

Practitioner's Commentary: The Great Lakes Problem

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Introduction

My remarks are based on the materials made available to me to review, as well as on my background and experience with the topic, which is detailed at the end of the remarks. I have reviewed the problem statement and its addendum of additional background information, as well as one of the Outstanding papers (Team 2429211, from Harvey Mudd College).

First, I believe it is proper and important that the management of the water levels, especially in the St. Lawrence River–Lake Ontario portion of the Great Lakes, be based on the best scientific modeling and technical management techniques. In fact, my Ph.D. thesis from 1977 was an attempt along these lines intended to improve upon the practices used at that time.

However, to do so requires the ability to accurately and adequately factor into the analysis many complex, and some not-well-understood, processes. In addition, as I discovered early on in my involvement with the issue, political realities will and do override even the most-rational and well-documented technical data and modeling results. I will point out only one or two examples of each of these with respect to the problem as stated and the one Outstanding paper solution that I reviewed. Rest assured, however, that there are many more.

In terms of complexities and accuracy of processes and effects, I will call out the treatment of the environmental factors involved and the assumptions regarding impacts and desires of the shipping industry.

Plan 2014

Plan 2014 by the International Joint Commission (IJC) [2014] was designed for regulating Lake Ontario–St. Lawrence River water levels and flows. Its development was spurred in no small part by years of criticism by environmental advocates and agencies that

- the water level of Lake Ontario was too tightly controlled, and
- more variability, not only annually but over the long term, was required to sustain the health and vitality of the Lake and St. Lawrence River ecosystems, especially the adjacent wetland communities.

However, when it came time to quantify the relation of these factors to water levels, it was found that

- the environmental impacts were nonlinear with water levels and depended upon the sequence of levels over multiple seasons, and
- the impacts on many species were overlapping, with both intended and unintended consequences, depending on which species was of interest.

“Natural water level regime” became a mantra that could not actually be defined, let alone achieved. In addition, the impacts to the St. Lawrence River ecosystems, especially downstream of the control dam, were sometimes contradictory to those in Lake Ontario under the same control actions.

The Shipping Industry

The impacts to, and desires of, the shipping industry are much more complex than those briefly stated in the problem statement. Shipping companies for the system can be broadly divided into

- **ocean-going vessels** accessing only as far as Montreal Harbor: Such vessels desire relatively high water levels through the shipping season, necessitating adequate releases of water from Lake Ontario while avoiding excessively-high water levels. The result is the need to set high outflow rates in the fall and low flow rates in the spring from the Lake, due many times to the contribution from the Ottawa River, which can heavily influence Montreal Harbor water levels.
- **lake carriers** that move through the St. Lawrence Seaway and the remainder of the Great Lakes: Lake carriers additionally require limits, both high and low, on the river flow rate, to maintain critical depths within the Seaway system but not allow flow rates so high that ships lose control in tight sections.

This categorization is necessary to understand, since the shipping industry is quite important, both economically and politically, especially in Canada and even more so in Montreal. This fact leads to my second point, regarding political realities in managing the system. Examples follow.

Political Realities

When faced with high water level on Lake Ontario, it is desirable to release high flows from it so as to avoid or minimize flooding and erosion damages to shoreline communities.

However, these high flow rates, especially in the critical early spring period, can curtail or block completely the shipping of goods on the St. Lawrence Seaway. The shipping industry, with its political connections, its unified voice through trade organizations, and its access to economic impact data, can and does put significant pressure on the IJC to avoid any curtailment of shipping.

By contrast, the shoreline communities are spread through many diffuse constituencies and they cannot exert the same influence. Thus, actual trade-offs among consequences are many times not adequately brought to the table when decisions are made. This can occur with both shipping and with the power-generation industries and their influence on the system management.

These realities are impossible to encompass in an optimization algorithm.

Politics Is Critical

In the Outstanding paper that I reviewed, the technical work was well done, but a politically critical aspect was ignored. The water levels and water level fluctuations of Lakes Michigan and Huron are a controversial topic in and of themselves. The operation of the control at the outlet of Lake Superior is based almost entirely on the balancing of impacts to Lake Michigan-Huron and Lake Superior, the shipping on the connecting channel, and power production, with no regard to impacts occurring much later, and with no assurance of what actually materializes to Lake Ontario. In fact, the modeling presented in the Outstanding paper showed extreme fluctuations in the level of Lakes Michigan-Huron, which would cause much harm and resulting public outrage not only there but in Lake Erie as well, due to the resulting fluctuations in the Detroit River flows. It must be remembered that the states of Michigan and Ohio, which border Lake Erie, are politically important in the U.S. Their interests cannot be simply ignored.

Conclusion

I hope these examples will shed some light on the realities and complexities of managing the Great Lakes water levels. I believe that the work done on this problem by the Outstanding teams is laudable, but expectations of it being useful may not be justified, given the points that I raised above and many others that I left out for brevity.

My Background and Experience with This Issue

My experience with this issue goes back to the research and preparation of my Ph.D. thesis in 1977, which suggested an improved method for forecasting the Lake Ontario water level so that better control of levels could be achieved. The research continued after that under a grant from the National Oceanic and Atmospheric Agency (NOAA). I served from 1995 to 2018 on the International St. Lawrence River Board of Control (later renamed the International Lake Ontario–St. Lawrence River Board), which had the responsibility of determining the weekly outflows from Lake Ontario in compliance with IJC guidelines.

I was one of two members (one from the U.S. and one from Canada) of that control board to serve from 2000 to 2006 on the International Lake Ontario–St. Lawrence River Study Board. After the six years of work, the Study Board recommended three potential new plans for regulating Lake Ontario outflows. The three plans consisted of one to maximize environmental benefits, one to maximize economic benefits, and one that was termed “balanced.” After years of intense lobbying by environmental groups and agencies, the IJC in December 2016 adopted a more radical version of the environmental plan and renamed it Plan 2014. It was hurriedly adopted by the IJC immediately after the 2016 U.S. election, which gave the White House and, hence the IJC appointments from the U.S., to a different political party. This changeability again demonstrates my point regarding the political aspects of this technical problem.

References

- International Joint Commission. 2014. Lake Ontario–St. Lawrence River Plan 2014: Protecting against extreme water levels, restoring wetlands and preparing for climate change. https://ijc.org/sites/default/files/IJC_LOSR_EN_Web.pdf.

About the Author

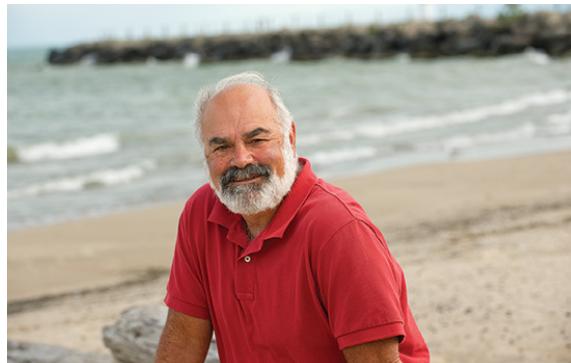


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