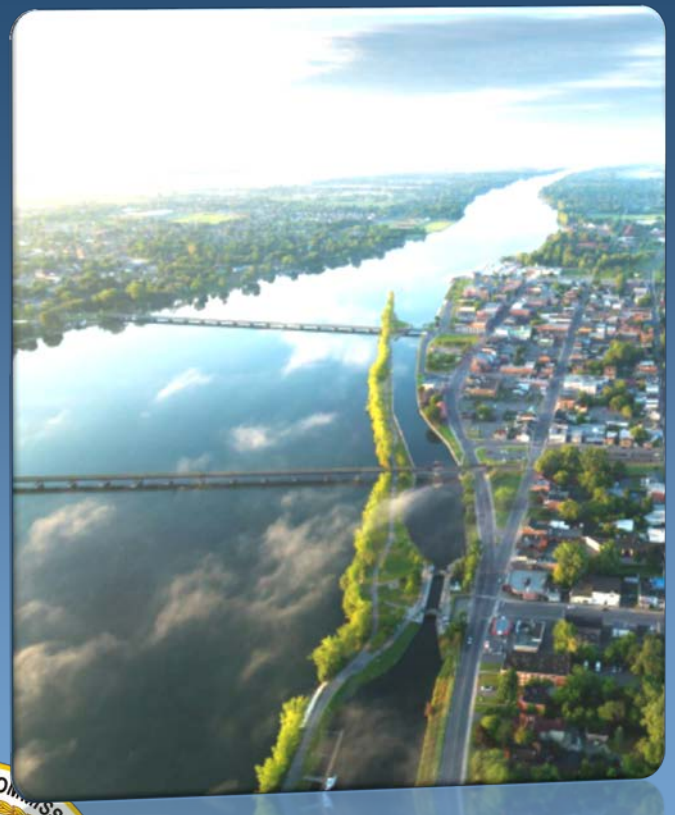

# Chambly Canal Diversion


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**Flood Management & Mitigation Measures**

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**Hydrologic and Hydraulic Mapping**


**December 9, 2020**

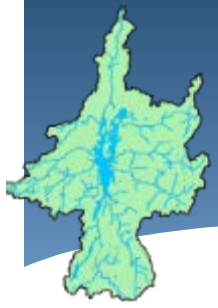
# Acknowledgements

The work reported here is a collaborative effort of the following:

International Lake Champlain-Richelieu River Study

Parks Canada

Pubic Service and Procurement Canada



# Presentation Features

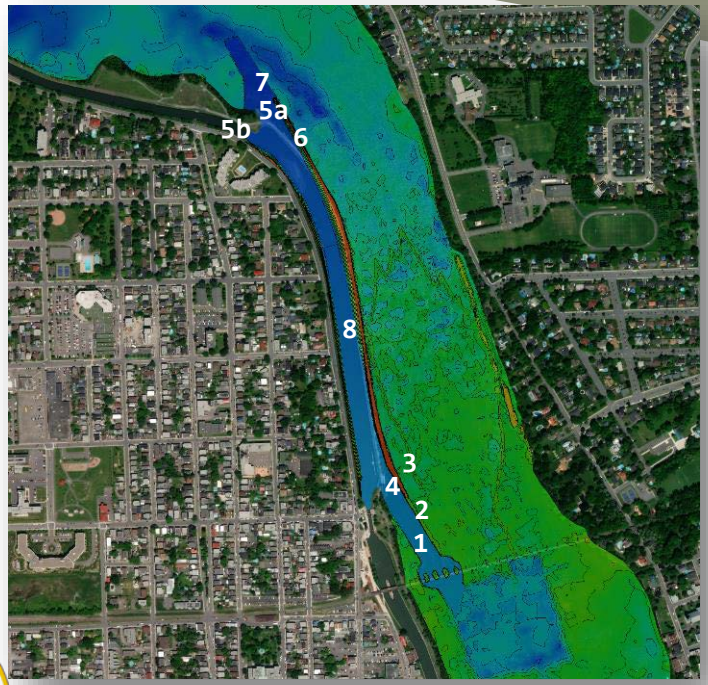
- Using Chambly Canal – early efforts
- How diversion is currently proposed for flood relief
- What are the physical features of the diversion
- Tools employed
- Cost and Benefit considerations – what is in and out
- Key messages

# Why focus on the Chambly Canal Diversion?

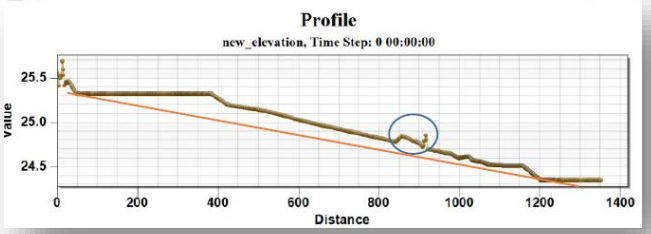
- Study Board has determined this alternative is a promising solution because:
  - Less intrusive than instream structures (i.e., dams).
  - With an optimized design, it can provide significant flood relief.
  - Used only during flood events.
  - Environmental impacts are expected to be minimal.

# Project Area – Key Features

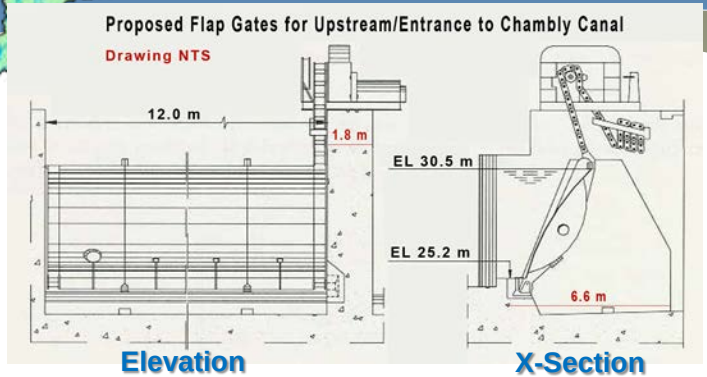
# Proposed and Tested Chambly Canal Hydraulics (Overview)

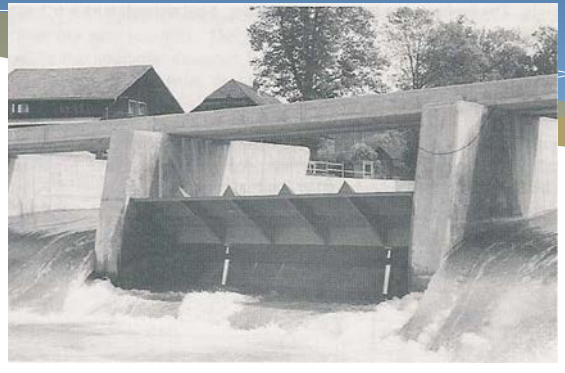


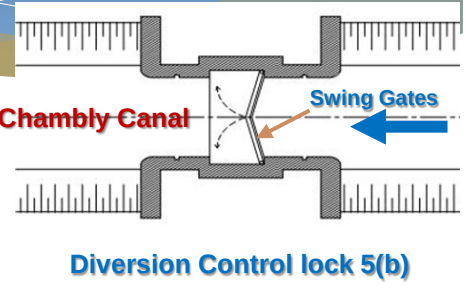

1. Dredging to 25.2 m (navd88)
2. Underwater dyke at 26.4 m
3. Canal wall reshaping at 30.5 m
4. Canal regulation features
5. Downstream control features
6. Canal wall reshaping at 30.5 m
7. Dredging at 24.35 m
8. Increased longitudinal canal slope and lateral slope changes



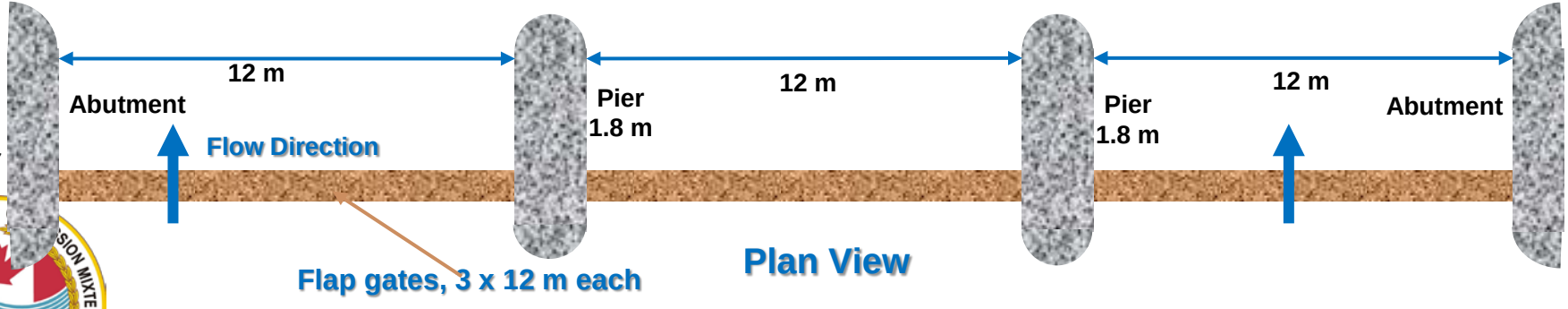
# Diversion Channel Entrance Configuration

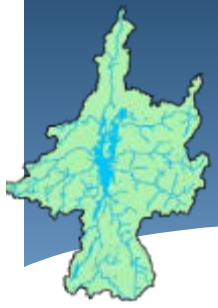





Diversion Control lock 5(b)



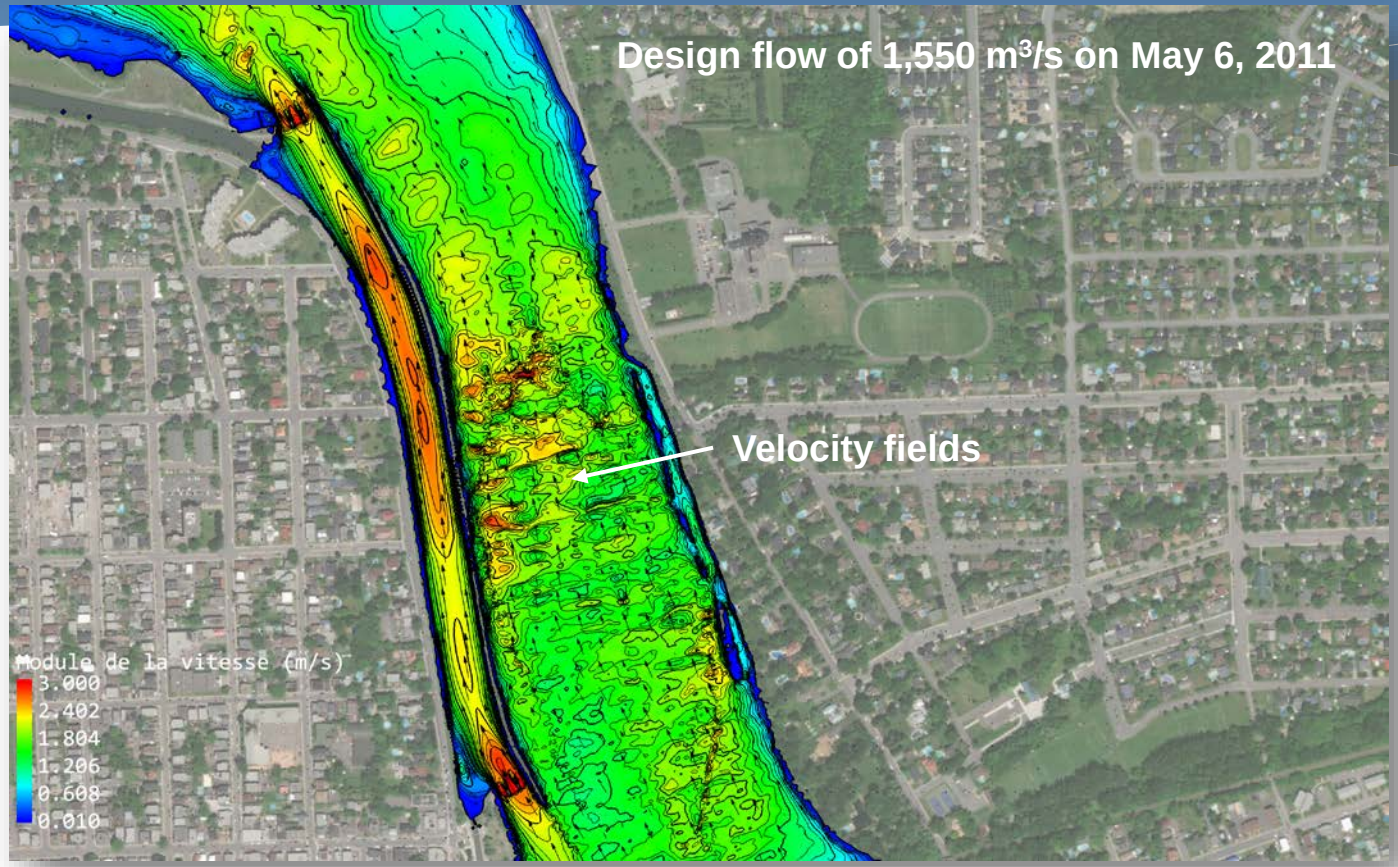


# Study Employed …

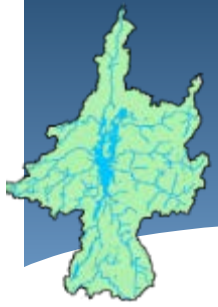
- Hydraulic Modelling from Saint-Jean-sur-Richelieu Marina to Fryer Island Dam
- Hydrological Modelling with the Water Balance Model
- Design of a operational plan
- Integrated Social Economic Environmental Assessment Tool
- Capital cost and ongoing operations & maintenance
- Suite of methods for benefits-cost analysis

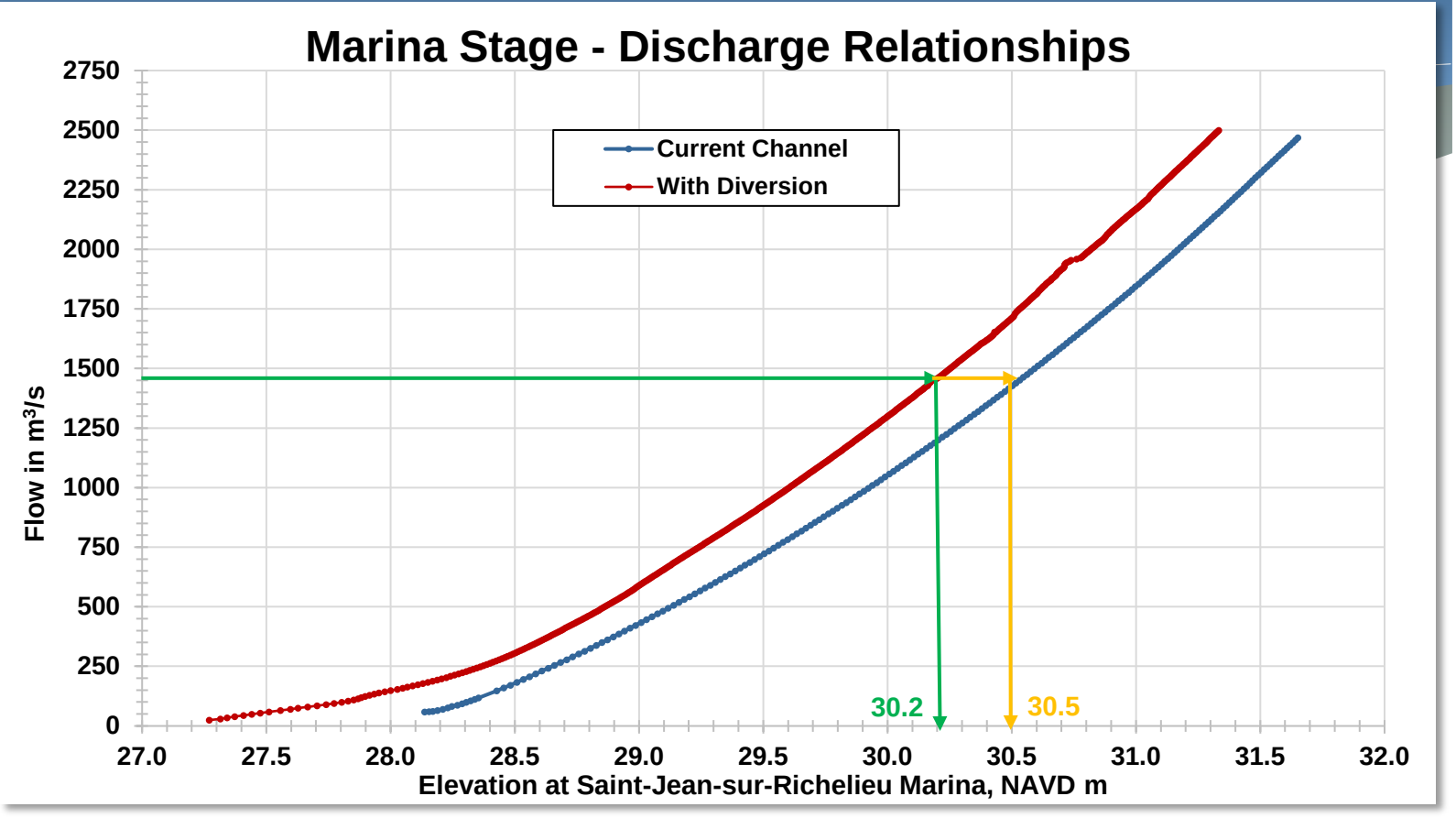
# Hydraulic Modelling Grid

# Hydraulic Modelling Output

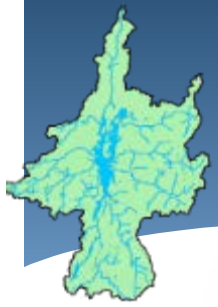


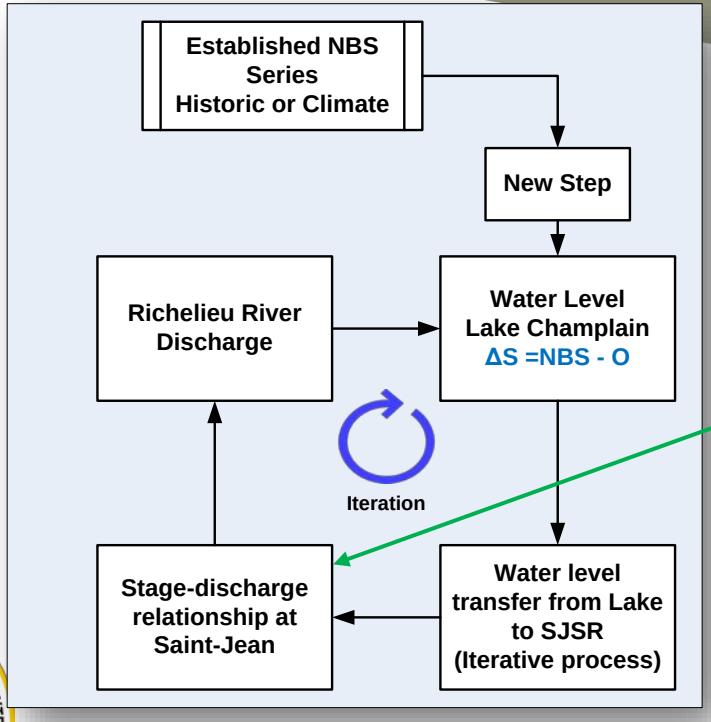
# Estimating the Impacts

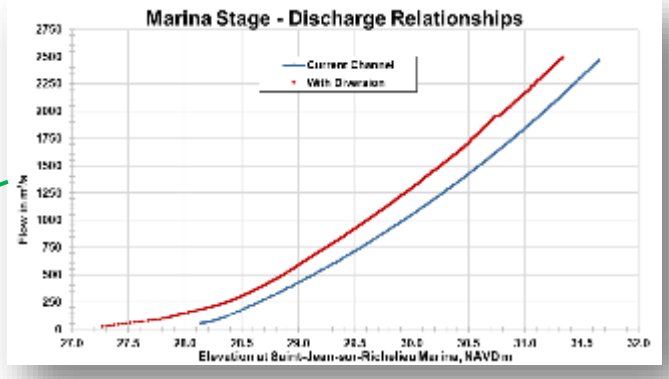


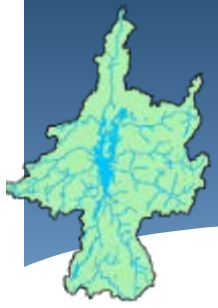


# Hydrological Modelling with Water Balance Model



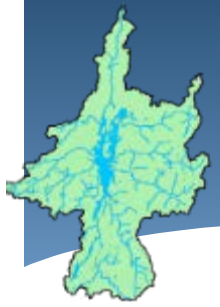


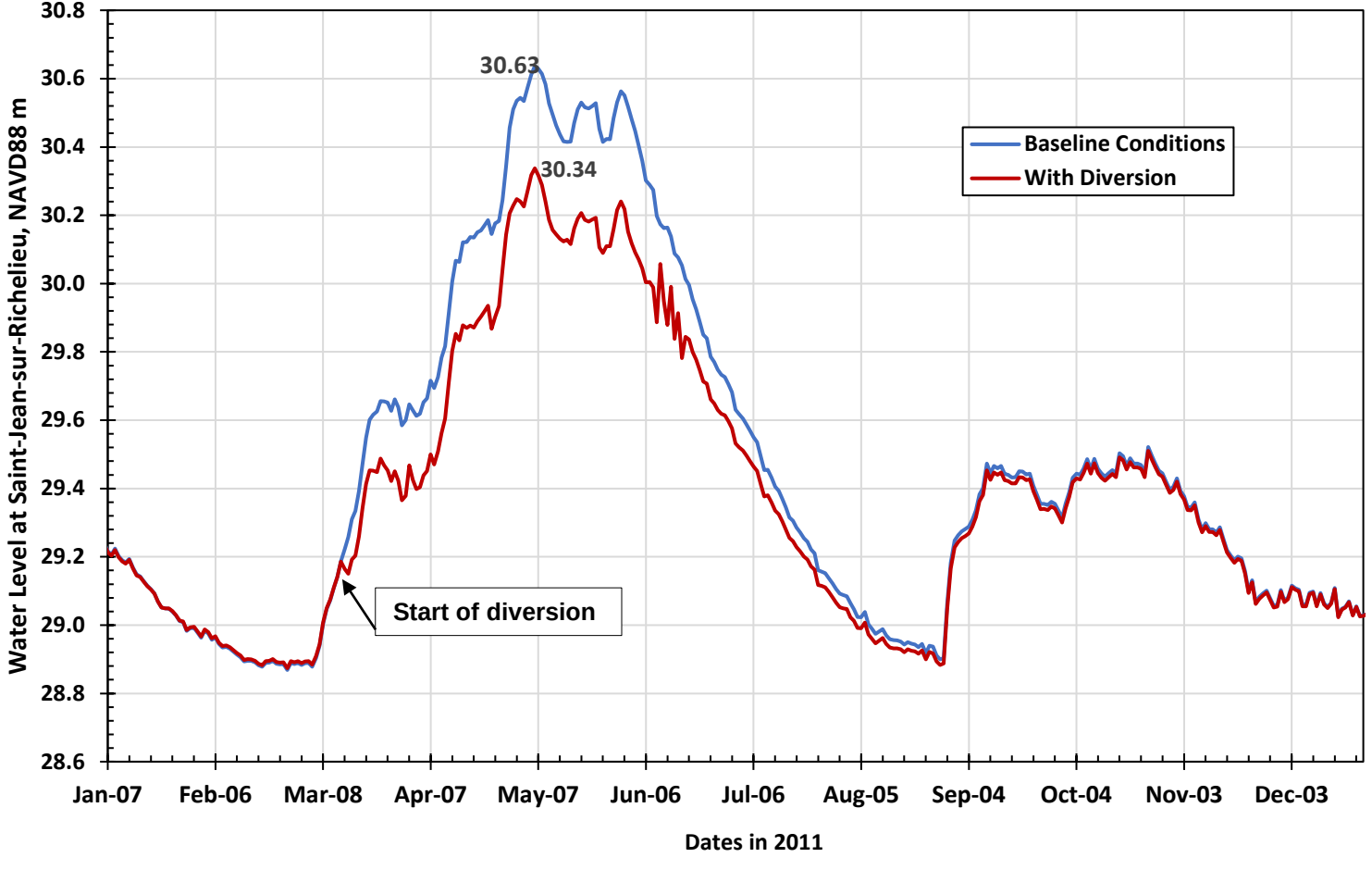


# The Perfect Forecast

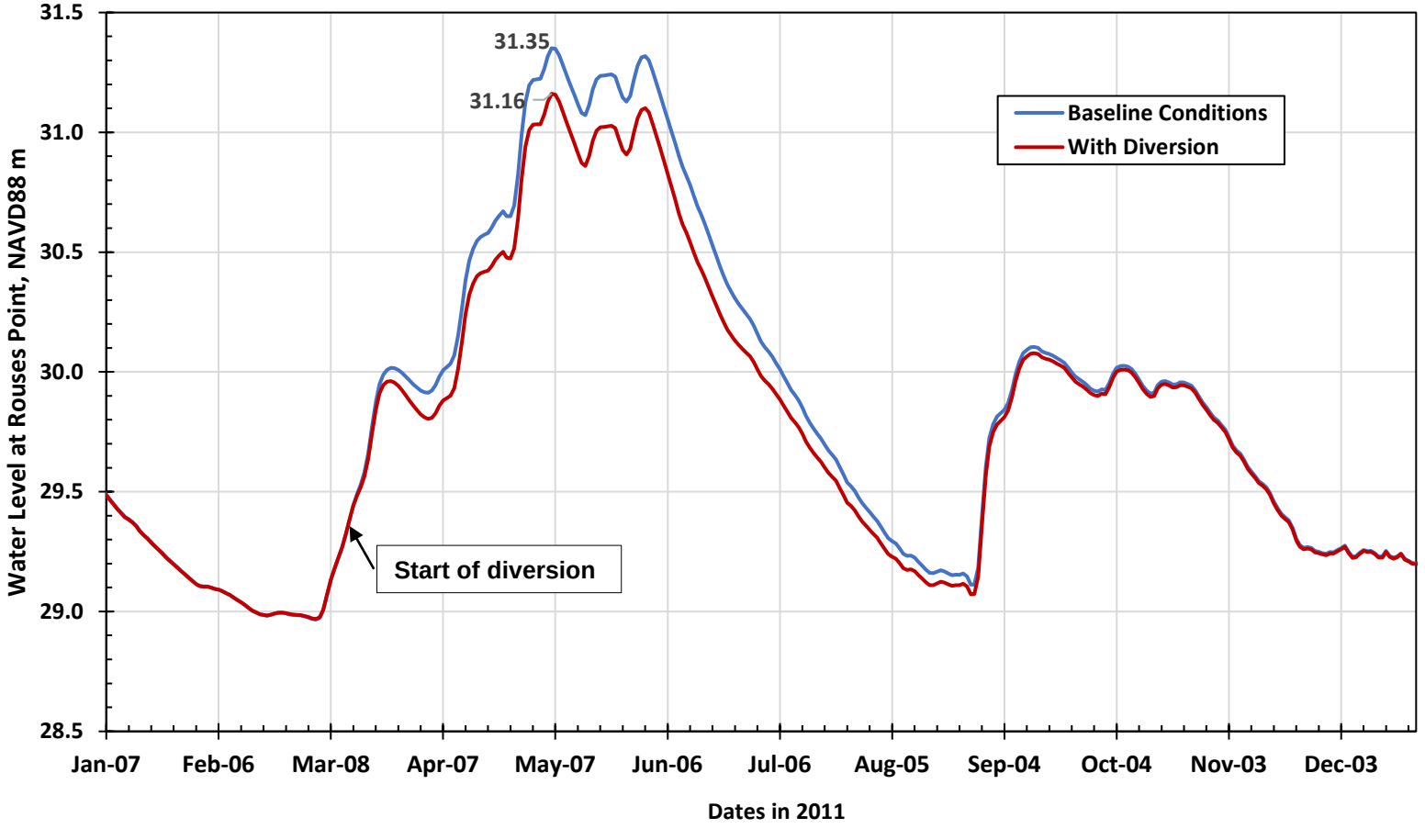
- What is a perfect forecast?
  - We assume a foreknowledge of how the outflows from Lake Champlain into Richelieu River will unfold.
- Why use perfect forecast?
  - By knowing the inflows before hand, allows the diversion to operate in the most efficient manner for maximum flood damage reduction.
  - Realistic forecast will not give the same level of reduction.
- As is, the forecasting system is challenged for a two-week lead time. The perfect forecast gave us a six-week lead time.
- This way, the diversion is given every advantage in evaluating its efficiency.

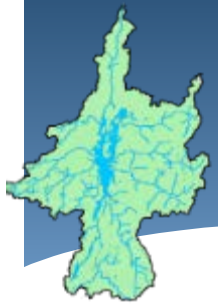


# Water Level Performance of the Diversion in 2011 Flood At Saint-Jean-sur-Richelieu

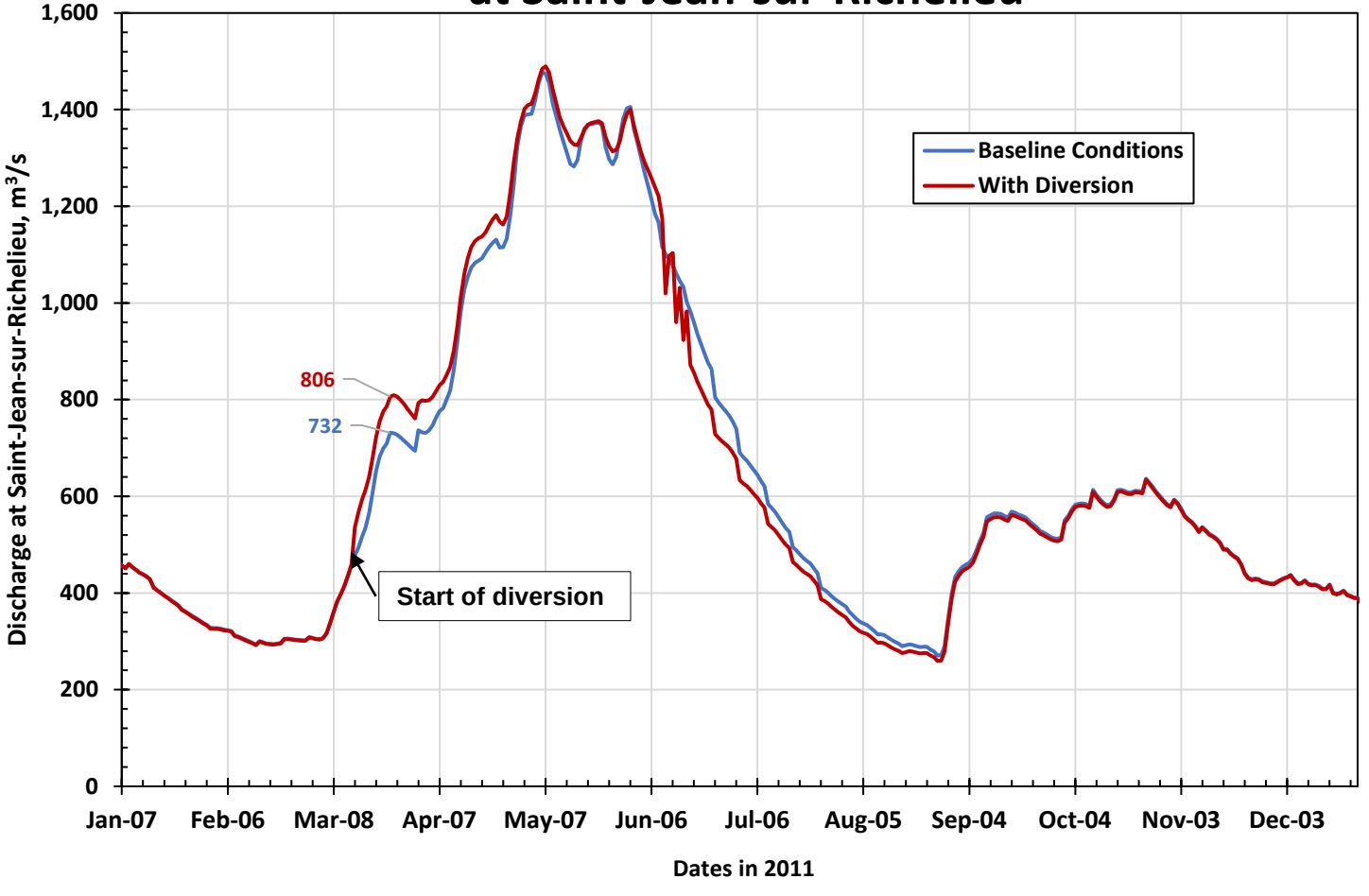


# Water Level Performance of the Diversion in 2011 Flood at Rouses Point

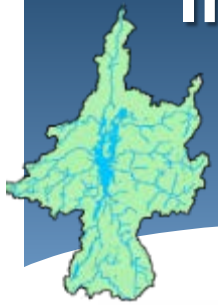


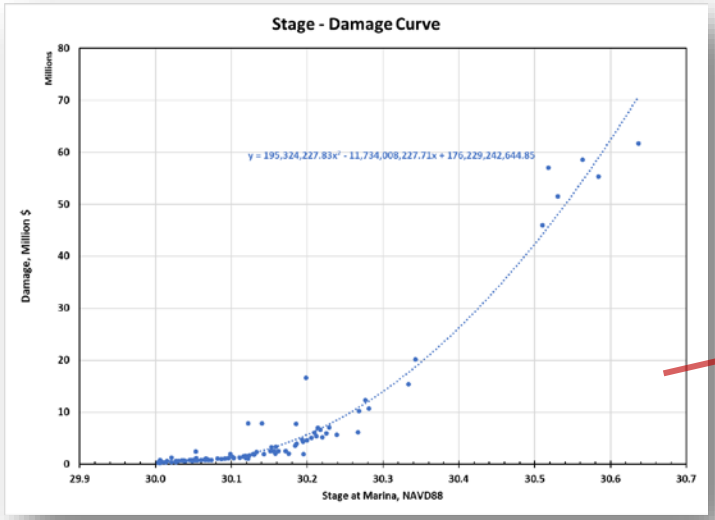


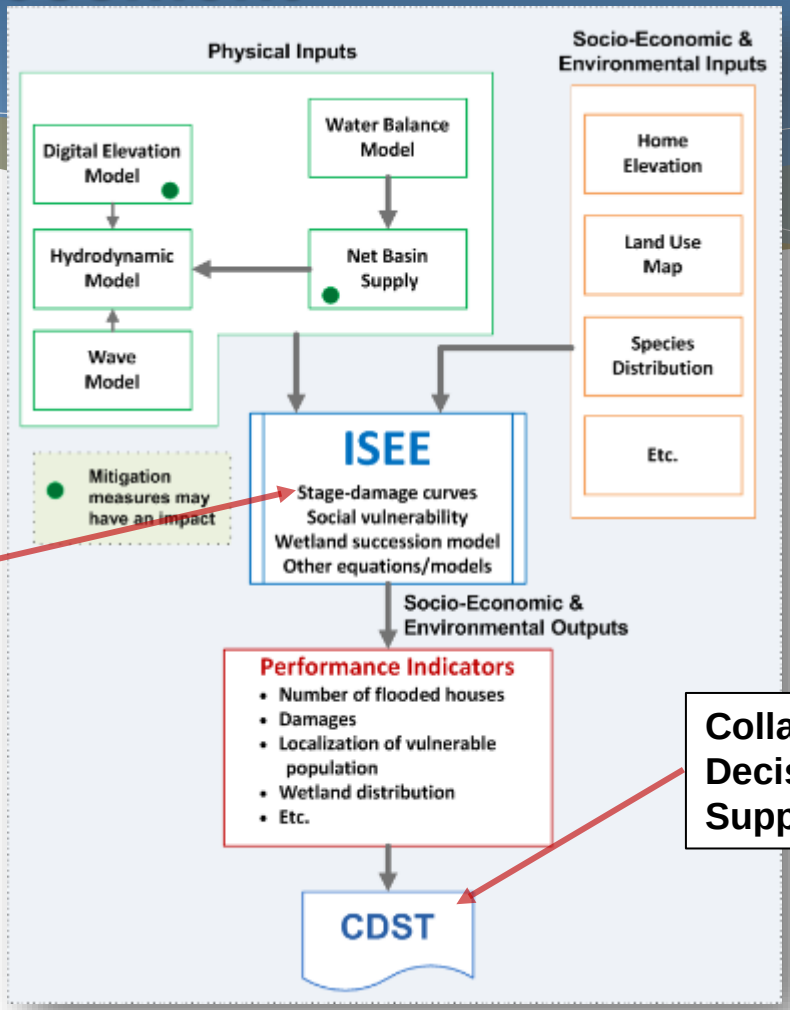
# Discharge Performance of the Diversion in 2011 Flood at Saint-Jean-sur-Richelieu



# Integrated Social Economic Environmental Assessment

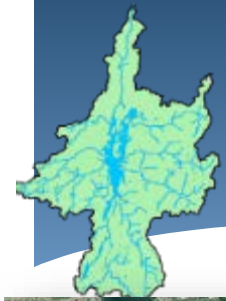


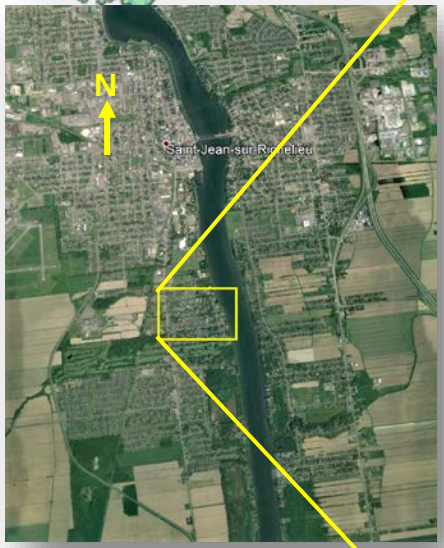


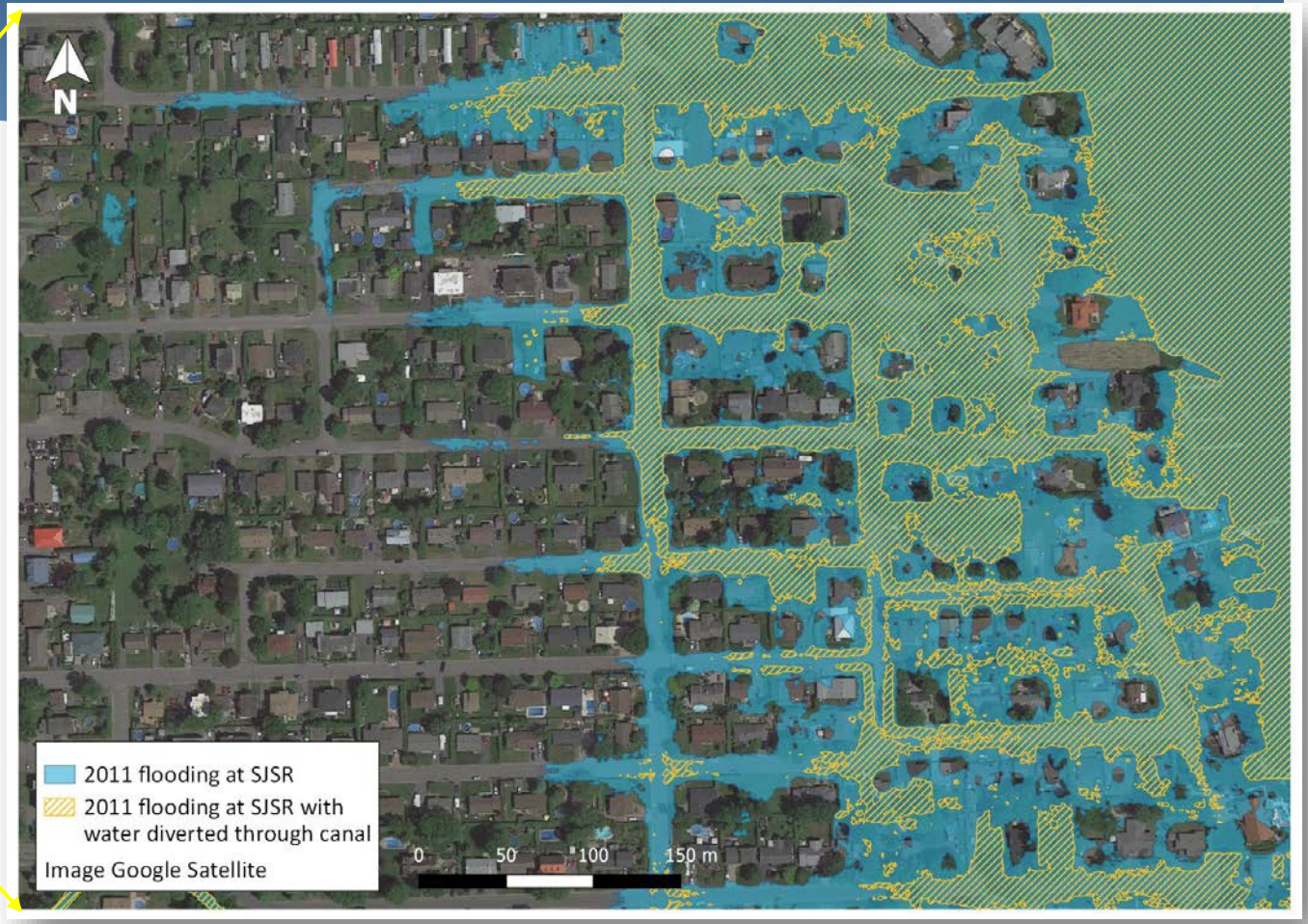




**Collaborative Decision Support Tool**

# Flood Relief

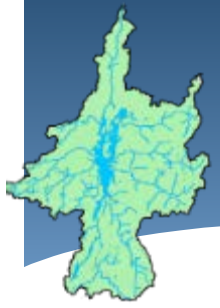




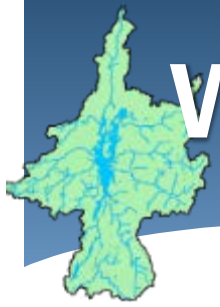
# Benefit - Cost of Diversion$_1$

- **Cost consideration of diversion**:
  - Capital cost of control gates, structure, reshaping of slope, excavation, dredging, access points, erosion protection in the canal
  - Based on the quantities estimated, the capital cost is appraised from $83 Million to $113 Million. For benefits-costs analysis, a weighted cost of $100 Million was used.
  - Ongoing operations of the diversion features are estimated at $1.0 Million per year consisting of management office, replacement and repair of gates, administration, etc.



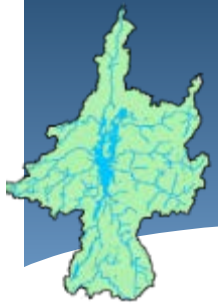
# Benefit – Cost of Diversion$_2$

- Benefits:
  - Relief in the spatial extent of the floodplain
  - Relief in the vertical aspect
  - Damages avoided from flood relief
  - Flood vulnerabilities are reduced
  - There are benefits that can be quantified and there are intangibles
- What is not included.



# Where are we in our Analysis?

- Assumptions:
  - Life of project → 50 years
  - Interest rates ranged from 0.5% for Government Bonds; 3.0% from US perspective; 8.0% based on Canadian Treasury Board guidelines.
- Two different approaches used → Economist and Engineering
- Based on different assumptions the benefit-cost ratio worked out to → **0.12 to 0.35**



# Key Messages

- May prove challenging getting a B/C ratio to 1, the breakeven point for benefits vs. costs.
- Some key information still to be included are the US damages.
- Still need to incorporate environmental impacts and climate change in the evaluation.
- Using the perfect forecast for operating the diversion is the best case scenario, the reality is the diversion cannot be operated this efficiently and will not be able to reduce flood levels by 30 cm (12 in).
- The study is also exploring much less costly but less effective solutions, such as dredging of human interventions on the shoal.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