Great Lakes – St. Lawrence Adaptive Management (GLAM) Committee

Adaptive Management and the Great Lakes Challenges and Successes

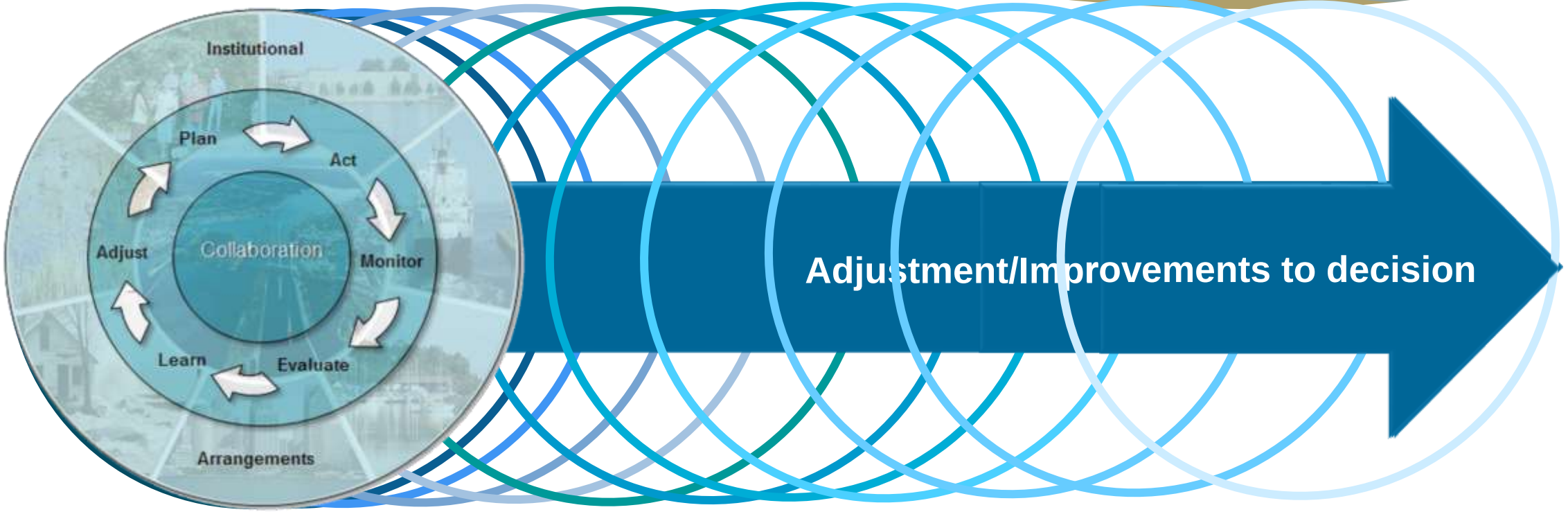
Columbia River Treaty
Adaptive Management Meeting
Thursday, May 9, 2019

Wendy Leger, Environment and Climate Change Canada
Canadian Co-Chair, GLAM Committee

Outline

- Background
- Applying the AM framework in the Great Lakes-St. Lawrence River system
- How 2017 immediately tested the AM framework
- 12 year strategy – where we want to be?
- Lessons learned

Adaptive Management is Iterative
Always working towards improvements



GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee

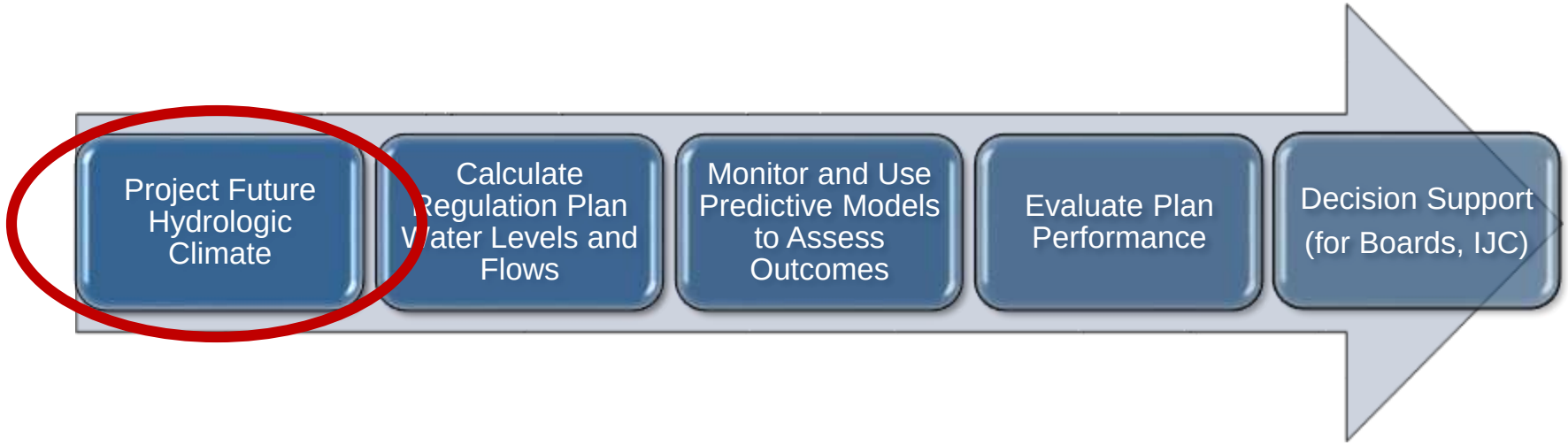
- Established by the IJC in January 2015 for on-going review of lake regulation plans recognizing changing conditions
- Binational Committee comprised of 16 members from federal, state, and provincial agencies

GLAM reports to all three Great Lakes Boards of Control

- Key questions include:
  - How well are the impacts of levels and flows represented by current data and models?
  - Are water supply conditions changing?
  - Are the physical, chemical, biological, and/or socio-economic conditions changing?
  - Can water level management be improved?

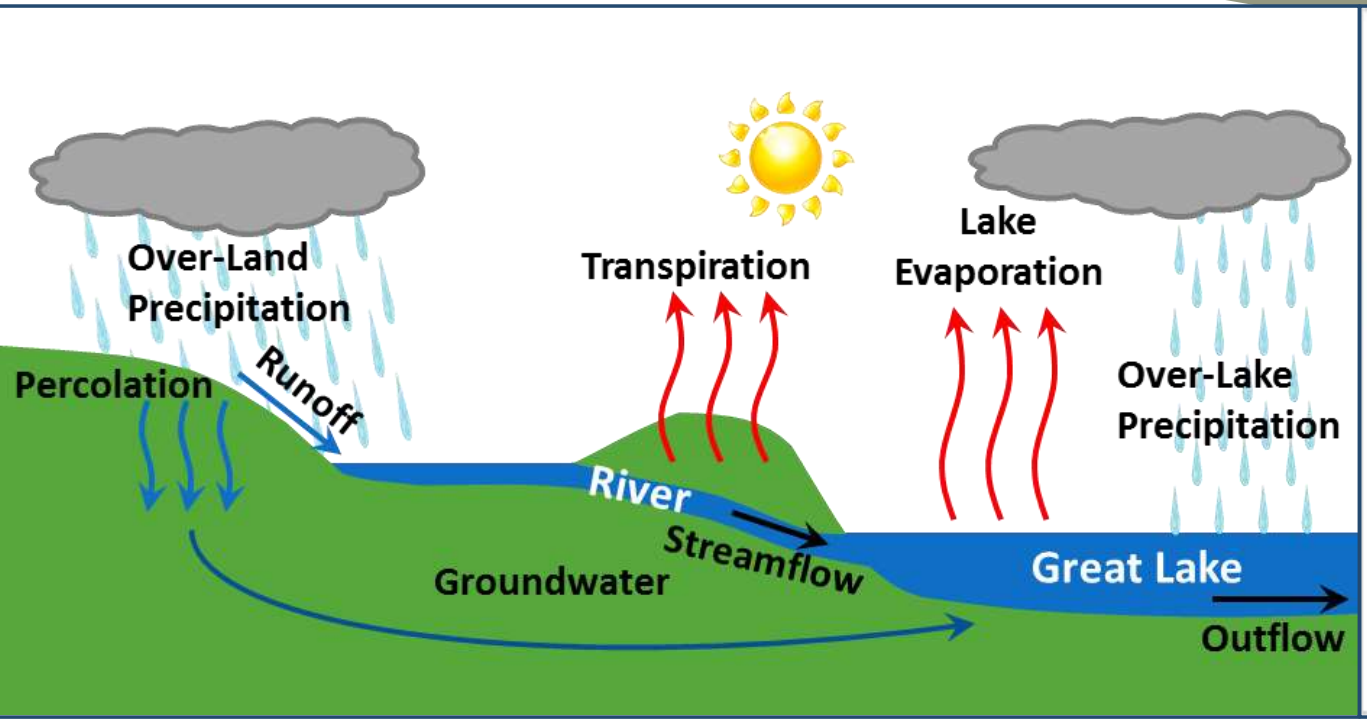
NOTE: GLAM is not a decision making body

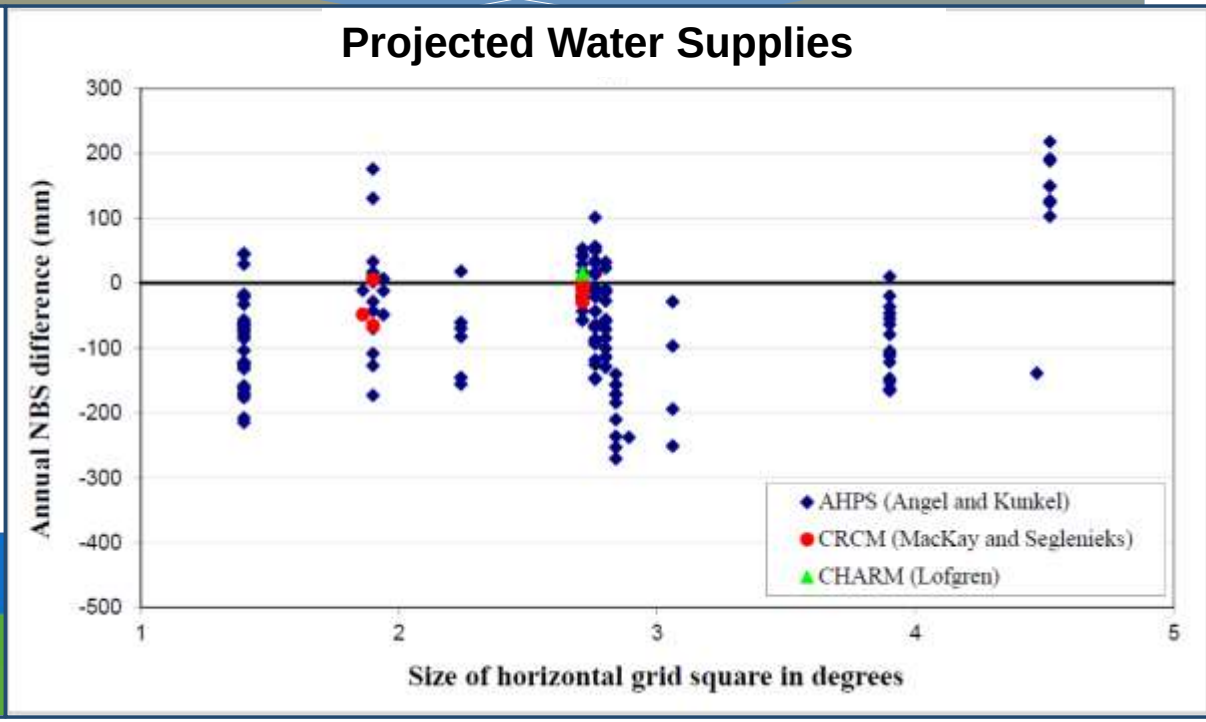
GLAM Adaptive Management Framework



GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

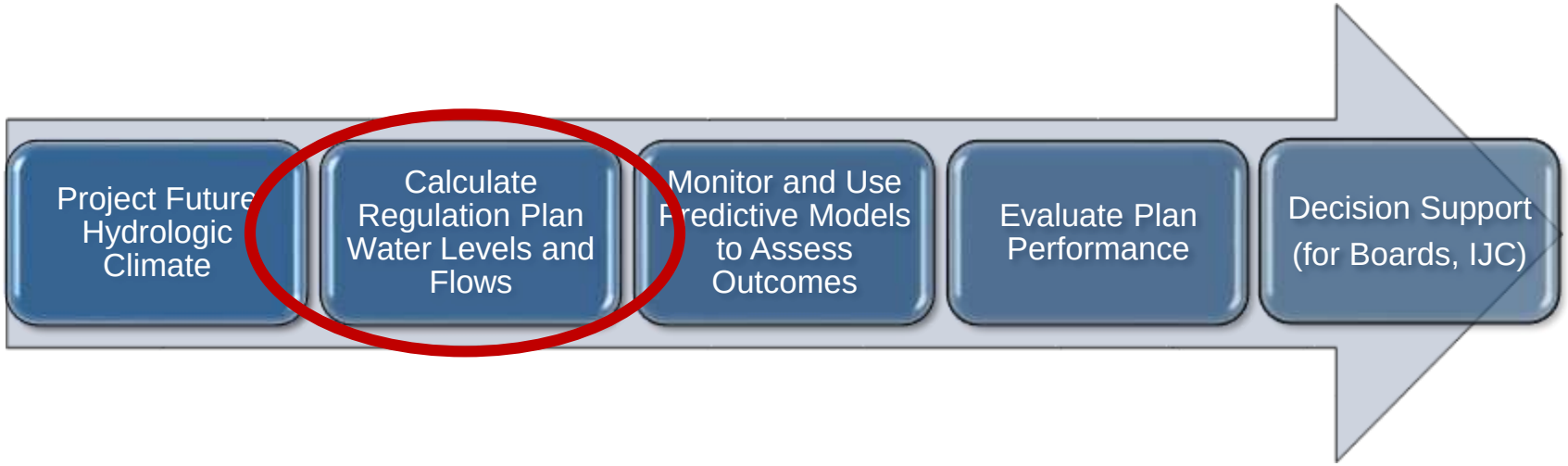
Project Future Hydrologic Climate





GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

GLAM Adaptive Management Framework



GLAM Adaptive Management Framework

Calculate Regulation Plan Water Levels and Flows

Non-regulated

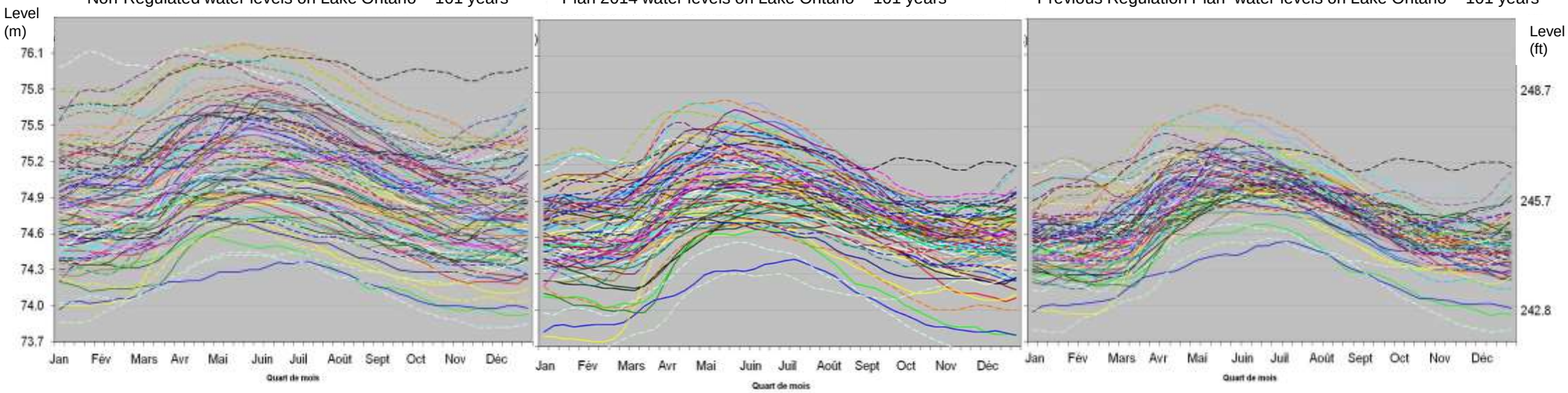
Plan 2014

Previous Regulation Plan

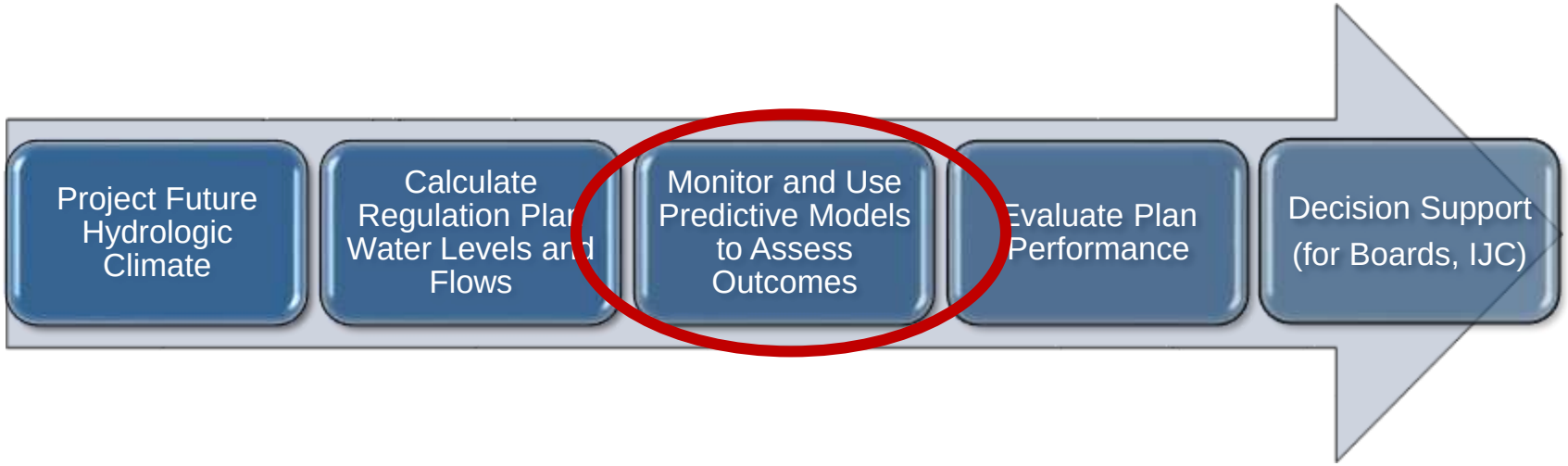
Non-Regulated water levels on Lake Ontario – 101 years

Plan 2014 water levels on Lake Ontario – 101 years

Previous Regulation Plan water levels on Lake Ontario – 101 years

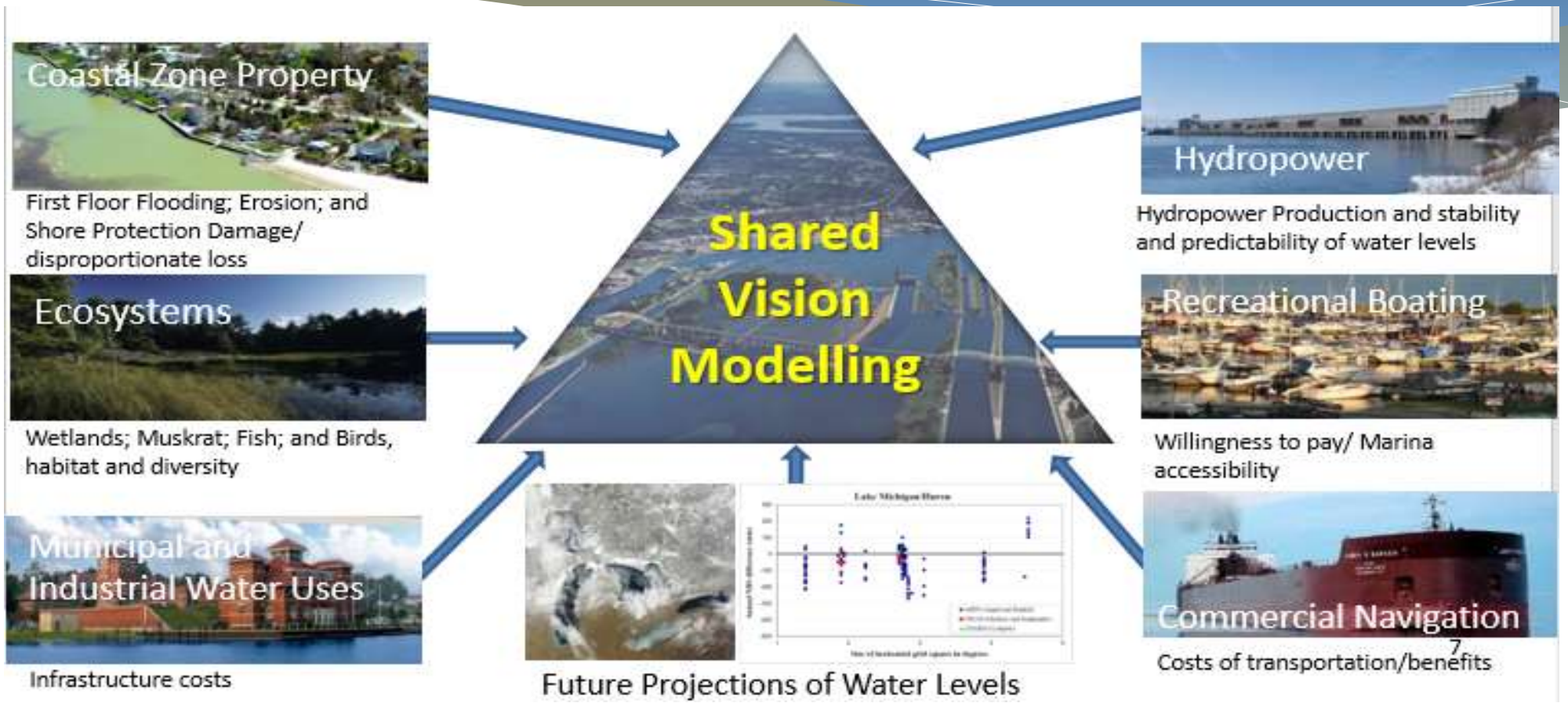


GLAM Adaptive Management Framework

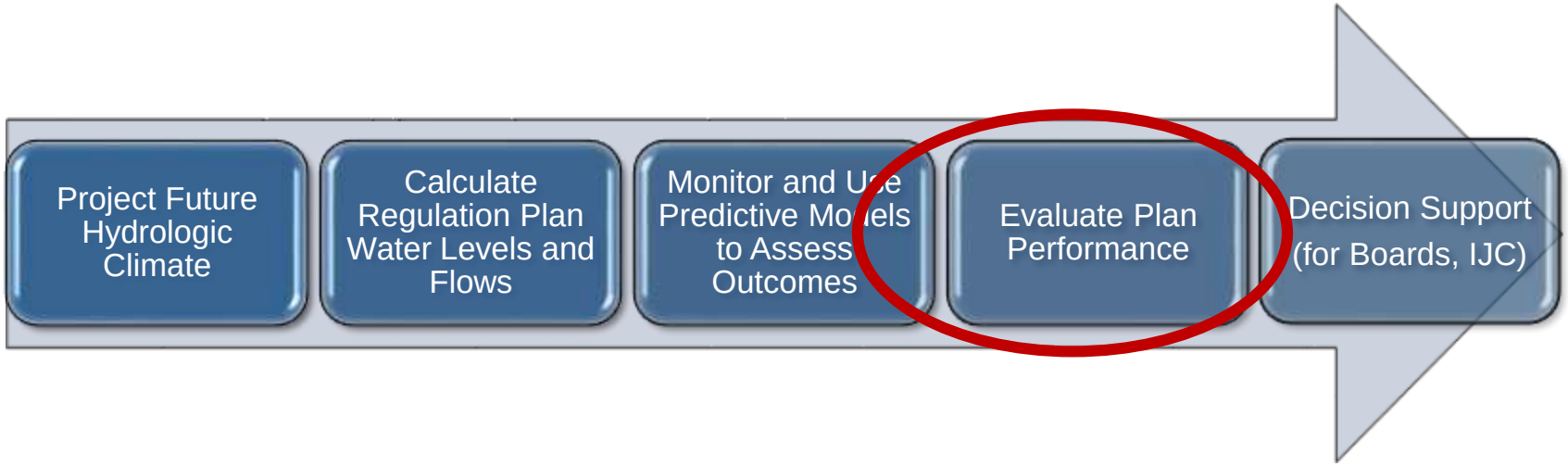


GLAM Adaptive Management Framework

Monitor and Use Predictive Models to Assess Outcomes



GLAM Adaptive Management Framework



GLAM Adaptive Management Framework

Plan Evaluation

Environmental Performance Indicators

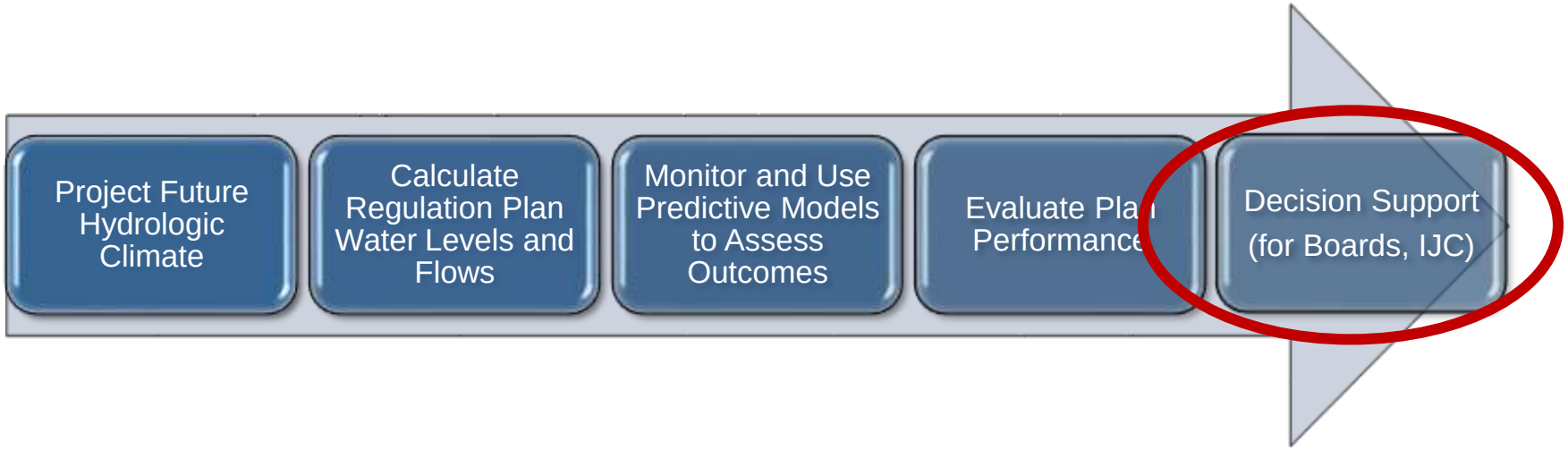
Environmental Performance Indicators Ratio to 1958DD Using historical water supplies	Regulation Plans					
	Natural	1958DD	B+	Bv7	Bv7 2-95	Plan 2014 (Bv7 2-90)
Lake Ontario						
Meadow Marsh	1.56	1.00	1.44	1.46	1.41	1.40
Spawning habitat supply (Low Veg 18C)	0.88	1.00	0.95	0.96	0.96	0.95
Spawning habitat supply (High Veg 24C)	1.08	1.00	1.00	0.98	0.99	1.00
Spawning habitat supply (Low Veg 24C)	1.11	1.00	1.02	1.05	1.04	1.03
Northern Pike YoY recruitment	1.03	1.00	1.00	0.98	0.99	1.00
Largemouth Bass YoY recruitment	0.96	1.00	0.98	0.98	0.98	0.98
Least Bittern reproductive index	1.13	1.00	1.04	1.12	1.11	1.09
Virginia Rail reproductive index	1.15	1.00	1.11	1.16	1.15	1.09
Black Tern reproductive index	1.16	1.00	1.12	1.19	1.16	1.11
Yellow Rail preferred breeding habitat	1.01	1.00	1.01	1.04	1.02	1.02
King Rail preferred breeding habitat	1.27	1.00	1.10	1.19	1.16	1.14
Upper River						
Spawning habitat (Low Veg 18C)	1.04	1.00	1.01	1.02	1.01	1.01
Spawning habitat (High Veg 24C)	1.02	1.00	1.01	1.00	1.01	1.00
Spawning habitat (Low Veg 24C)	1.04	1.00	1.01	1.02	1.01	1.01
Northern Pike YoY recruitment	1.06	1.00	1.03	1.03	1.03	1.03
Largemouth Bass YoY recruitment	1.00	1.00	1.00	1.00	1.00	1.00
Northern Pike YoY net productivity	2.07	1.00	1.46	1.39	1.39	1.39
Virginia Rail (RALI) reproductive index	1.33	1.00	1.27	1.17	1.17	1.19
Muskrat house density, drowned river mouth wetlands	14.29	1.00	2.99	2.59	2.56	2.60
Lower River						
Golden Shiner - suitable feeding habitat area	1.01	1.00	1.00		1.00	1.00
Wetlands fish - abundance index	0.97	1.00	0.90		1.00	1.00
Migratory wildfowl - habitat area	0.94	1.00	0.97		0.98	0.99
Least Bittern reproductive index	1.06	1.00	1.03		1.02	1.02
Virginia Rail reproductive index	1.04	1.00	1.05		1.03	1.02
Migratory wildfowl productivity	1.02	1.00	1.01	See Note	1.01	1.01
Black Tern reproductive index	1.01	1.00	0.97		1.01	1.00
Northern Pike reproductive area	1.01	1.00	1.03		1.01	1.01
Eastern Sand Darter reproductive area	1.00	1.00	0.99		1.00	1.00
Spiny Softshell Turtle reproductive habitat area	1.01	1.00	1.01		0.99	0.99
Bridle Shiner reproductive habitat area	0.97	1.00	0.92		0.95	0.94
Muskrat surviving houses	1.05	1.00	0.99		0.96	0.96
Shading indicates species at risk						

Economic Performance Indicators

Economic Benefits (in $US Million 2005) Net Average Annual Using stochastic water supplies	Regulation Plans					
	Natural	1958DD	B+	Bv7	Bv7 2-95	Plan 2014 (Bv7 2-90)
Total	**-$20.80**	**$0.00**	**$1.31**	**$1.61**	**$3.12**	**$3.85**
Municipal and industrial water use	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
St. Lawrence River one-time infrastructure costs	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lake St. Louis water quality investments	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Commercial Navigation	**-$0.05**	**$0.00**	**-$1.24**	**-$0.02**	**$0.00**	**$0.00**
Ontario	-$0.02	$0.00	-$0.01	-$0.01	-$0.01	$0.00
Seaway	-$0.02	$0.00	-$1.19	-$0.01	$0.00	$0.00
Montreal	-$0.01	$0.00	-$0.04	$0.00	$0.01	$0.01
Hydropower	**$12.59**	**$0.00**	**$6.08**	**$5.40**	**$5.26**	**$5.26**
NYPA-OPG	$8.77	$0.00	$3.85	$3.45	$3.41	$3.54
Hydro-Quebec	$3.82	$0.00	$2.22	$1.95	$1.85	$1.76
Coastal	**-$29.88**	**$0.00**	**-$2.78**	**-$3.17**	**-$2.23**	**-$2.24**
Lake Ontario total	-$27.38	$0.00	-$2.53	-$3.11	-$2.22	-$2.23
Shore protection maintenance	-$19.85	$0.00	-$2.16	-2.62	-$1.94	-$1.95
Erosion to unprotected developed parcels	-$0.58	$0.00	-$0.17	-0.17	-$0.16	-$0.18
Flooding	-$6.94	$0.00	-$0.20	-$0.32	-$0.11	-$0.11
Upper St. Lawrence River flooding	-$2.00	$0.00	-$0.04	-$0.07	-$0.01	-$0.01
Lower St. Lawrence River flooding	-$0.49	$0.00	-$0.22	$0.00	$0.00	$0.00
Recreational Boating	**-$3.46**	**$0.00**	**-$0.74**	**-$0.60**	**$0.10**	**$0.79**
Above the dam	-$5.31	$0.00	-$1.42	-$1.33	-$0.68	-$0.10
Lake Ontario	-$4.93	$0.00	-$1.18	-$1.11	-$0.57	-$0.15
Alexandria Bay	-$0.36	$0.00	-$0.29	-$0.25	-$0.14	$0.00
Ogdensburg	-$0.07	$0.00	$0.00	-$0.02	-$0.01	$0.00
Lake St. Lawrence	$0.05	$0.00	$0.05	$0.04	$0.05	$0.05
Below the dam	$1.85	$0.00	$0.68	$0.72	$0.78	$0.90
Lake St. Louis	$1.03	$0.00	$0.49	$0.45	$0.48	$0.54
Montreal	$0.64	$0.00	$0.19	$0.20	$0.22	$0.26
Lake St. Pierre	$0.18	$0.00	$0.00	$0.07	$0.08	$0.10

GLAM

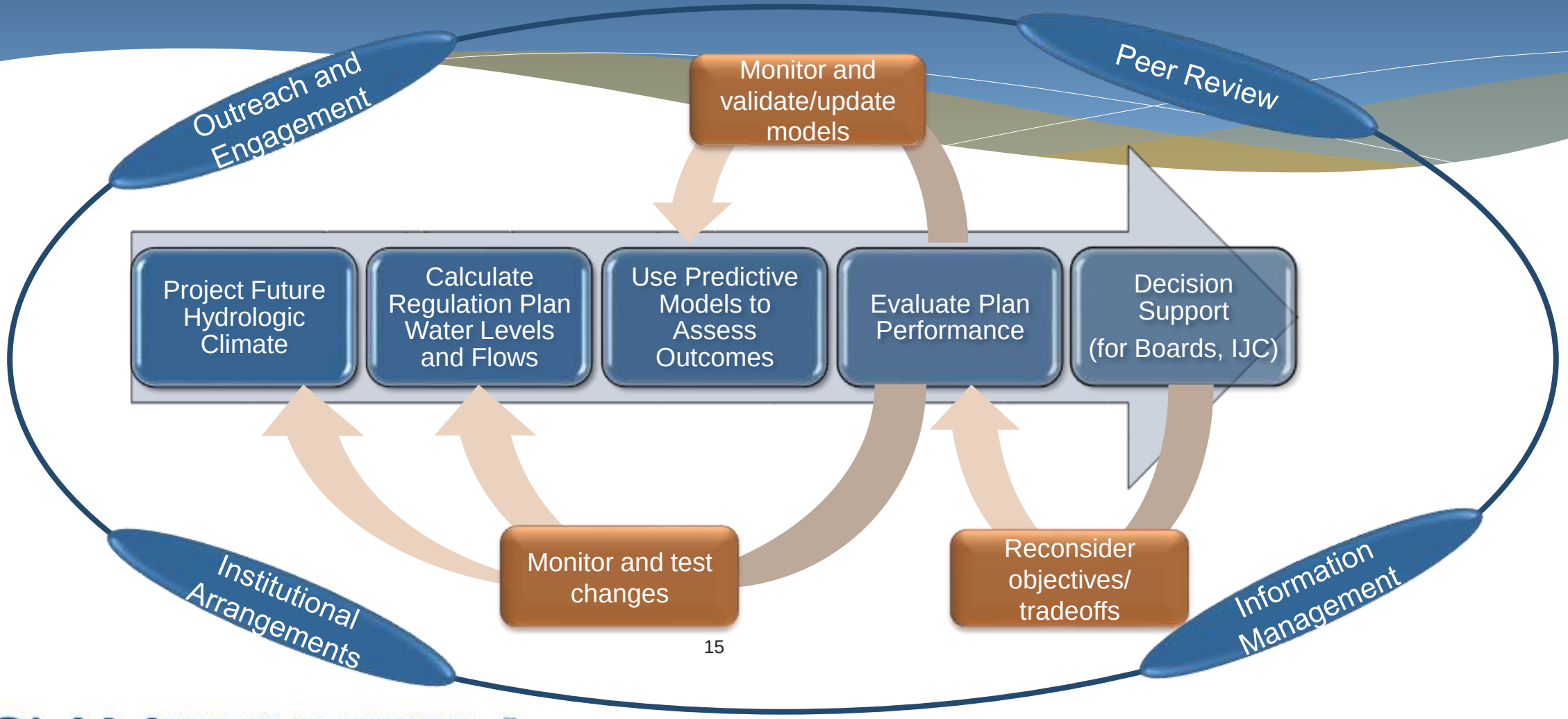
GLAM Adaptive Management Framework



GLAM Adaptive Management Framework

Decision Support

GLAM Adaptive Management Framework



GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Challenges for GLAM Committee

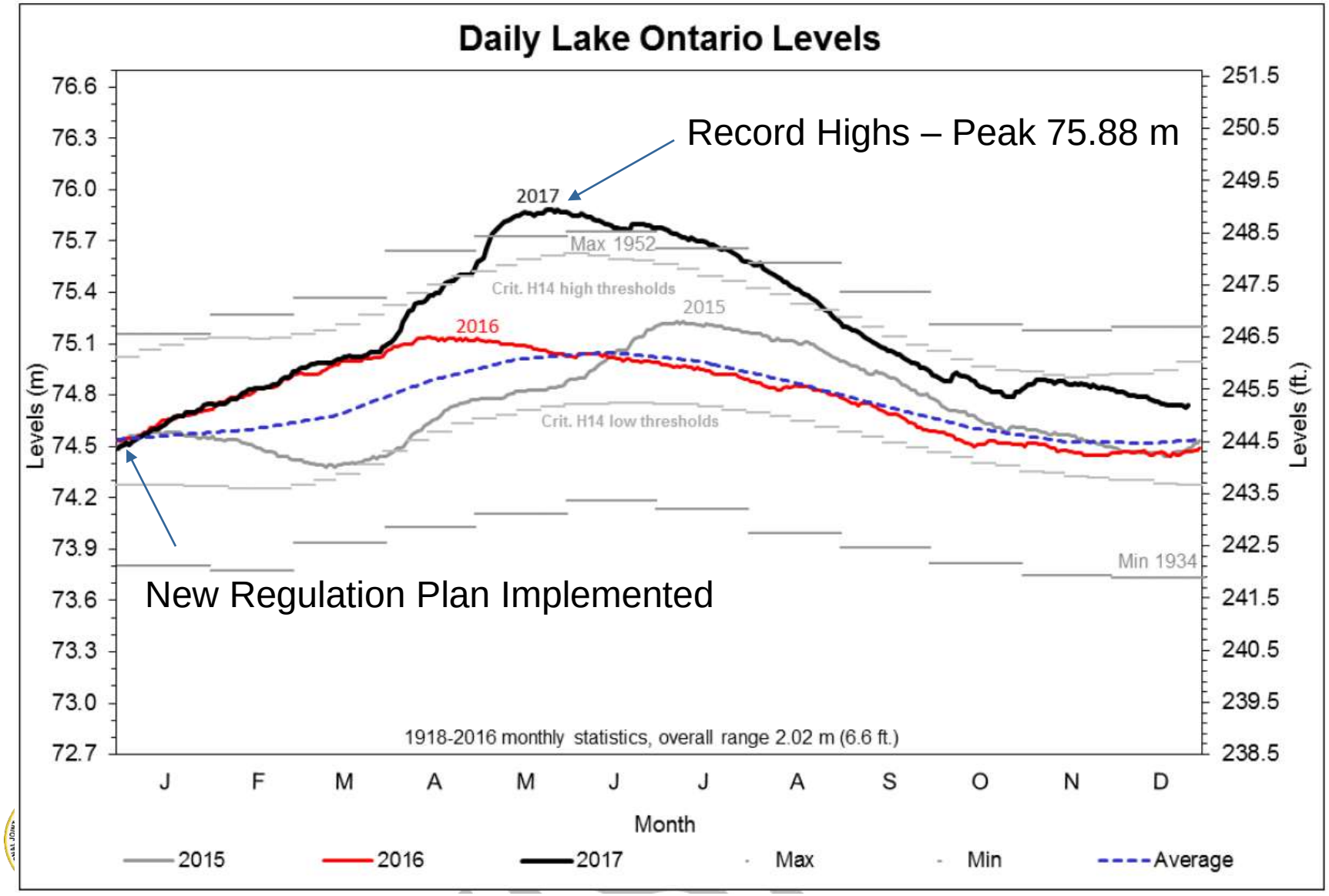
- Geographic scope of Great Lakes is very large
- Committee working without a sustained budget and with limited resources
- Existing models are getting out of date and/or are no longer useable
- Not all performance indicators are easily updatable – need long-term monitoring program
- Engaging stakeholders takes considerable effort, commitment and a strategy
- Information management is necessary and complicated in a binational setting
- Mother Nature can throw you a curve ball!

GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

2017 – As Luck would have it…

GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

2017 – Record High Water Levels




Source: Wendy Leger
ECCC, Grimsby, ON


Source: Tim Dixon, New York.
Date 10/30/2017

Many Blame New Regulation Plan

Cuomo on Lake Ontario flooding: 'There's that the IJC blew it'

by Tyler Head | Monday, May 29th 2017

Cuomo on Lake Ontario flooding: 'There's no doubt that the IJC blew it'

TOP STORY

Tenney: Plan 2014 a 'major contribu

By MATTHEW REITZ matt@fultonvalleynews.com Jun 26, 2017 0

Congresswoman Claudia Tenney, R-New Hartford, is pictured on the left in Mexico last year surveying damage brought by flooding from Lake Ontario. Tenney announced earlier this week the town of Mexico would receive funding for an approved water district.

Seth Wallace photo

Mobilizing to fight Plan 2014: Trouble rising

Grassroots groups push for replacement of new lake level control plan

BY TIM FENSTER tim.fenster@lockportjournal.com Sep 24, 2017

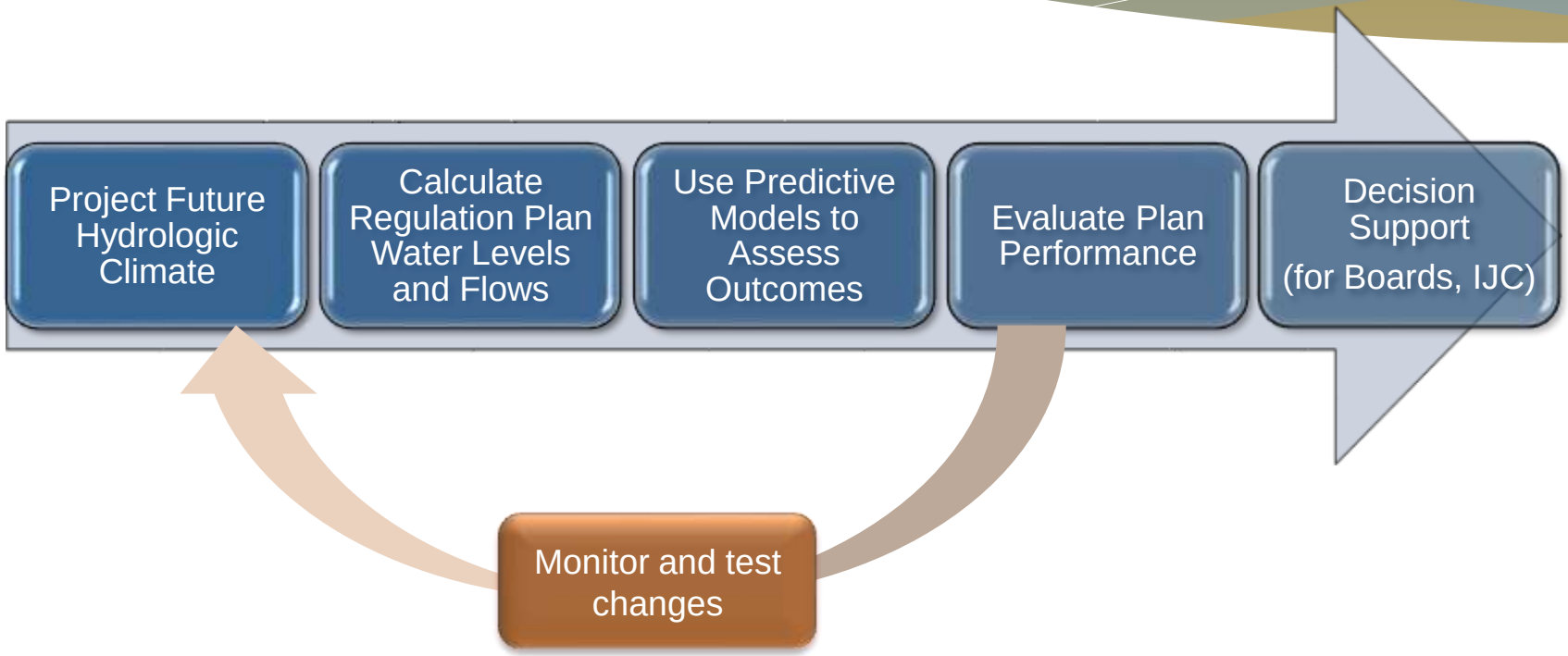
Is Plan 2014 to Blame for Lake and River Flooding?

BY BRIAN DWYER | JEFFERSON COUNTY

MAY 30, 2017 @9:35 PM

GLAIVI ADAPTIVE MANAGEMENT COMMITTEE

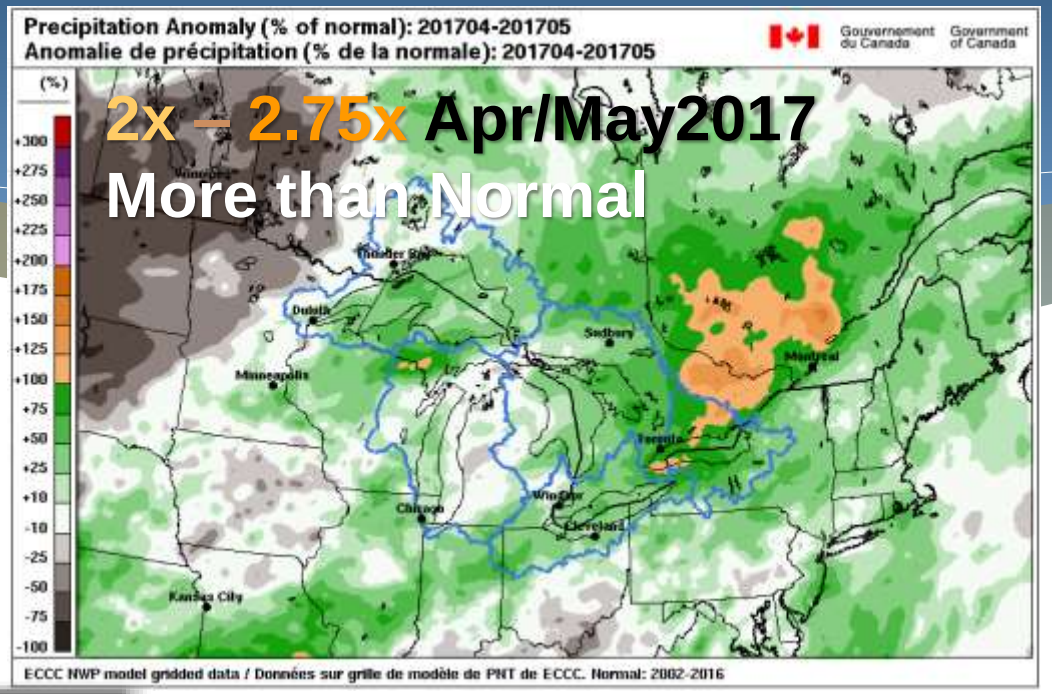
GLAM Adaptive Management Framework

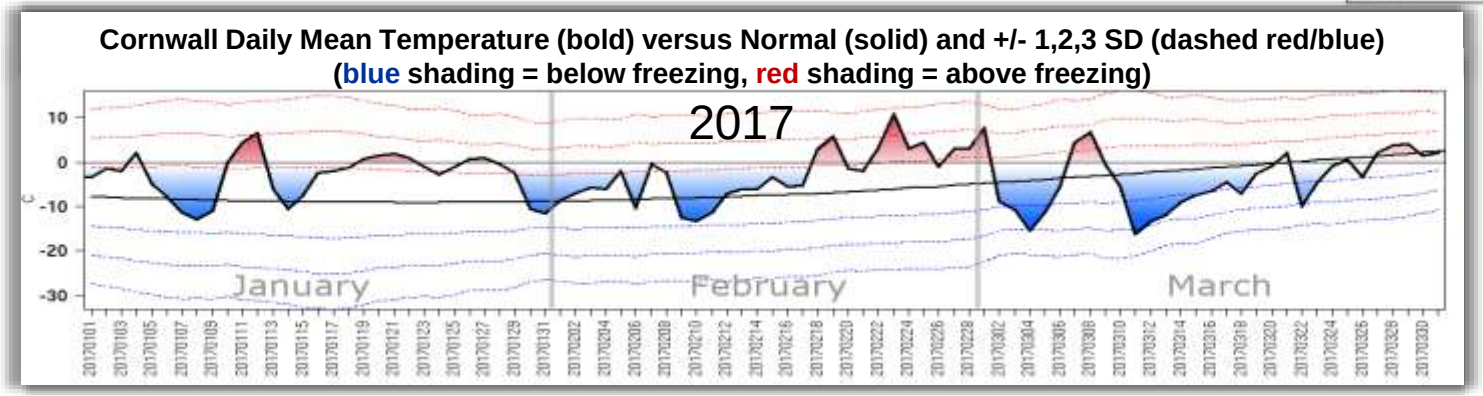


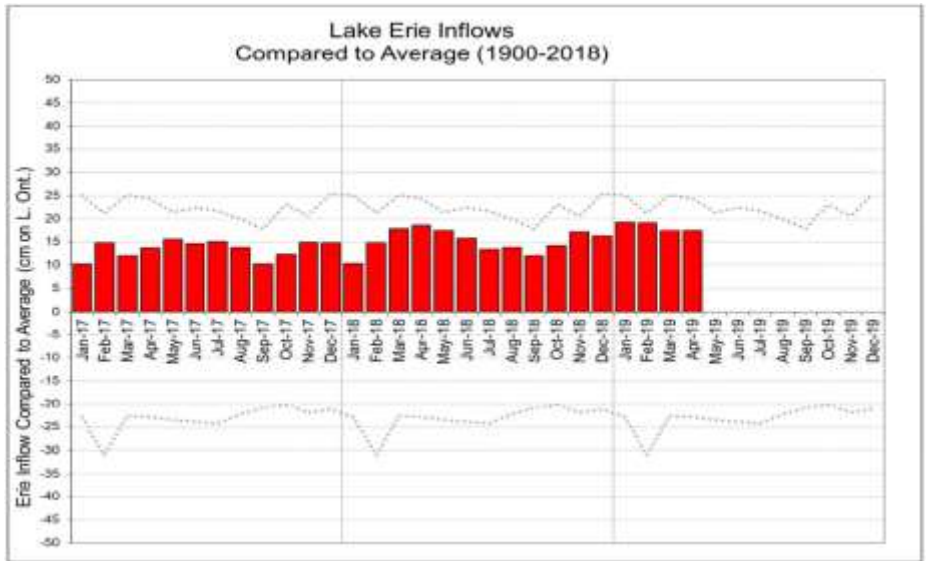
GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Understand the Causes/Drivers

- Extreme water levels a result of **the combination** of:
  - record breaking precipitation in April and May 2017 over **both** Lake Ontario basin and Ottawa River basin, similar in 2019
  - high inflows from Lake Erie since Jan 2017
  - unusual ice conditions in St. Lawrence River in 2017



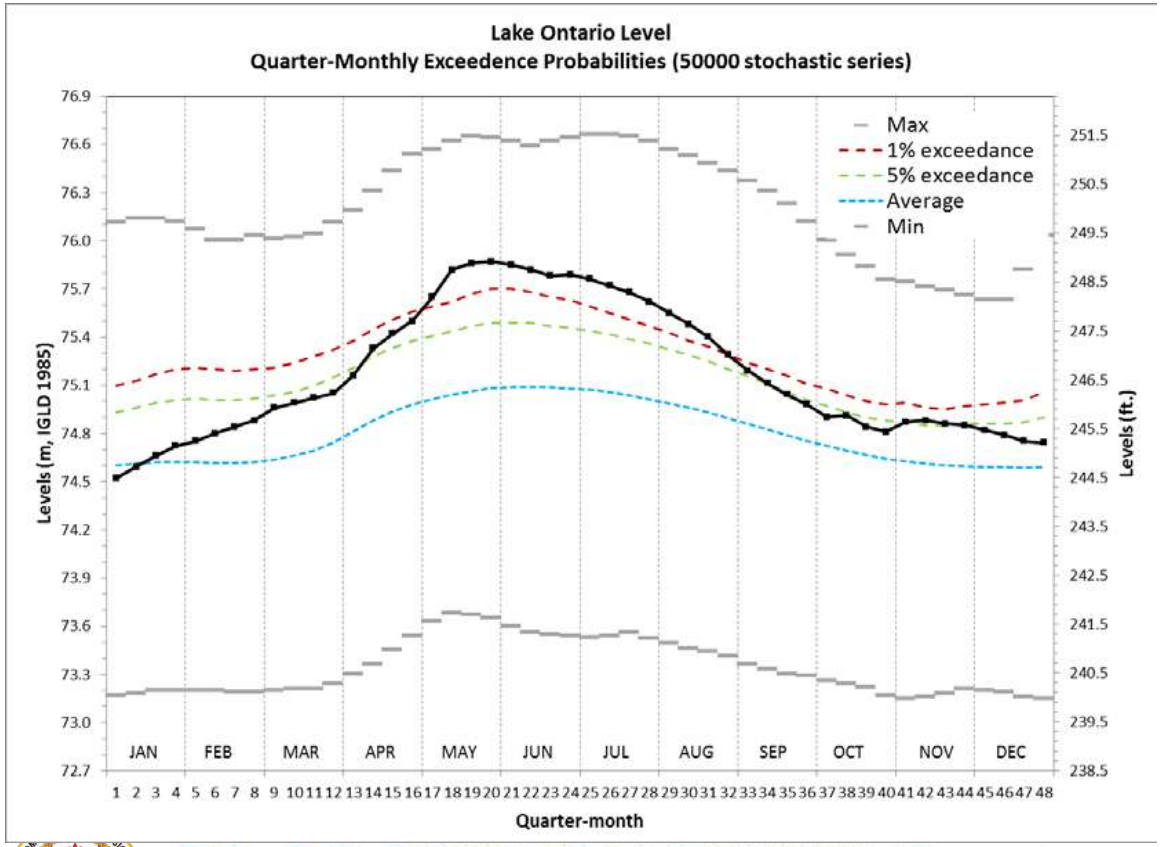




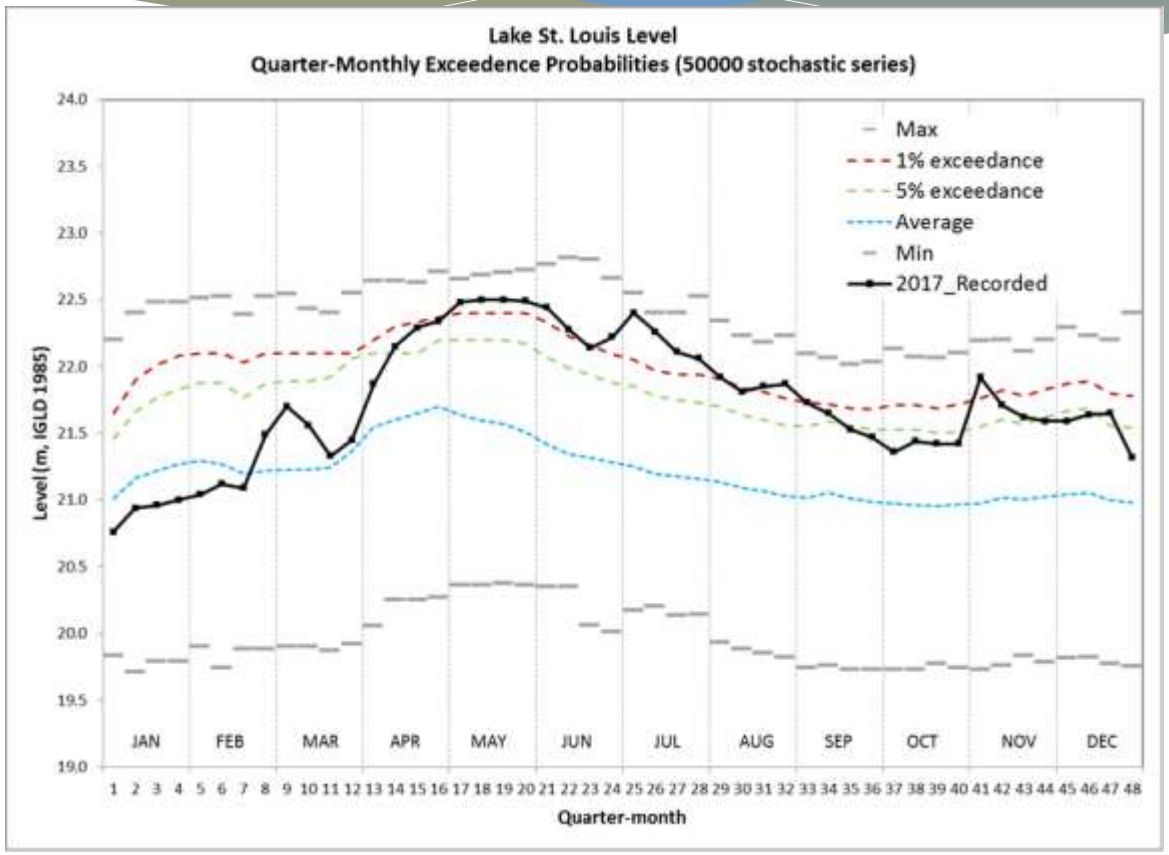
GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Are Levels within Ranges Used to Assess the Plan?

Lake Ontario

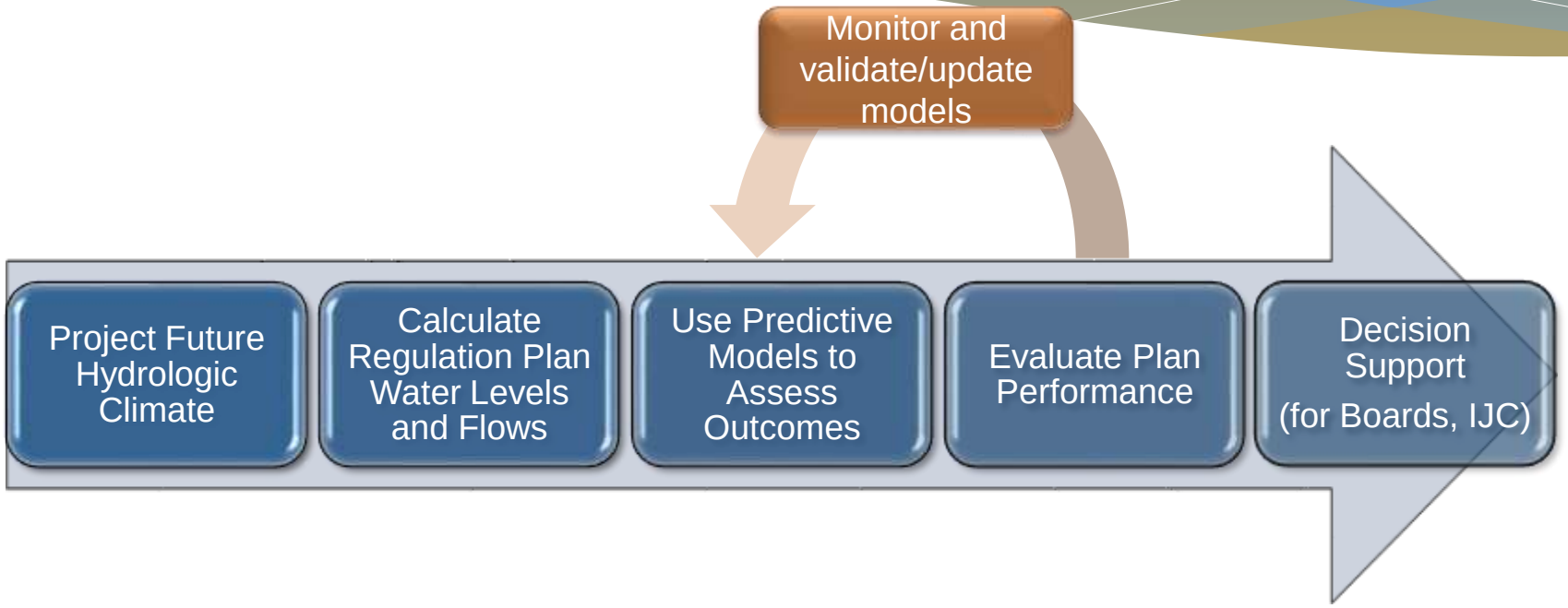


St. Lawrence River



GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

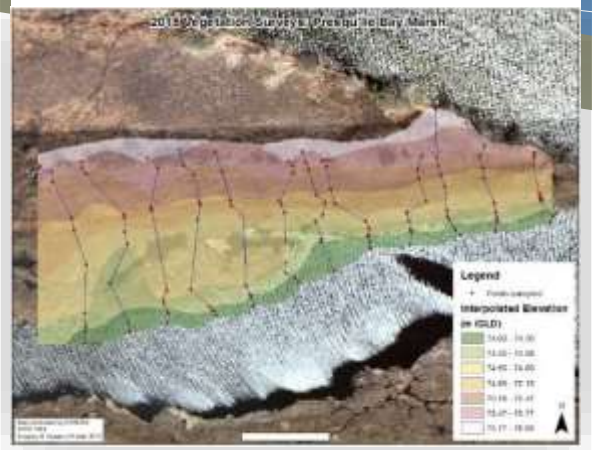
GLAM Framework



2017 Impact Assessment - Monitoring

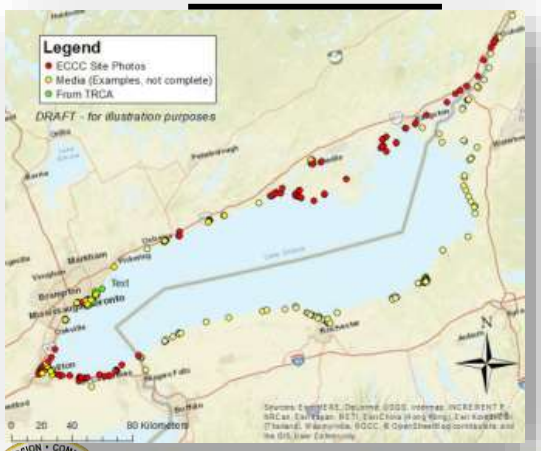
Aerial Imagery Analysis

Wetlands Monitoring



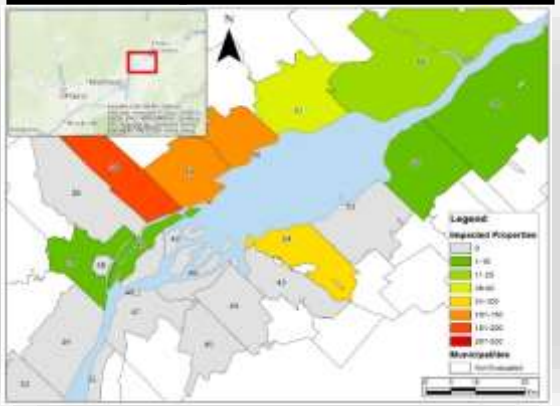
On-line Self Reporting Survey

Site Visits

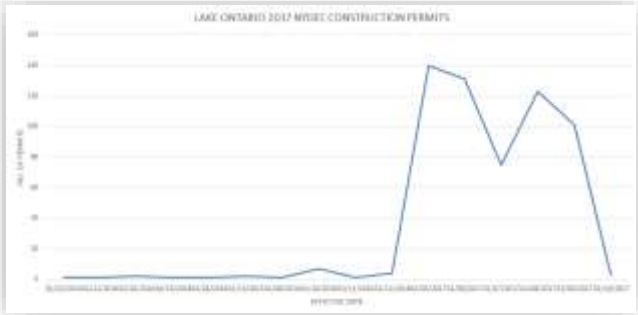


Media Review

Municipal Summaries



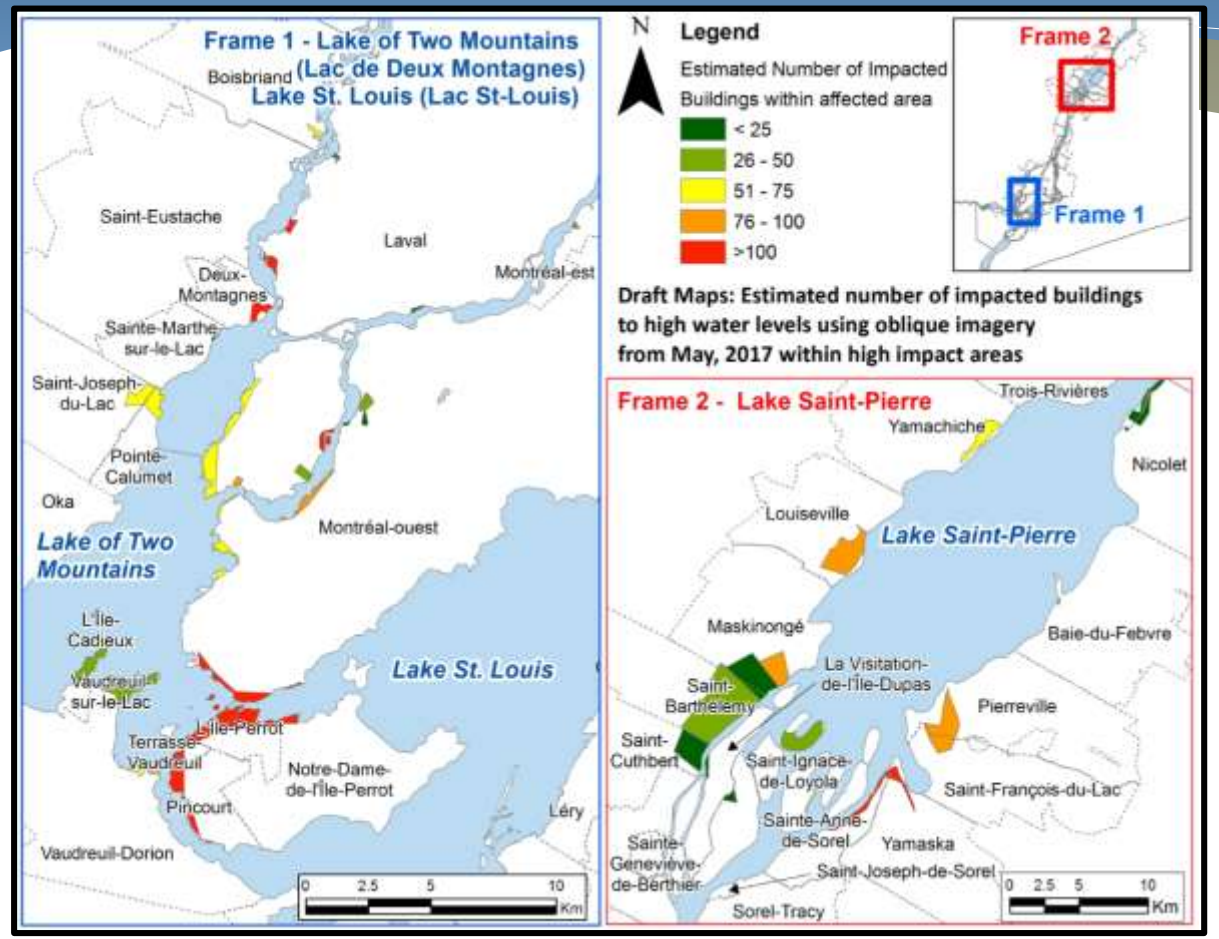
Provincial/State Data



GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Flooding Impacts

Oblique Imagery Review: Lower St. Lawrence River



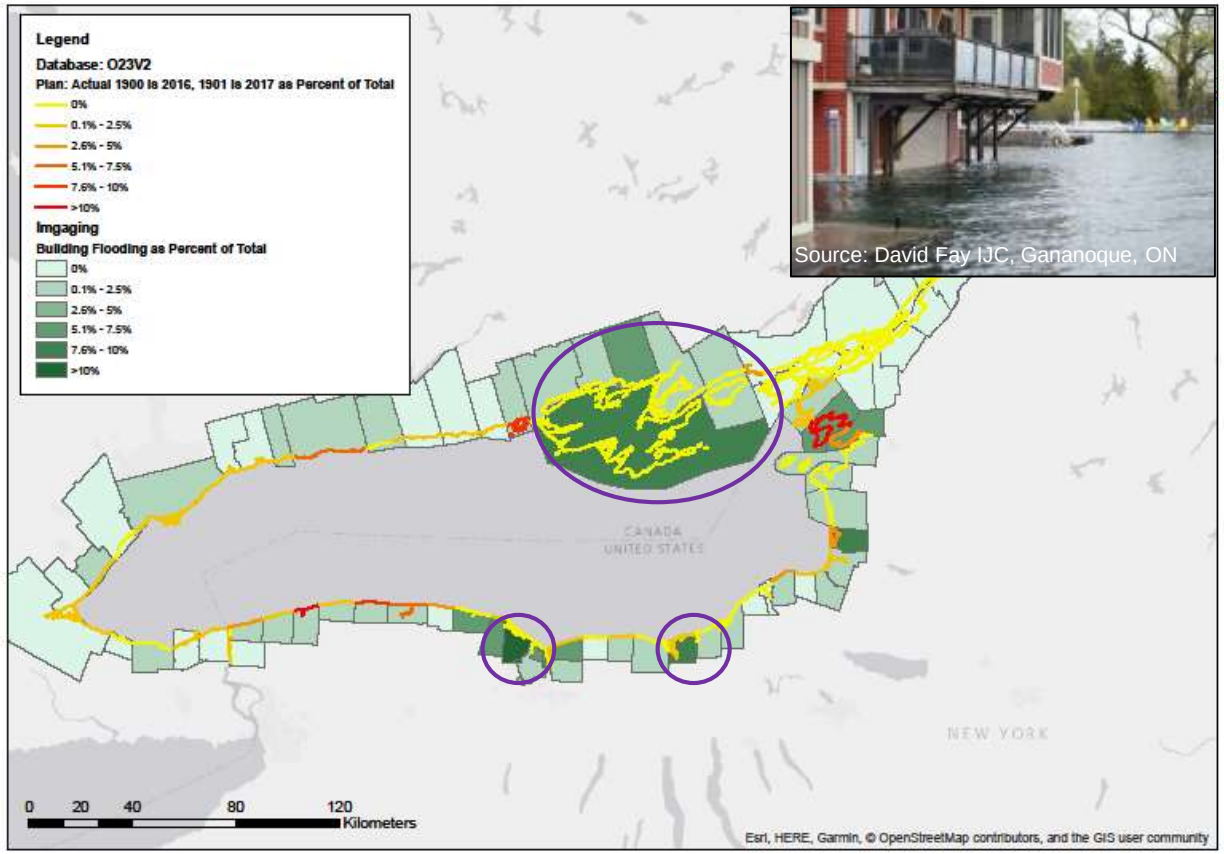
Pierrefonds neighbourhood in Montreal Quebec on 05/09/2017

Chenail-du-Moine area near Sorel, (Lake Sainte-Pierre) Quebec on 05/09/2017

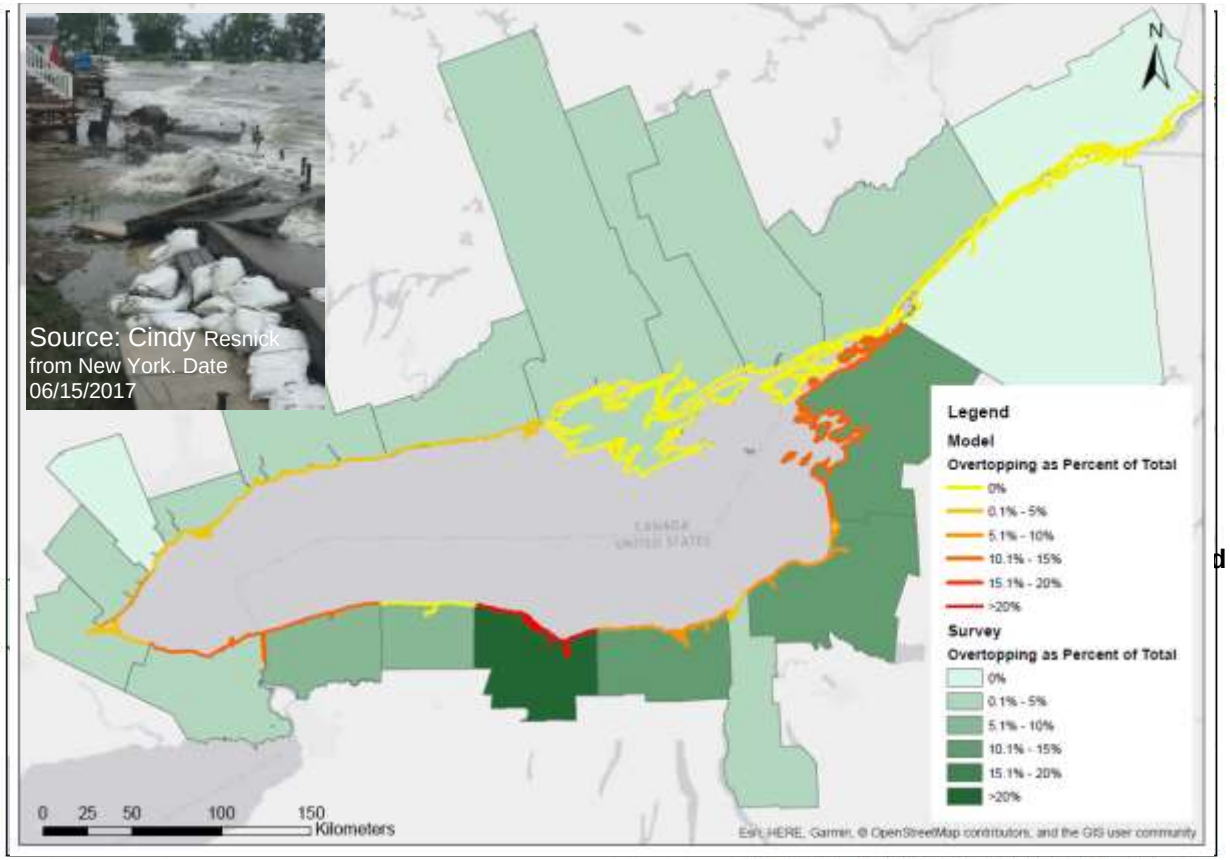
GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Comparing Monitoring Data to Modelled Outcomes to Validate/Update Models

Aerial Imagery Analysis v.s. Modelled Expected Flooding



Survey Responses v.s. Modelled Expected Overtopping

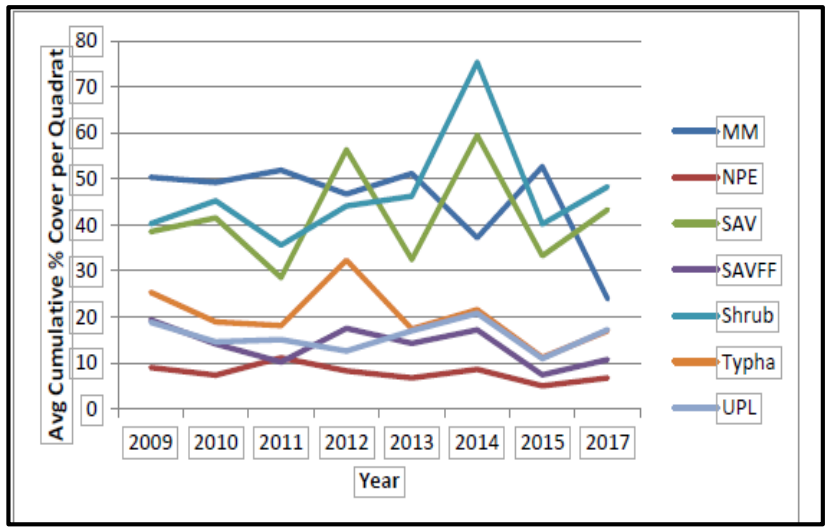


d by

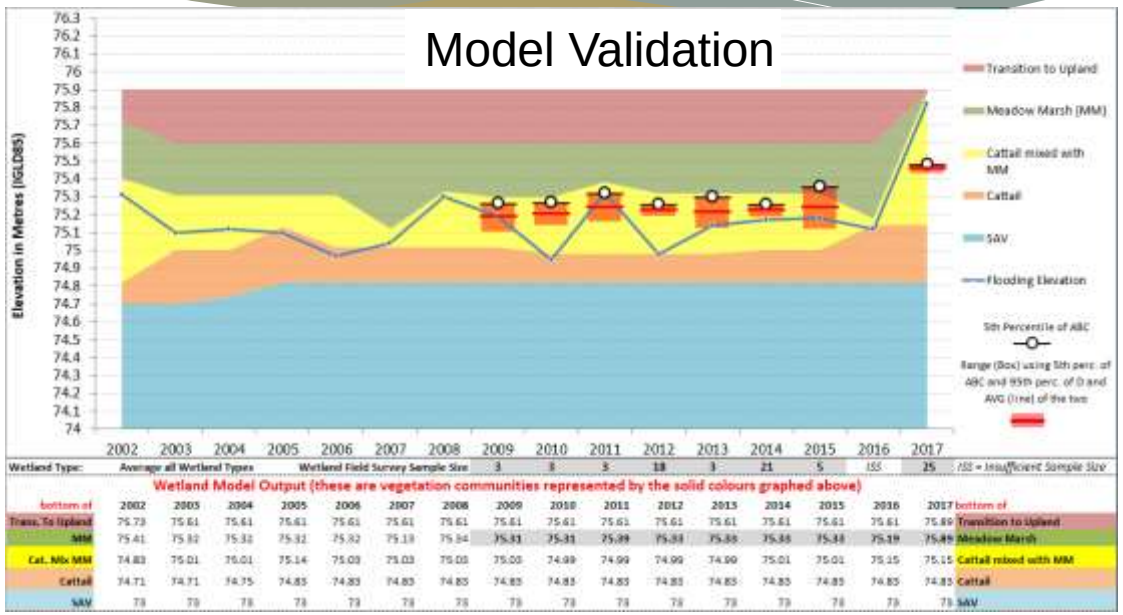
Wetlands Monitoring and Model Validation

Monitoring

Data Analysis



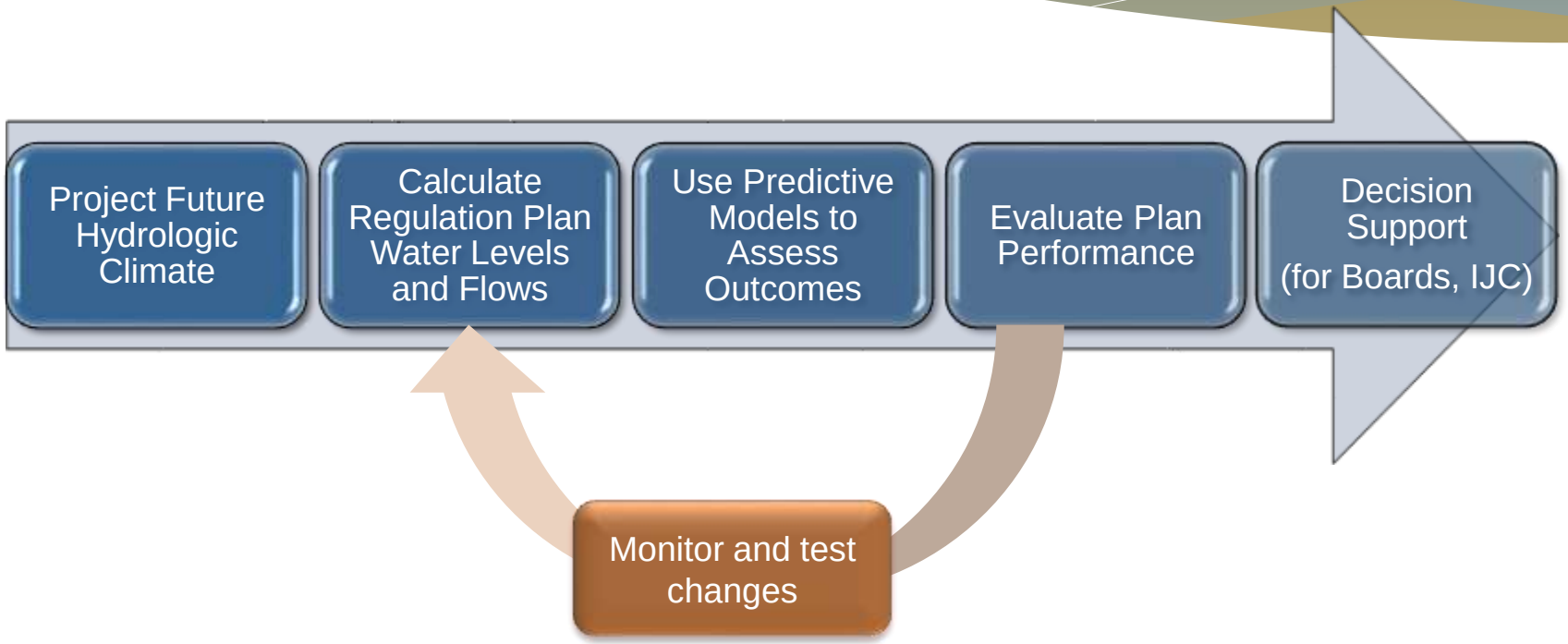
Model Validation



Assess whether expected modelled shifts in vegetative guild extent from 2017 water level conditions evident in monitored data from following years

GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

GLAM Adaptive Management Framework



GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Regulation Plan Review
Immediate Retrospective

- What can be learned from 2017 that could inform plan improvements?
  - Testing Plan 2014 under alternative hydroclimate conditions
  - Can regulation be improved in the future? Examine modifications to Plan Rules, limits and Trigger levels

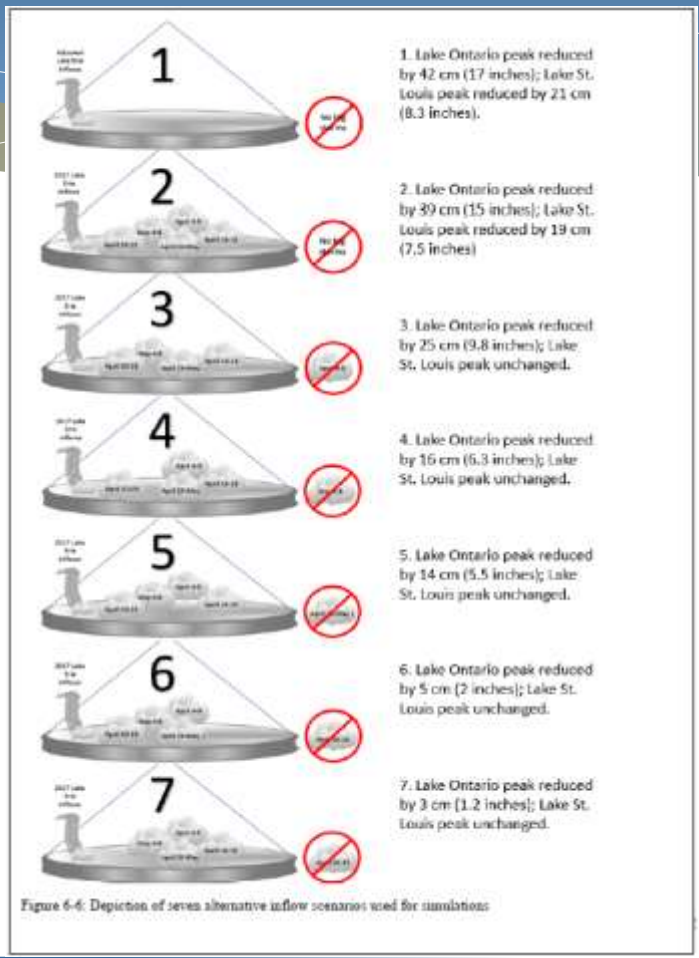
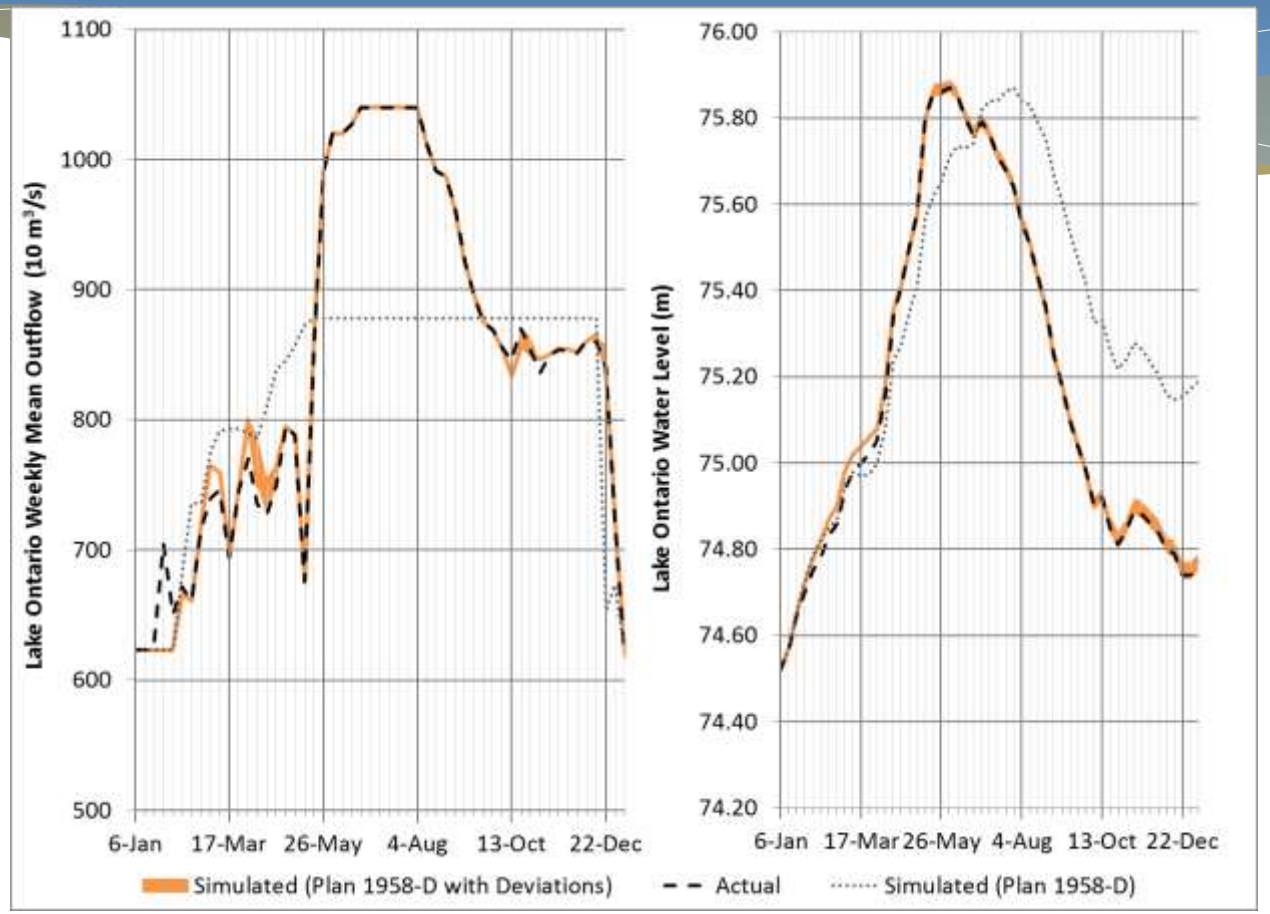


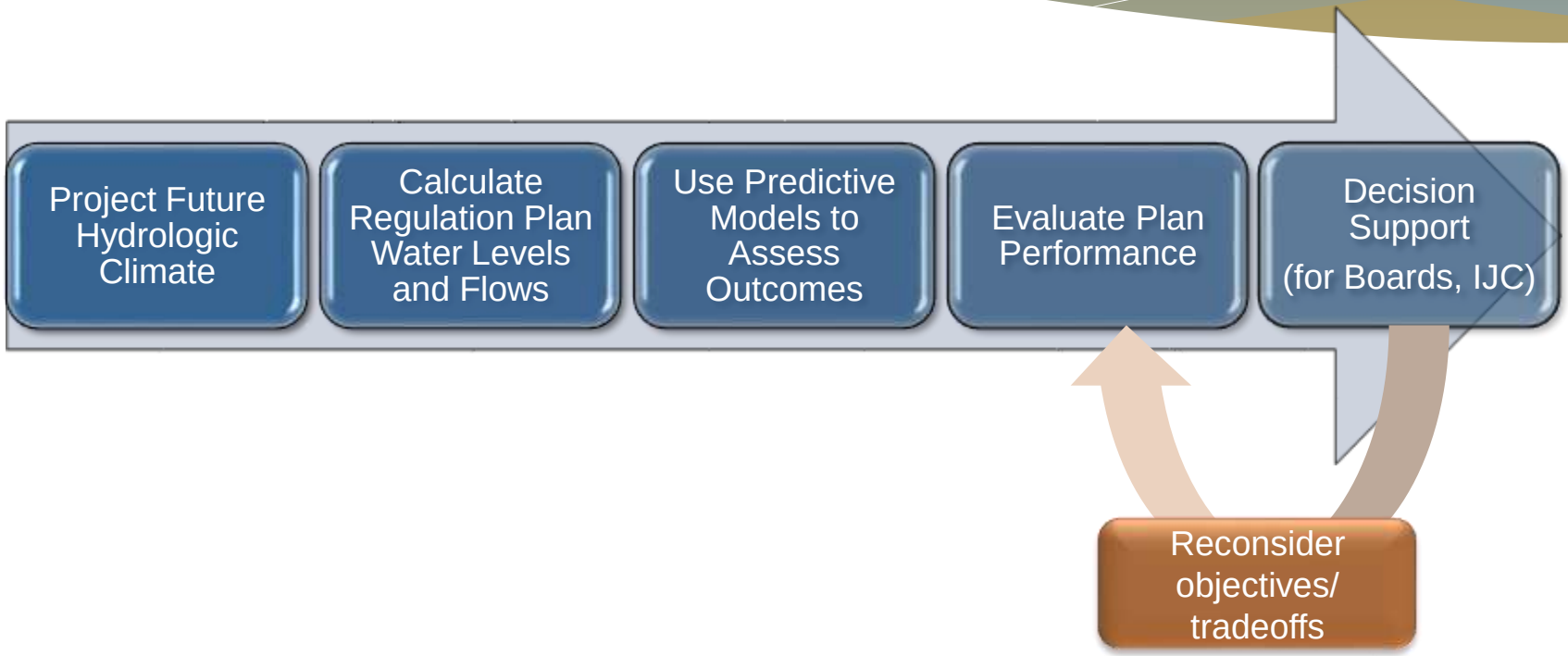
Figure 6-6: Depiction of seven alternative inflow scenarios used for simulations

Finding : 2017 had extraordinary conditions across Lake Ontario and the St. Lawrence River, but Plan 2014 did not contribute to record high water levels

- One year of analysis based on an extraordinary event
- Will continue to inform future analyses
- Provides an assessment of conditions never experienced before (only modelled)



GLAM Adaptive Management Framework



Decision Support

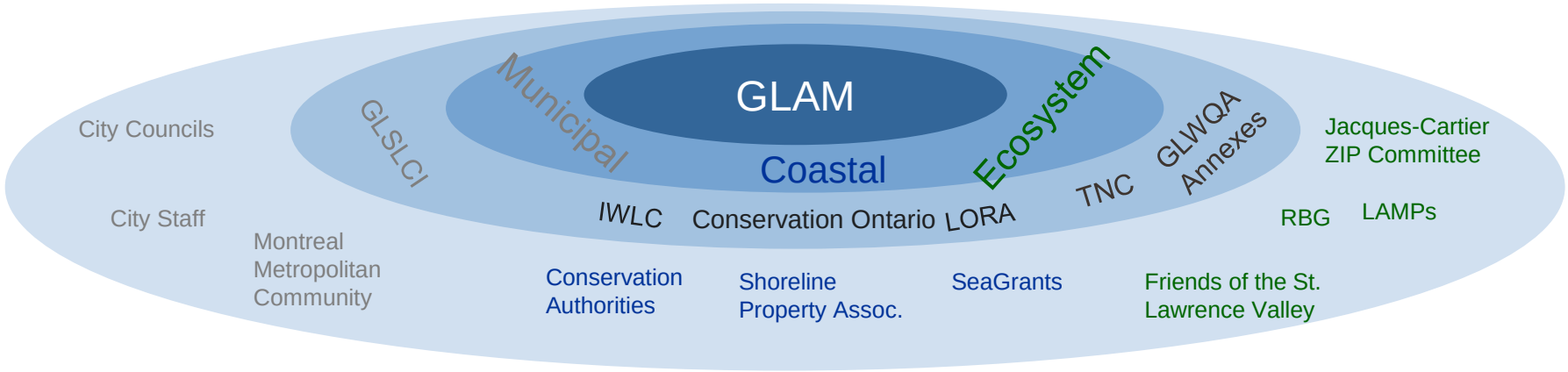
- GLAM not a decision maker, but assists Board and IJC in decision making process. Asking the right questions is essential!
- Plan assessment requires multi-year strategy

GLAM Interpretation of IJC Plan Objectives

- Consistent with Boundary Waters Treaty
- Net benefits (economic and ecosystem)
- No disproportionate losses (balance between interests and upstream/downstream)
- Robustness under a range of plausible future climate conditions

Communication, Outreach and Engagement

- Focus is on two way, peer to peer communication, not broadcasts (any broadcasts will come through Boards)
- GLAM to build circles of influence covering all interest categories

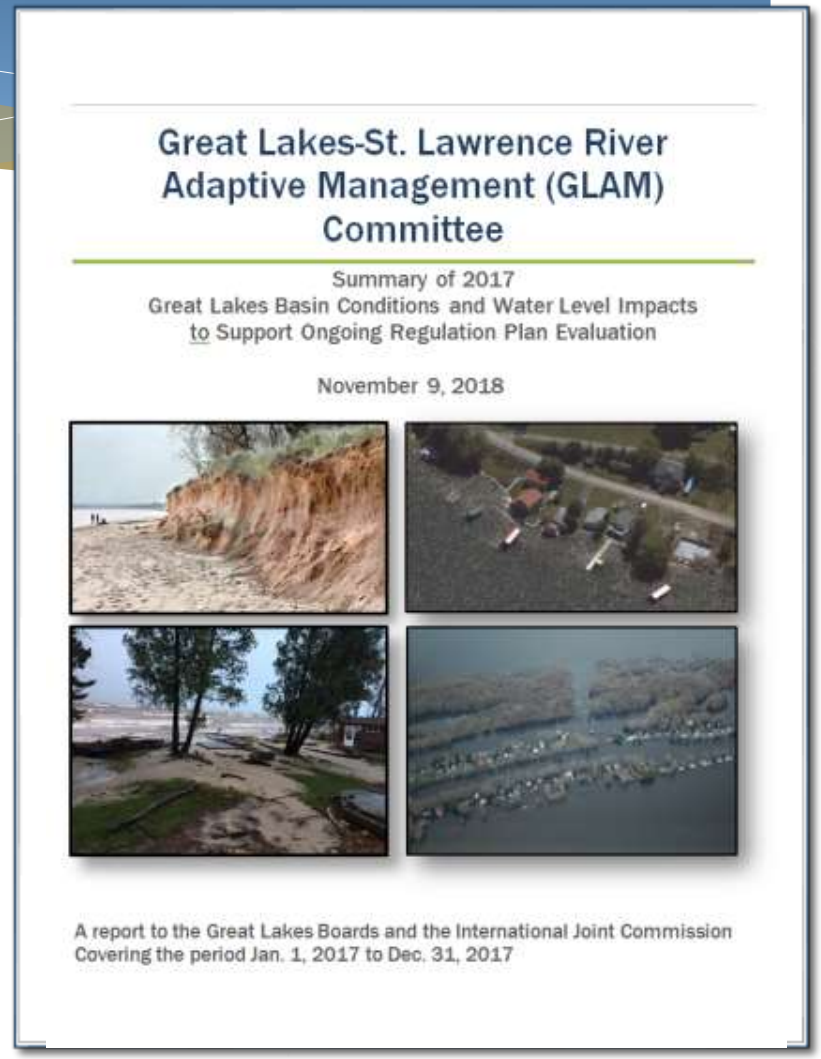


- GLAM is working to establish networks with research community
- Engagement with First Nations is through Boards and IJC

GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

Early Successes

1. **Strategy development**
2. **Monitoring changes**
   - Hydrology, operational issues, LO wetlands, shore protection
     - Impacts of 2017 high water (coastal, municipal/industrial water, marinas, shipping, hydropower, environment)
   - Leveraging activities/data of other agencies and funding sources
3. **Analysis** of Great Lakes hydrology (modelling, water balance uncertainty analysis)
   - Modelling (St Mary's River eco-hydraulic model)
4. **Outreach** to science community
5. **Forum** for coordination of work
6. **Reporting** to IJC, public


Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee

Summary of 2017
Great Lakes Basin Conditions and Water Level Impacts to Support Ongoing Regulation Plan Evaluation

November 9, 2018

A report to the Great Lakes Boards and the International Joint Commission
Covering the period Jan. 1, 2017 to Dec. 31, 2017

GLAM GREAT LAKES – ST. LAWRENCE RIVER ADAPTIVE MANAGEMENT COMMITTEE

12 Year Strategy Proposed Items

1. **Calculate Water levels and flows** [$$/yr]
   - Develop Water Supply Scenarios for plan evaluation (Great Lakes - St. Lawrence)
   - Refine routing models to calculate system levels and flows
   - Develop and test long-range forecasting in regulation plans
2. **Performance Indicators and predictive models** [$$$/yr]
   - A monitoring plan (prioritize performance indicators)
   - Performance indicator updates/development, model validation.
3. **Plan Formulation and Evaluation** [$/yr]
   - “Shared Vision Modelling” integration
   - Visualization tools
   - Plan development and testing
   - Assessing outcomes with the Boards and IJC
4. **Decision support** and trade-off analysis [$/yr]
5. **Peer review**/science engagement [$/yr]
6. **Stakeholder engagement** [$/yr]
7. **Information Management** [$/yr]
8. **Institutional Arrangements**

Lessons Learned

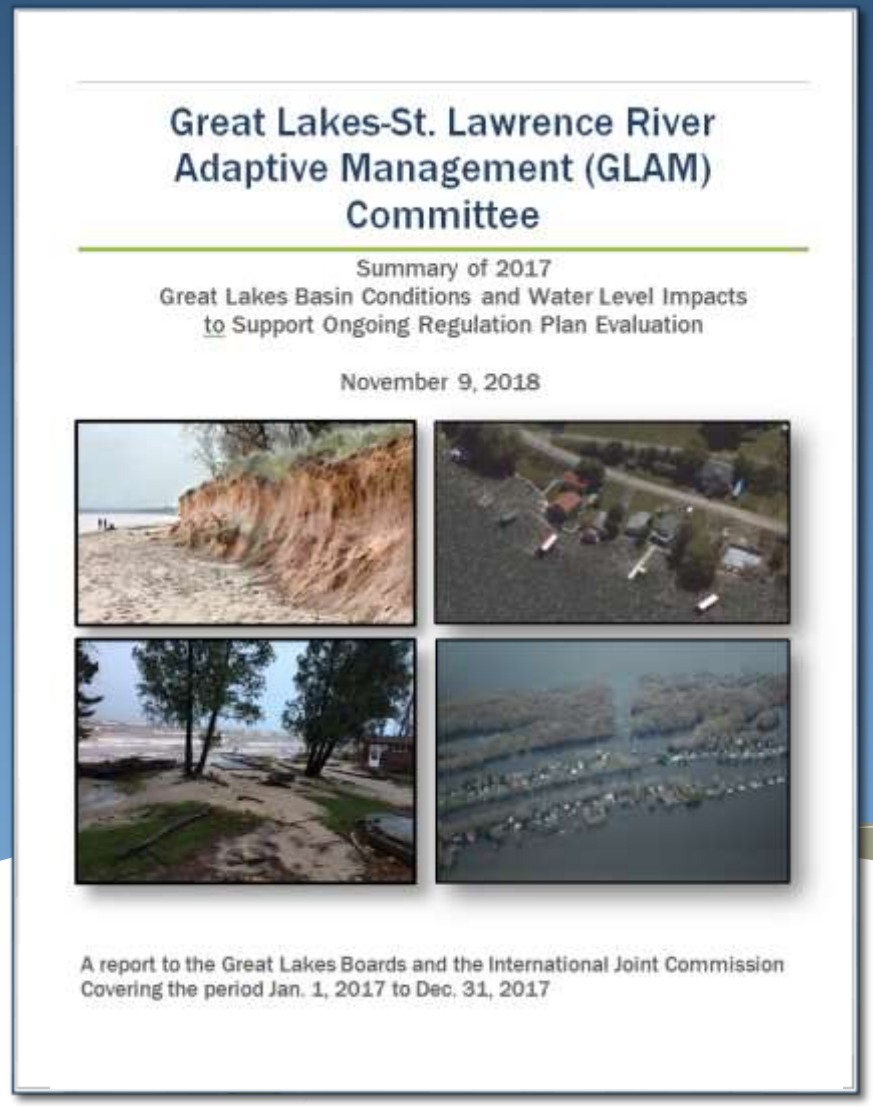
- Funding continues to be a challenge
- Monitoring plan has to consider event based requirements (need to be able to mobilize quickly)
- Connections with other agencies/organizations and stakeholders is essential and needs to be maintained
- On-going assessments need to be practical
- Adaptive management is not easy, but it is possible

GLAM Committee

The GLAM Committee is comprised of eight members from Canada and eight members from the U.S. with a broad diversity of expertise and interests

U.S.	Canada
U.S. Co-Chair – USACE (Vacant)	Wendy Leger, Canadian Co-Chair - ECCC
Don Zelazny – NYDEC	Jonathan Staples - OMNRF
David Hamilton – The Nature Conservancy	Patricia Clavet – MDDELCC (Quebec)
Kevin O'Donnell– USEPA	Sue Doka – DFO
NOAA (Vacant)	Frank Seglenieks – ECCC
Bill Werick – Consultant	Jean Morin – ECCC
Keith Koralewski – USACE	Rob Caldwell – ECCC
John Allis – USACE (acting co-chair)	Jacob Bruxer - ECCC
Bryce Carmichael, U.S. Secretary - USACE	Mike Shantz, Canadian Secretary - ECCC

For more information, please visit



Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee

Summary of 2017
Great Lakes Basin Conditions and Water Level Impacts to Support Ongoing Regulation Plan Evaluation

November 9, 2018

A report to the Great Lakes Boards and the International Joint Commission
Covering the period Jan. 1, 2017 to Dec. 31, 2017

http://ijc.org/en_/GLAM

https://ijc.org/en/glam/summary-2017-great-lakes-basin-conditions-and-water-level-impacts-support-ongoing-regulation