per cent were from Canadians.

Most of these letters came from the Great Lakes states, and some came from Ontario. Others came from locations outside the basin, such as Saskatchewan, Florida, Texas and California.

Of the total figure, 78% (193 letters) supported the Study recommendations. These respondents supported land use and shoreline management measures, especially erosion setbacks and flood elevation requirements, real estate disclosure and shoreline acquisition, as the most appropriate way to deal with property damages associated with fluctuating water levels.

This group firmly opposed any further regulation of Great Lakes-St. Lawrence River water levels through dredging and construction of control works. Reasons given for these views were: concerns about possible adverse effects on wetlands, wildlife and water quality; the high cost of such works; and the relatively small reductions in flooding and erosion damages that would result from them.

Twelve per cent (31) of the letters opposed the draft recommendations. This group consisted of shoreline property owners from the Great Lakes states and Ontario, one congressman from Wisconsin and two members of the Pennsylvania legislature.

The position of the 31 respondents was consistent with that of the International Great Lakes Coalition, which favors installation of control works in the Niagara River. These writers maintained that the impact analysis conducted by the Study was flawed; that the benefits to shoreline property were understated in the benefit-cost analysis; and that the costs of mitigation works in the St. Lawrence River could be avoided by refinement of the plan. They also questioned the validity of the environmental studies.

A third group of writers (14 or 5%) expressed concerns about the levels of Lake Superior or Lake Ontario as follows: "Lower Lake Superior" (9); "Do not lower Lake Superior" (1); "Lower Lake Ontario" (2); "Raise Lake Ontario" (2). ❐

Common Questions Raised At Forums

Following are some of the key questions raised at the forums, together with the Study Board's responses.

Q: Which of the recommendations will provide relief to shoreline property owners?

A: Recommendations for emergency preparedness plans will help provide relief from extremely high or low lake levels. The Board recognizes that levels are currently near crisis levels on Lakes Erie and Ontario and recommends quick action to implement long-term planning for, and coordination of, such plans. Meanwhile, many shoreline communities already have their own plans in place to respond to emergencies.

For the long term, the Board recommends comprehensive and coordinated land use and shoreline management measures that will help reduce shoreline owners' vulnerability to fluctuating water levels. Improvements in communication with the public are also recommended in order to ensure that citizens have as much information as possible to make decisions about their shoreline property.

Q: Wouldn't the implementation of three-lake (Superior, Erie and Ontario) regulation eliminate, or significantly reduce, flooding and erosion on Lakes Michigan-Huron and Erie?

A: Three-lake regulation would not eliminate flooding and erosion, but it would reduce it somewhat on Lakes Michigan-Huron and Erie. In most cases, the costs of shore protection could be reduced, since the extent of required protection would not be as great as it would have been without three-lake regulation. However, investigations in this study have shown that, in most cases, shoreline erosion occurs regardless of the range of water level fluctuations. Further, the most severe flooding and erosion occurs as a result of wind-induced rises in water levels, rather than as a result of increases in the long-term stillwater levels.

Q: The estimated cost of dredging and installation of control works in the Niagara River for three-lake regulation is $528 million; but, the estimated additional cost of mitigation works in the St. Lawrence River would be $2.85 billion. Why do these costs seem out of proportion, and why is the $2.85 billion required?

A: The addition of a control structure in the Niagara River would mean that flows into Lake Ontario would sometimes be increased to provide relief from high levels on the upstream lakes. This additional water would, then, have to be passed out of Lake

Ontario, which would necessitate increased flows through the St. Lawrence River.

Because the St. Lawrence River below Montreal is very flat, even modest changes in the River's flow would necessitate major works to prevent flooding from increased flows. Although modifications could be made to the three-lake plan that would reduce the need for mitigation works in the St. Lawrence River, these modifications would reduce the benefits of the plan to riparians on Lakes Michigan-Huron and Erie.

Q: How were the benefit-cost ratios for three-lake regulation developed?

A: The reduction in damages to shoreline property that would result from implementation of three-lake regulation was compared to the amount of shoreline damages that could be expected to occur without such regulation. The difference between the two figures represented the potential benefits to riparians of three-lake regulation. In addition, the potential losses or gains to hydropower production, commercial navigation and recreational boating were calculated. This information was translated into annual costs or benefits and compared to the annual costs of a three-lake regulation plan. The costs of the plan were divided into its benefits (For riparians, these were estimated at two levels: most likely, and maximum possible.) to obtain a benefit-cost ratio of between 0.07 and 0.14. Neither ratio approaches the ratio of 1.0, which would indicate that the benefits of the plan would equal its costs.

Q: Won't the recommended land use and shoreline management measures infringe upon individual property rights?

A: The measures recommended for comprehensive and coordinated implementation are already in place to varying degrees throughout the basin. Implementation of setback or elevation requirements would be based on estimates of flood and erosion potential that were developed cooperatively by federal, state/provincial and local governments in an open process. Compliance would reduce the potential for damages and could lead to increases in the future value of the property. Acquisition of developed or undeveloped land is recommended only where appropriate, and on a willing buyer/willing seller basis wherever possible. Requirements to disclose flood or erosion hazards in real estate transactions would protect prospective buyers. ❐

IJC To Evaluate Study Before Passing It On

The final report of the Levels Reference Study Board is now in the hands of the International Joint Commission.

The Commission was asked by the Governments of the United States and Canada to, "examine and report upon methods of alleviating the adverse consequences of fluctuating water levels." The Commission appointed the Study Board to carry out the study on its behalf. The Commission will now evaluate the results before making its own recommendations to Governments.

Once the annexes to the main report have been printed, they will also be forwarded to the Commission. These annexes are supported by numerous task group and contractors' reports that will be kept on file. A complete bibliography of these reports is in the final report.

This is the last issue of **UPDATE**. Further information on the Study will be contained in the Commission's newsletter, **FOCUS**. The next issue is planned for July/August. To get on the mailing list for this newsletter, or for information on follow-up actions to the Study Board's report, please contact the International Joint Commission:

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