Study on Flooding in Lake Champlain and the Richelieu River

Pierre Béland, Canadian Chair, International Joint Commission (IJC)

Jean François Cantin, Canadian Study Co-Chair, International Lake Champlain-Richelieu River (LCRR) Study Board

May 20, 2020
• Study Objectives
• Flooding in the Region
• LCRR Study Methodology
• Mitigation Measures Selection Criteria
• Importance of the Saint-Jean Shoal
• Possible Structural and Non-Structural Alternatives
• Consultations in Quebec
• Key Messages
• Q&As
Study Objectives

- Determine the causes and impact of Lake Champlain and Richelieu River flooding
- Propose acceptable, viable structural and non-structural mitigation solutions for a range of expected water inflows under various climate conditions
- Develop and make recommendations for implementing a system to forecast floods and to map flood zones in real time
### Causes of 2011 Flooding

- Heavy rains, large snow pack, sudden thaw, etc.
- Urban development, expansion of impermeable surface areas, conversion of wetlands to other uses, building of transport infrastructure in and along rivers, etc.

### Chain of Events

<table>
<thead>
<tr>
<th>Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter 2011</td>
<td>Second snowiest winter in the mountains</td>
</tr>
<tr>
<td>April 2011</td>
<td>Record snowfall of more than 200 mm – triple the norm</td>
</tr>
<tr>
<td></td>
<td>Nothing unusual at present; minor flood threshold reached</td>
</tr>
<tr>
<td>Late April - early May</td>
<td>Sudden rise in temperatures, very heavy rainfall, and rapid snow melt causing high water inflows and major flooding</td>
</tr>
<tr>
<td>May 2011</td>
<td>A record 125 to 255 mm, 180-280 mm in the mountains</td>
</tr>
<tr>
<td>Spring 2011</td>
<td>A record of more than 510 mm in Burlington, VT</td>
</tr>
</tbody>
</table>
Extent of 2011 Flooding at St-Jean-sur-Richelieu

80% of the damage was in Canada, most of it in Saint-Jean-sur-Richelieu.
• The LCRR basin has a long history of flooding.

• The 2011 flood event was the worst and longest on record.
• The study explores a wide range of flood mitigation solutions.
• The initial focus was on Theme 1.
• A basin-wide analysis is underway for Theme 2.
• Expert workshops are currently exploring solutions for themes 3 and 4.
• Recommendations will combine measures associated with the four themes.

Goal 1: Reduce High Water Levels and Thereby Flooding Impacts (Moderate Structural Solutions)
- Theme 1: reduce water levels
- Theme 2: impede flows

Goal 2: Reduce Vulnerability to High Water and Build Flood Resiliency (Non-Structural Solutions)
- Theme 3: flood response
- Theme 4: floodplain management
## Mitigation Measures Selection Criteria

<table>
<thead>
<tr>
<th>#</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Included in the study’s scope and mandate</td>
</tr>
<tr>
<td>2</td>
<td>Achievable/feasible</td>
</tr>
<tr>
<td>3</td>
<td>Technically viable</td>
</tr>
<tr>
<td>4</td>
<td>Economically viable</td>
</tr>
<tr>
<td>5</td>
<td>Fair and equitable</td>
</tr>
<tr>
<td>6</td>
<td>Environmental issues</td>
</tr>
<tr>
<td>7</td>
<td>Climate change resilience</td>
</tr>
</tbody>
</table>
The Saint-Jean Shoal is the hydraulic control for Lake Champlain and the upper Richelieu River and “naturally” regulates water levels upstream.
Human activity has affected water flow and levels:

- Eel traps (1850)
- Submerged dykes for old mills (1860)
- Man-made islands, Iberville (1800)
- Bridges and bridge piers
- Chambly Canal widening, early 1970s
Theme 1: Possible Structural and Non-Structural Alternatives

- Dredging at Saint-Jean shoal to remove obsolete man-made structures
- Diversion through Chambly Canal
- Implementing the aforementioned alternative and dredging certain man-made structures
- Setting up a fixed crest weir upstream from Saint-Jean-sur-Richelieu*
- Setting up an inflatable weir at the above location**
- Setting up an inflatable weir at Saint-Jean Shoal**

*Stress the importance of not exacerbating low levels
**Extensive dredging
Diversion Through Chambly Canal

- Used only during a flood – no impact otherwise
- For flooding like that of 2011, a diversion would greatly reduce water levels (-33 cm at SJSR, -15 cm at Lake Champlain) and save many buildings
- The LCRR Study is working with Parks Canada on this option
Impact of Diversion for an Event Similar to 2011

Water inflows observed in 2011

Management plan:
Opening gates to 30.05 m and closing to 29.89 m (NAVD 88)

Quarter-monthly data
Advantages:
• Would protect against flooding
• Would protect against low lake levels
• Esthetically, can be hidden in normal circumstances

Disadvantages:
• Expensive
• Canal must be extended and another lock put in
• Less water upstream of crest
• Extensive dredging

1. Saint-Jean shoal is excavated to 25.8m, a volume of 244,658 m³
2. A movable crest weir is built
3. Chambly Canal is extended and another lock is built
• Strong support from watershed environmental groups, chiefly in the U.S.

• The current in-depth study (INRS-ETE):
  • Has shown there is a slight chance of increasing wetland area to further reduce flooding in the LCRR basin
  • Indicates that LCRR basin wetlands play a key role in natural regulation (-10% of the 2011 maximum flood flow)
  • Highlights the need to preserve existing wetlands and their benefits
Theme 3: Improve the prediction and intervention capacity

- Developing and making recommendations for implementing, as appropriate, an operational, real-time forecasting and flood inundation mapping system for the basin considering:
  - Sharing and use of prediction products
  - Uncertainty quantification
  - Mapping of inundation zones
- Survey on public risk perception, survey on first respondents, literature review on early warning systems
- Workshop with first respondents and modelers to ensure a proper needs response – delayed due to COVID-19
• The study will provide local information and tools (numerical models, database, etc.) to determine flood exposure and vulnerability in various flow and level scenarios.
• These tools can help local stakeholders assess the best way to manage their flood plains.
• The study has also called on U.S. and Canadian experts to suggest flood plain best management practices and offer ideas on:
  • Flood risk mapping
  • Flood plain occupancy and use
  • Flood cost-sharing and insurance programs
• The Study Board will review these ideas and recommend those it considers most promising.
The Study approach has taken an iterative approach

- Provincial inter-departmental group: 10 ministries/departments
- Federal inter-departmental group: 10 ministries/departments
- MNAs: Lemieux, Roberge Education Minister, Samson, Charest Status of Women Minister, IsaBelle, Jolin-Barrette Immigration Minister
- Federal MPs: Bessette, Blanchet, Normandin, Barsalou-Duval, Plamondon
- Senate: Dalphond
- Municipalities: St-Jean, Noyan, Venise-en-Québec, Saint-Paul-de-l’Île-aux-Noix, Sainte-Anne-de-Sabrevois
- MRCs: MRC de Pierre-de-Saurel, MRC de la Vallée du Richelieu, MRC du Haut-Richelieu, MRC Brome-Missisquoi, MRC de Rouville
- Stakeholders: local and regional environmental groups, Chambre de commerce et de l'industrie du Haut Richelieu (Haut-Richelieu Chamber of Commerce and Industry), UPA, etc.
- Network: consortium (Ouranos), OBVs (watershed organizations), universities, Eastern Township and Montérégie first responders, etc.
- First Nations
- Public
• IJC Commissioners are the communication channel of choice for elected officials/senior managers in Quebec, Vermont, and New York State
• The MELCC coordinates Quebec’s inter-departmental panel and is the LCRR study’s operational gateway to the Quebec government
• Two MELCC staffers (Daniel Leblanc and Richard Turcotte) sit on the Study Board
• The Direction de l’expertise hydrique et atmosphérique (DEHA) does a portion of the HHM’s work (Simon Lachance-Cloutier, Dominic Roussel)
• The team tasked with reviewing the Politique de protection des rives du littoral et des plaines inondables/PPRLPI (Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains) is in contact with the IJC (Marie-Claude Théberge and team, Valérie Vendette)
• The study is working on a series of structural and non-structural solutions and presents them for public discussion

• Solutions will take a “whole concept” approach from the four themes

• The study has identified a series of possible structural solutions and wishes to start a dialogue on their social and political acceptability

• A great deal of work is being done to identify non-structural solutions to propose in 2020

• Various levels of government, stakeholders, and the public are being consulted
• In coming months, the study will explore options and get initial feedback from partners (you and others) on potential structural solutions.
• The Study Board will keep working on these solutions and use selection criteria to narrow the list of socially or politically acceptable ones.
• Other consultations will be held in 2020 along with public information sessions.
• A more thorough economic, social, and environmental impact assessment will be available in 2020 for all proposed structural solutions.
We would like to:

• Learn your views, positions, concerns, challenges, and possible solutions
• Determine their acceptability
• Know if you see opportunities or connections with what you are doing
• Do you think flooding is still a serious issue in your area? If so, why? If not, why not?
• What are your priorities with regard to flooding?
What proposed solution or solutions do you prefer? Do you have questions about any of the solutions presented to you?

- Theme 1: reduce water levels
- Theme 2: impede flows
- Theme 3: flood response
- Theme 4: floodplain management
Q&As

• Have stakeholders in your community (mayors, citizens, local businesses) ever talked to you about the Commission’s work?

• Could we follow up with you?
Thank you!

Fisk Point – Isle La Motte, VT; Lake Champlain Basin Program
The Chambly Canal Issue

• Widened in the early 1970s
• Raises upstream water levels (10 cm or 4 in) when flows are high
• We are looking at the feasibility of moving more water through the canal
Event similar to 2011 with water diverted through Chambly Canal

MELCC estimates that SJSR’s 100-year recurrence interval is 30.54 m* (the level reached in 2011 was 30.68 m, at SJSR marina)

* Recurrence interval calculated for 1972 – 2000 period
Profil de la surface de l'eau pour plusieurs conditions de débits / Water surface elevation for several discharge condition
• Early 1970s Chambly Canal widening caused water levels to rise by some 15 cm.

• Removing structures (1-4) would reduce water levels by some 9 cm and we can calculate the number of houses it would save.