Adaptive Management for the Lake Ontario–St. Lawrence River System

Adaptive management is a key feature the International Joint Commission (the Commission) is proposing in its plan for regulating water levels and flows in Lake Ontario and the St. Lawrence River. This background paper explains the concept of adaptive management and how it would be used in the Lake Ontario–St. Lawrence River system, regardless of what Order of Approval and regulation plan are finally put into place.

What Is Adaptive Management?

Adaptive management is a formal process for continually improving policy and practices to help ensure that their objectives are reached, even while conditions change over time.

As part of the Lake Ontario–St. Lawrence River plan, adaptive management means regular assessments to determine whether the anticipated outcomes and benefits, as predicted in scenarios or models of what would happen in particular situations, have been realized and, if not, what needs to be done to achieve these outcomes and benefits. In practice, this requires monitoring the physical and ecological integrity of the Lake Ontario–St. Lawrence River system to identify both the ongoing impacts of flow regulation and the changes or corrections, if any, that are needed. It is for this reason that adaptive management is often described as "learning by doing."

Lake Ontario and the St. Lawrence River do not exist in a vacuum. The environmental conditions that affect them—such as climate change and other factors—are continually evolving over time. This is also true about various socioeconomic interests, such as recreational boating and commercial shipping, and the impacts of urbanization and population growth. In this context, adaptive management is a practical strategy to ensure that the plan for regulating the Lake Ontario–St. Lawrence River system is always timely and relevant.

Origins of the Concept

Adaptive management for environmental applications was first conceived in the late 1960s and has developed further since then. It is now used around the world.

In 2006, the International Lake Ontario–St. Lawrence River Study Board recommended in its final report that the Commission make adaptive management part of its proposed plan for regulating the Lake Ontario–St. Lawrence River system. The Study Board, an independent group of Canadian and U.S. scientists established by the Commission, had spent five years studying the system and consulting with the public through its Public

Interest Advisor Group. The study identified a number of areas of uncertainty that, in the Study Board's view, could best be addressed through adaptive management.

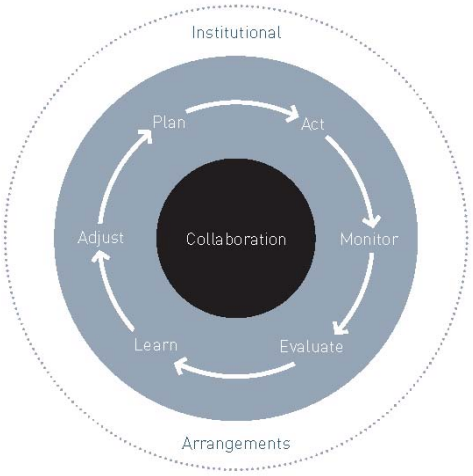
At the Commission's request, the Study Board's methodologies and recommendations were subsequently reviewed by two prestigious organizations—the National Academy of Sciences in the United States and the Royal Society of Canada. These organizations also recommended adaptive management, as did a number of other groups, including the Lake Ontario Lakewide Management Plan (which operates under the Canada–United States Great Lakes Water Quality Agreement), the Conservation Authorities of Ontario, and the Nature Conservancy in the United States.

Ideas about how adaptive management could be applied to the Lake Ontario–St. Lawrence River system were then developed in a series of workshops in Washington, D.C., Cornwall, Ontario, and Montreal, Quebec, over the next two years. Adaptive management experts from various locations, such as the Florida Everglades and Glen Canyon Dam in Arizona, took part in these events. All participants agreed that monitoring key aspects of the Lake Ontario–St. Lawrence River system over time was essential and that the Commission should initiate development of an adaptive management plan in collaboration with all levels of government and interested organizations in both countries.

How Would Adaptive Management Work?

The goal of an adaptive management program for the Lake Ontario–St. Lawrence River system is to provide monitoring data, scientific information, and analysis that will help improve water level regulation and flow.

The key components of the proposed adaptive management program shown in the diagram are described below in further detail:



Plan – On behalf of the Commission, the Lake Ontario–St. Lawrence River Study Board examined the environmental and economic benefits and impacts of regulation, and consulted widely with the public. The Study Board developed three options for regulating water levels in Lake Ontario and the St. Lawrence River. Subsequent work by the Commission led it to propose a new plan, known as Plan 2007, which includes adaptive management.

Act/Implement – The current regulation plan operates under an Order of Approval implemented by the Commission's International St. Lawrence River Board of Control. The Commission's goal is to sign a new Order of Approval by the end of December 2008 and put in place a new water level and flow regulation plan as soon as possible after that. The Commission will restructure the existing Board of Control and charge it with refining and finalizing the adaptive management plan for approval within nine months from the date the new order goes into effect.

Monitor and Evaluate – As part of adaptive management, data about key performance indicators will be used to monitor and assess how the Lake Ontario–St. Lawrence River system is behaving, and to identify any changes that may be required in the regulation plan. Sixteen performance indicators were tentatively selected in the aforementioned workshops, ranging from shoreline erosion and habitat conditions through flooding and populations of fish and wildlife. Through its new Board, the International Lake Ontario–St. Lawrence River Board, the Commission will also consider other new scientific information as it becomes available, even if it has not been identified as a key indicator. In some cases, it may take decades to demonstrate potential cause-and-effect relationships associated with flow regulation because some impacts take a long time to occur and others only occur during rare high or low water levels. The new Board will make monitoring reports at annual public meetings and obtain stakeholder input at that time.

Collaborative Group Learning – Collaboration is an important element because effective public involvement is critical to the success of adaptive management. In addition to the annual public meetings, where experts, stakeholders, and members of the public can provide input, workshops will be held every five years to refine the adaptive management program.

Adjust – The Commission will review the results of regulation under the order to assess the extent to which the results predicted by models have occurred. These reviews will take place when necessary, as determined by the outcome of monitoring and evaluation, but no less often than 15 years after the effective date of the new order. Consistent with Commission procedures, public hearings would be part of the reviews. Based on the findings, the Commission could further refine the models or specific regulation rules in order to reflect improved understanding. Such findings could also result in the Commission considering the adoption of a new regulation plan.

Making Adaptive Management Work

The Commission intends that its revamped International Lake Ontario–St. Lawrence River Board will establish a Monitoring and Adaptive Management Committee (MAMC). MAMC will be comprised of six to 12 water resources policy makers or managers drawn from governmental and nongovernmental organizations—with equal representation from both countries—who would collaborate to provide the data and scientific information required for adaptive management.

Specifically, MAMC will provide communication between the public and the new Board on the subject of adaptive management (through forums and other means). It will also make recommendations to the Board for revising the adaptive management program every five years. These recommendations could include proposals to adjust the monitoring protocols, the models, or the regulation plan; they could even propose implementing a new plan altogether.

The new Board will consider such recommendations and determine whether they should be submitted to the Commission for its consideration, possibly after modification. In addition, MAMC will report on monitoring activities and results at the Board's annual public meetings, receive public input, and develop material for the Board's reports to the Commission.

MAMC will include an Adaptive Management Monitoring Group (AMMG) comprised of technical and scientific experts from governmental and nongovernmental organizations, with equal representation from both countries. The role of AMMG will be to oversee or conduct monitoring, assessment, and model refinement, and to interpret monitoring results and help adjust the adaptive management program every five years. AMMG will also develop the information to be considered by MAMC and the Board in making recommendations to the Commission. AMMG will be led by the MAMC co-chairs.

The Commission will appoint two individuals, one from each country, to provide an independent review of the adaptive management program. The duties of these advisors will include providing advice to the MAMC co-chairs on all aspects of adaptive management, including the five-year review cycle, as well as on which private contractors to engage for monitoring, assessment, and other functions. They will also report to the Commission, as part of the Board's semiannual reporting or as otherwise requested, when the adaptive management program is being finalized or revised. To enhance their effectiveness, the advisors will be independent of the Board, MAMC, and AMMG.

Projected Costs and Funding

The Commission has undertaken a preliminary assessment of the resources that will be required to support an appropriate adaptive management program, but additional work needs to be done. Table 1 outlines the key performance indicators and the expenditures

required to operate the adaptive management program. It is estimated that the annual cost of monitoring and assessing the key performance indicators and refining models will be approximately U.S. $485,000. Thus, the average estimated budget for the first five years is just under U.S. $2.5 million, including U.S. $25,000 to manage the project and U.S. $250,000 for communications and public engagement. The proposed monitoring could be significantly enhanced through the use of existing or planned monitoring for other purposes at relatively small additional cost.

Some government departments and agencies already carry out monitoring programs that could be realigned to support adaptive management. Accordingly, actual costs can only be determined after further consultation with those organizations. While an adaptive management plan will incur higher costs for regulating the Lake Ontario–St. Lawrence River system in the near-term than is now the case, long-term costs are likely to be reduced because new knowledge gained from monitoring and analysis would be incorporated into regulation plans and would reduce uncertainties.

The Commission itself is not funded to conduct monitoring activities. Therefore, an adaptive management program will require financial support from federal, state, and provincial governments, and possibly from some of the various sectors with interests that are affected by water levels and flows. For this reason, the Commission is seeking long-term commitments from governments and nongovernmental organizations in both countries that have an interest in shorelines, water levels, ecosystems, and other aspects of Lake Ontario and the St. Lawrence River, and which would benefit from an adaptive management program for the system. Their support should be both financial and in-kind—that is, the provision of monitoring data, scientific information, and analysis so essential to adaptive management.

The governments of Canada and the United States have indicated their strong support for monitoring and adaptive management as ongoing activities connected with future water level and flow regulation, and will actively participate in the further development of an adaptive management plan for implementation.

Managing the Lake Ontario–St. Lawrence River system is a responsibility shared by all interests and stakeholders. The Commission, therefore, calls on them to participate meaningfully in adaptive management for better regulation of the system. The success of an adaptive management program will depend largely on actual commitments from stakeholders to collaborate and provide or redirect resources for this purpose.

Table 1 – Preliminary Lake Ontario-St. Lawrence River (LOSLR) Environmental and Coastal Processes Performance Indicators (PI) Summary-5 Year Costs		
Key PIs	**General Location Description**	**Approximate 5 yr Costs (Monitoring/ Modeling) US $1000**
Key PIs		
Wetland Meadow Marsh Surface Area	Lake Ontario and Upper River	240-595/5
Shoreline Protection Structure Maintenance (SPSM)	Lake Ontario & Upper River	60-200/5-40
Shoreline Structure Elevation and Integrity	Lake Ontario & Upper River	65 (2-3 month effort)/NA
Net Basin Supply Hydrologic Forecasting	Lake Ontario, Upper & Lower River	NA/75-185
Muskrat House Density	Upper River, drowned river mouth wetlands only	301/NA
Virginia Rail Reproductive Index	Lake Ontario, Upper & Lower River	250/NA
Wetland Prairie and Shallow Marsh Area	Lower River	300/150
Shoreline Erosion	Lake Ontario & Upper River	Included in SPSM costs above
Building Flooding	Lake, Lower & Upper River	Included in SPSM costs above
Eastern Sand Darter Reproductive Area	Lower River	NA/40
Northern Pike Habitat & Recruitment in Spring	Lower River in Spring	NA/40
Yellow perch in Spring	Lower River in Spring	NA/40
Golden Shiner habitat in Late Summer	Lower River	NA/40
Copper horse	Lower River	NA/40
Wetland Shorebirds (L. bittern, B. Tern, Y. Rail, K. Rail)	Lake Ontario, Upper & Lower River	100/NA
Muskrat winter houses survival	Lower River	80/NA
Adaptive Management Communications Cost		250
Project Management for 5 years		25
Grand Total Costs (average) all key PIs for 5 year period		**$2421**