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

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3<sup>rd</sup> Semi-Annual Progress Report to the Great Lakes Boards and the  
International Joint Commission  
Covering the period January 1<sup>st</sup>, 2017 to August 31<sup>st</sup>, 2017

October 11<sup>th</sup>, 2017



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*Cover photo: High water conditions near Fair Haven, New York (upper right, photo credit: U.S. Army Corps of Engineers, June 2017) and Lake St. Pierre (lower right, photo credit: Transport Canada National Aerial Surveillance Program, May 2017)*

## GLAM Committee Membership

Blue text identifies other International Joint Commission Board and Committee affiliations

United States	Canada
<p>Arun Heer, Co-Chair            U.S. Army Corps of Engineers – Great Lakes and Ohio River Division  <a href="#">U.S. Secretary, International Lake Ontario – St. Lawrence River Board, International Lake Superior Board of Control</a></p>	<p>Wendy Leger, Co-Chair            Environment and Climate Change Canada</p>
<p>Don Zelazny            New York Department of Environmental Conservation</p>	<p>Jonathan Staples            Ontario Ministry of Natural Resources and Forestry  <a href="#">International Niagara Working Committee Member</a></p>
<p>David Hamilton            The Nature Conservancy - Michigan</p>	<p>Patricia Clavet            Ministry of Sustainable Development, Environment and Climate Change  <a href="#">International Lake Ontario - St. Lawrence River Board Member</a></p>
<p>Fred Luckey            U.S. Environmental Protection Agency</p>	<p>Susan Doka            Fisheries and Oceans Canada</p>
<p>Drew Gronewold            Great Lakes Environmental Research Laboratory - NOAA</p>	<p>Frank Seglenieks            Environment and Climate Change Canada  <a href="#">International Niagara Working Committee Co-Chair</a></p>
<p>Bill Werick</p>	<p>Jean Morin            Environment and Climate Change Canada</p>
<p>Keith Koralewski            U.S. Army Corps of Engineers – Buffalo District  <a href="#">International Lake Ontario - St. Lawrence River Board Alternate Regulation Representative</a></p>	<p>Rob Caldwell            Environment and Climate Change Canada  <a href="#">International Lake Ontario - St. Lawrence River Board Regulation Representative</a></p>
<p>John Allis            U.S. Army Corps of Engineers – Detroit District  <a href="#">International Lake Superior Board of Control Alternate Regulation Representative</a></p>	<p>Jacob Bruxer            Environment and Climate Change Canada  <a href="#">International Lake Superior Board of Control Regulation Representative</a></p>
<p><i>Bryce Carmichael, Co-Secretary</i>            U.S. Army Corps of Engineers – Great Lakes and Ohio River Division  <a href="#">U.S. Secretary, International Niagara Board of Control</a></p>	<p><i>Mike Shantz, Co-Secretary</i>            Environment and Climate Change Canada</p>

**NOTE:** The Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee was established by the International Joint Commission (IJC) and is comprised of an equal number of members from the United States and Canada. Members of the Committee serve at the pleasure of the IJC and are expected to be full participants in all activities of the Committee. As with all IJC Boards and Committees, the GLAM Committee members serve in their personal and professional capacity, not as a representative of their agencies or employers.

## Executive Summary

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The International Joint Commission (IJC) established the Great Lakes – St. Lawrence Adaptive Management (GLAM) Committee through an IJC directive on January 16, 2015, to provide monitoring and evaluation of regulation plans in support of the three Great Lakes-St. Lawrence River Water Management Boards (Boards). This report is the third semi-annual report to the IJC and the Boards and it highlights the work completed between January 1 and August 31, 2017 as the GLAM Committee continued to implement its 2017 work plan.

The committee's 2017 work plan, covering the period of October 1<sup>st</sup>, 2016 to September 31<sup>st</sup>, 2017, was prepared to align with its preliminary strategic framework which separates activities into two broad categories. The Plan Review and Evaluation category represents the primary hydroclimate, impact assessment, and plan review functions of the committee while the Oversight and Administration category covers the overarching functions required to keep the committee on track.

Significant progress was made within the Plan Review and Evaluation category during the reporting period. The Hydroclimate, Impact Assessment, and Plan Review Working Groups spent considerable time developing the guidance and direction for the routine baseline activities which will be integrated into the upcoming 2018 work plan. There was also good progress on a range of targeted studies. The Hydroclimate Working Group led projects to improve understanding and characterization of the water balance within the Great Lakes Basin. The Impact Assessment Working Group continued to make progress validating and improving existing tools used to simulate the potential impacts and benefits of alternative water level management strategies as well as developing new tools which are needed to support longer-term needs of the Plan Review Working Group. The committee also made good progress on a range of oversight and administration activities including finalizing its first triennial report which was presented to the Commission in May, 2017 and coordination with various aspects of the Great Lakes Water Quality Agreement including a presentation to the Great Lakes Executive Committee in June 2017.

High water levels throughout the Lake Ontario – St. Lawrence River basin during the reporting period have received particular attention from the committee. This attention is reflected in the development of the draft 2018 work plan where further emphasis will be placed on acquiring information to support validating and improving existing evaluation tools based on observations from the extreme conditions.

Much of the progress made by the committee during the reporting period was supported through in-kind agency contributions. As well, a number of tasks received direct support through the International Watersheds Initiative (IWI). The committee appreciates the support of the both the IJC and contributing agencies and continues to look at options for balancing expectations with available resources.

## **1.0 Introduction**

A directive signed January 16, 2015 by the International Joint Commission (IJC) established the Great Lakes – St. Lawrence Adaptive Management (GLAM) Committee to undertake monitoring and assessment of Lake Superior, Niagara River, and St. Lawrence River Boards' regulation plans and activities, as well as coordinate with the Water Quality and Science Advisory Boards on issues of common interest. The GLAM Committee (committee) is comprised of a Canadian and U.S. co-chair, as well as members from government agencies, the Great Lakes Water Management Boards (Boards), and technical experts. The committee also previously appointed a Canadian and U.S. secretary to provide ongoing support.

The overall objective of the GLAM Committee is to provide information to the Boards and the IJC while advising them on the effects that the control structures approved in the IJC's Orders of Approval and directives have on levels and flows in boundary waters. GLAM also captures the benefits and impacts that the regulation plans have on the affected interests and communicates this to the Boards and the IJC. This includes the on-going review and evaluation of regulation plans related to:

- a) the effectiveness of the existing regulation plans;
- b) examining how the system may be changing over time and whether any modifications to the regulation plan(s) may be warranted; and
- c) any other questions requested by the Boards and/or IJC that may affect the Boards' water management decisions over the long-term.

The GLAM Committee was initiated to establish a structured, iterative process of robust evaluation in the face of uncertainty, with an aim to reduce uncertainty over time via system monitoring and feedback to the decision-making framework based on knowledge gained.

The committee finalized its first triennial report in the spring of 2017 covering the period up to December 31<sup>st</sup>, 2016. As a result, it did not prepare a semi-annual report at that time. This semi-annual report will highlight GLAM Committee progress and accomplishments for the subsequent reporting period of January 1 to September 30, 2017.

## **2.0 Work Plan Progress**

The GLAM Committee's annual work plans cover the October 1 to September 30 time period, consistent with the U.S. fiscal year. This semi-annual report includes items from the Fiscal Year 17 (FY17) work plan (starting October 1, 2016). The GLAM Committee's FY17 work plan was approved by the IJC in October 2016.

The core technical work within the Plan Review and Evaluation Section is organized using a three-tiered framework including:

Tier 1 baseline foundational analyses;

Tier 2 exploratory investigations; and  
Tier 3 strategic improvement studies.

Only tier 1 and 2 activities are included in the FY17 work plan. The second section of the work plan deals with overarching oversight and administration components.

GLAM Committee activities are supported in large part by in-kind agency contributions as well as project specific support through the International Watersheds Initiative (IWI). Through these resources, considerable progress was made during the reporting period towards completing tasks from the FY17 work plan. Highlights of progress are discussed below and task-specific details are provided in *Appendix A*.

## **2.1 Plan review and evaluation**

Much of the technical work outlined in the GLAM Committee's first two work plans occurs within three overarching themes including hydroclimate science, impact assessment, and plan review. These activities are led by separate working groups and progress on specific tasks is outlined in the following sub-sections.

### **2.1.1 Hydroclimate working group**

The need for a routine, annual baseline assessment was outlined as part of the GLAM Committee's strategic framework for the hydroclimate, impact assessment, and plan review activities as part of their Tier 1 strategy. For the Hydroclimate Working Group, the intent is to complement and enhance information that would already be provided to the Boards through the regulation representative offices. During the reporting period, the primary product developed through this effort was a draft outline for the hydroclimate section of the 2017 annual report that will be prepared early in 2018. The outline identifies the critical areas that will be reported on annually. Given the extreme conditions observed in 2017, it is expected that the hydroclimate review may be more extensive this year than in subsequent years, although the primary topics will be the same. They include a review of key hydrological variables, climatological drivers such as El Nino, forecasting accuracy and skill, and historical context.

The FY17 work plan included two Tier 2 hydroclimate tasks, both of which were supported through the IWI. The first project was led by Dr. Fortin of Environment and Climate Change Canada and is part of a multi-year effort to improve understanding of water supply components and particularly over-lake precipitation in transboundary watersheds including the Great Lakes basin. During the reporting period, Dr. Fortin and his team developed an initial 5-year hindcast dataset for water balance components in the Great Lakes basin at a 50 km and 15 km scale and started developing the procedures necessary to develop a full 30 year dataset to be included in the FY18 work plan. When completed, the full hindcast dataset will allow further understanding of the contributions of key water supply components in the Great Lakes basin including precipitation, evaporation, and runoff and will allow further assessment of how their relative

contributions change over time. The work also complements the second hydroclimate task led by Dr. Gronewold from the National Oceanic and Atmospheric Administration. Dr. Gronewold and his team are developing a statistical water balance model for the Great Lakes basin which will allow a better understanding of uncertainty in various water balance components. Good progress has been made during this reporting period with significant advancements in reducing the model computation time along with application of the model across all of the Great Lakes (the original version was only applied to Lakes Superior and Michigan-Huron, and only to data from 2005 through 2014). Work is progressing on extending the model back to 1950 while continuing to improve model efficiency and reduce computation time.

Both of the tier 2 projects, along with the tier 1 annual hydroclimate review support the GLAM Committee's longer-term requirement in the Directive to consider whether future water supplies will be different from those used to test the current management of water levels and flows.

### ***2.1.2 Impact assessment working group***

The impact assessment activities focus on ensuring that the outcomes of water level and flow scenarios affecting the various interests are measurable and assessable. More specifically, they support the GLAM Committee in understanding how accurately the impacts on these groups are represented by current data and models used in evaluating the management of levels and flows and whether conditions of the system are changing over time. Just like the Hydroclimate Working Group, the Impact Assessment Working Group worked through requirements for the routine, annual foundational analyses required to understand and maintain knowledge of existing performance indicators during the reporting period. This included an Impact Assessment Working Group meeting on February 6<sup>th</sup> and 7<sup>th</sup>, 2017 in Buffalo, NY, and monthly conference calls. Working Group members spent considerable time becoming familiar with existing models and also supported the development of a draft annual report outline highlighting critical topics including the identification of information to validate and support performance indicator review and general surveillance to identify water level and flow impacts that may not be captured by existing performance indicators.

The FY17 work plan had a number of Tier 2 impact assessment tasks. For the Lake Ontario – St. Lawrence River System, considerable effort has been placed on looking at ways to validate the meadow marsh performance indicator through comparison with vegetation information gathered through monitoring efforts over the past number of years. A draft progress report was prepared and a subject matter expert workshop was held on April 3-4, 2017 in Burlington, ON with over 30 invited experts to discuss the initial findings and determine appropriate next steps. There was fairly good consensus, but not 100%, that the field sampling validates the performance of the IERM model under the study period (2009-2015). There was agreement that the validation period must extend to include a time series with more extreme water levels than were experienced during the 2009-2015 sampling period. The IJC also hired an external expert to undertake a peer review of the draft report and workshop. These findings were provided to the project team over the summer and will be reviewed and responded to in the

fall. Through the IWI, and in keeping with recommendations from the experts workshop, additional wetland monitoring is currently taking place (Aug-Sept, 2017) on both the U.S. and Canadian shoreline of Lake Ontario. This new monitoring information will be critical to the ongoing model evaluation process given the record high water levels this past summer.

In addition to the wetland monitoring supporting the performance indicator review, two additional IWI projects were completed in the spring of 2017 related to the Lake Ontario – St. Lawrence River system. The first project compared the distribution of Common Reed (*Phragmites australis* spp.) in a set of coastal wetlands with varying degrees of hydrologic connectivity to Lake Ontario water levels to determine if there were differences in distribution. That exploratory investigation, which was somewhat inconclusive in terms of water level impacts, will support the committee’s surveillance efforts and further examination of whether a performance indicator relating Common Reed to changing Lake Ontario water levels is needed/possible moving forward. In addition, the coding for the lower St. Lawrence River Integrated Ecological Response Model (IERM) was updated to allow future use and application in the plan review and evaluation process.

The FY17 work plan also included ongoing work carried over from the FY16 work plan to look at testing assumptions within the Flooding and Erosion Prediction System (FEPS) related to shore protection crest elevations for Lake Ontario. ECCC staff worked with the updated FEPS database previously provided through the U.S. Army Corps of Engineers (USACE) based on new shore protection elevation information obtained through post-LOSLR field surveys. Preliminary runs of the FEPS model were completed with the new database to compare outcomes.

For Lake Superior, the primary Tier 2 progress for the Impact Assessment Working Group was the development of a 2-dimensional IERM model for the rapids section of the St. Marys River. This was a collaborative project between the USACE in Detroit and ECCC in Quebec City and was supported through the IWI. The model will allow for comparison of gate operations for the compensating works on the St. Marys River above the rapids. The preliminary model has performance indicators for four Habitat Suitability Indices (HSI) including Walleye, Lake Whitefish, Lake Sturgeon, and Sea Lamprey, and the hope is to continue refining the model and adding additional indicators as new validation data becomes available.

### **2.1.3 Plan review working group**

When the plan review tasks were identified within the FY17 work plan, the focus was on the operations by the International Lake Superior Board of Control of the gates of the compensating works in the St. Marys River. This included a closer look at side channel capacity and partially open gate settings for the implementation of Plan 2012 and the potential benefits/impacts. Initial progress has been made on coding and model improvements necessary to allow modelling of alternative operational scenarios, although this process was more challenging than expected and has taken longer than anticipated. During that process, it became clear that further performance indicators were required within the rapids area and that led to the development of the IERM2D model discussed previously. Now that the new model is

available for use, it will be possible to begin simulations to test alternatives. This work will be carried over to the FY18 work plan.

Particular attention was also placed on the development of the annual routine procedures of the plan review process. As with the Hydroclimate and Impact Assessment Working Groups, the primary outcome was the development of a draft annual report outline which includes a plan review section. The proposed outline includes sensitivity analysis regarding observed conditions for the year being reviewed. Given this is the first year of operation of Plan 2014 and there has been record high water levels on Lake Ontario and the St. Lawrence River, this year's plan review will pose a considerable challenge in establishing the appropriate annual review processes. Initially, it is expected that the focus will be on water level and flow simulations. Over time, it is desirable for the annual simulations to also include outcomes from the performance indicator models.

## **2.2 Oversight and administration**

Activities within the Oversight and Administration category include the overarching functions required to keep the committee on track. This includes ongoing secretariat functions and reporting, communications and engagement, and information management. During the reporting period, the committee prepared its first comprehensive triennial progress report to the IJC, a requirement outlined in the 2015 Directive. The report, covering the period ending December 31<sup>st</sup>, 2016, was reviewed and approved by the three Boards prior to the spring semi-annual meeting and subsequently approved by the IJC in May. Translation was recently completed and will be posted to the GLAM Committee website once reviewed by francophone GLAM members. The triennial report included an overview of the committee's mid-term strategy, another task identified in the FY17 work plan.

The committee continued efforts to link with the activities of the Great Lakes Water Quality Agreement. In particular, the GLAM committee co-chairs continue to stay connected with both the Water Quality Board and the Science Advisory Board through IJC sponsored co-chair meetings. In addition, the GLAM committee co-chairs presented to the Great Lakes Executive Committee (GLEC) in June 2017 in Chicago as a way to promote potential collaboration where appropriate.

Communications remain an important, yet challenging, component of GLAM Committee activities. Since January, GLAM co-chairs and secretaries have participated regularly as part of the International Lake Ontario – St. Lawrence River Board's communications committee. This has helped ensure appropriate messaging regarding the committee, particularly in the context of recent high water conditions in the Lake Ontario and St. Lawrence River basins. GLAM members continue to make targeted presentations to various groups on background related to the committee and directive with the objective of supporting long-term collaboration. For example, presentations were made to Le Regroupement des usagers du Saint-Laurent (RUSL), the Province of Ontario's Surface Water Monitoring Centre, and various Ontario Conservation

Authorities throughout the reporting period. As well, a presentation was made at the annual technical conferences of the Canadian Water Resources Association. The GLAM Committee continues to look for ways to connect and engage with partners to support its long-term objectives, in particular as they relate to the impact assessment activities and the model validation effort.

### **3.0 2017 High Water Levels and Impact on Current and Future Work**

The extreme high water levels on 2017 in the Lake Ontario – St. Lawrence River system were unforeseen when the FY17 work plan was developed. The unique conditions required considerable attention from the regulation representative offices of the USACE and ECCO that support the newly appointed International Lake Ontario – St. Lawrence River Board. As well, there were observed water level and flow impacts to a range of stakeholders and impact areas within the system. Capturing these impacts is critical to support long-term efforts to validate and improve existing tools to evaluate regulation performance. While the long-term goal of the GLAM Committee is to routinely capture water level benefits and impacts to support regulation plan review, extreme conditions such as those observed this year are particularly important as they allow for observations during conditions that could only be simulated when developing the existing plan evaluation models.

In response to the high water levels, the GLAM Committee has prioritized a number of activities during the reporting period that will be added to the FY18 work plan covering the period of October 1, 2017 to September 30, 2018. All of these additional activities initiated during the reporting period broadly fall within the Tier 1 framework outlined in the existing mid-term strategy which are directed at improving our understanding of existing hydroclimate, impact assessment and regulation conditions to help describe regulation plan performance and how the system may be changing over time. Specifically, the GLAM Committee has been identifying a range of options to document high water impacts so the data can be used for future model validation and plan review activities. Through this effort, the committee will have access to a series of oblique photographs of the Lake Ontario and St. Lawrence River shoreline acquired during the high water period. As well, efforts are underway to identify what impact information is being collected by groups and agencies that are not directly affiliated with the GLAM Committee to see how that information may ultimately support the model validation and plan review process. Given limited resources of the committee, it is important to leverage activities of other agencies and groups where possible and identify priority gaps that need to be filled directly by the committee. For example, the New York Sea Grant and Cornell University have undertaken a self-reporting survey for shoreline property owners on the U.S. shoreline of Lake Ontario and the upper St. Lawrence River and will be reporting on their findings. While the effort is not directly associated with the GLAM Committee, there is no doubt that any results reported by the Sea Grant and Cornell will be informative regarding impacts along the U.S. shoreline. Since no similar survey was identified for the Canadian shoreline, the GLAM Committee is moving forward to fill that gap. GLAM Committee members and associates also

conducted a number of site visits along the north and south shores to take photos and witness impacts first hand. The GLAM Committee is organizing an internal database of damage reports, photographs, and media reports to help guide future activities and identify priority areas or impacts themes. While supportive of the longer-term effort to report on regulation plan performance, the volume of information related to the record high water level conditions requires additional resources in the coming FY over what might be expected during a more typical year.

Through the development of its FY18 work plan, the GLAM Committee will be identifying immediate priorities in fitting with the urgent need to gather information related to the high water event as well as the longer-term horizon for the committee. The boards will have the opportunity to review these priorities prior to submission to the IJC for their approval. The goal is to seek IJC approval at the October 2017 semi-annual appearances. Priorities for the next reporting period include the preparation of the 2017 annual report and related activities to document and synthesize available information on high water impacts and hydroclimate drivers of the event. As well, sensitivity analysis will be pursued to better understand and differentiate between the many factors that led to this year's high levels. Such an analysis will allow the committee to further evaluate and study contributing factors, including how they compare to historical values used in plan development, whether the system is changing, and whether there is a need to adapt to these changes. The Communication, Outreach, and Engagement effort is an overarching component of that effort and the committee will continue to move that process forward.

### **3.1 Upcoming International Watersheds Initiative projects**

The GLAM Committee's 2017 work plan represented tasks that the committee believed could be accomplished within the year given the available agency in-kind staff contributions at the time the work plan was developed. A number of additional tasks were identified in the work plan as ones that would be considered should alternative funding sources become available. The committee did not submit any additional proposals for the fall 2016 IWI process. However, in April 2017, the committee submitted three additional proposals and received conditional approval. One project supports the continuation of the hydroclimate task aimed at developing improved hindcasts of Net Basin Supply (NBS) components for the Great Lakes basin. Another project extends 2017 wetland monitoring to the Canadian shoreline which was deemed important given the record high water level year, and the final project will develop a synthesis of remote sensing approaches that might support future wetland monitoring which was a recommendation from the wetlands experts workshop. Table 1 identifies all current IWI projects including ones that are active, ones that were completed during the reporting period, and ones that have been conditionally approved. The committee continues to work with our IJC liaisons and the IWI coordinators to ensure all necessary conditions are met and that appropriate funding and contracting mechanisms are in place for individual projects. In some cases, this can lead to delay project implementation and require work to be carried over to subsequent work plans.

**Table 1: Current GLAM Committee IWI projects (in order of submission)**

<b>IWI Project Code</b>	<b>Source</b>	<b>Project Title</b>	<b>Project Status</b>
AM-04-2015	US	Closing the water balance of the Great Lakes: developing a new historical record of reconciling bias and uncertainty	Agreement in place. Will conclude as part of FY18 work plan.
AM-05-2015	US	Programming support for update of Coordinated Great Lakes Regulation and Routing Model	Agreement in place. Will conclude as part of FY18 work plan.
AM-06-2015	US	Monitoring of Lake Ontario - St. Lawrence River coastal wetland habitat in support of adaptive management (US shoreline)	Agreement in place. Will conclude as part of FY18 work plan.
AM-07-2015	US	Monitoring the extent of wetland types in the Lake Ontario - St. Lawrence River coastal system in support of adaptive management (US shoreline)	Agreement in place. Will conclude as part of FY18 work plan.
AM-08-2015	CAN	Update the computing code of the Lower St. Lawrence Environmental Performance Indicators (IERM2D)	Complete
AM-01-2016	CAN	Extended hindcast of Water Supply Components over Canada/U.S. Transboundary Watersheds	Complete – this is part of a multi-year effort.
AM-02-2016	CAN	Baseline Common Reed extent in selected Lake Ontario coastal wetlands	Complete
AM-03-2016	CAN	Detailed scoping of requirements for developing an ecohydraulic model of the St. Marys River	Complete
AM-01-2017	CAN/ US	Extended hindcast of Water Supply Components over Canada/U.S. Transboundary Watersheds based on the CaPA, CaLDAS and GEM systems and coordination with NWS Multi-Precipitation Estimates (MPE)	Agreement partially in place. Finalizing U.S. component.
AM-02-2017	CAN	Monitoring of Lake Ontario coastal wetland habitat in support of adaptive management	Agreement in place. Will conclude as part of FY18 work plan
AM-03-2017	CAN	State of Science Assessment of Remote Sensing for Great Lakes Coastal Wetlands	Responding to conditions.

#### **4.0 Funding and Resourcing**

The GLAM Committee would like to thank the IJC for contributing funds to support specific GLAM activities over the reporting period, particularly through the IWI. Four IWI-supported projects were completed in the reporting period and a number will be initiated or finalized in the coming months as part of the FY18 work plan.

As with past updates to the IJC, all other committee activities within the reporting period relied on in-kind contributions from supporting agencies, including those represented through members of the GLAM Committee as identified on page 3 of this report. These contributions have been critical to the ability of the committee to move activities forward during the reporting period. The committee would like to acknowledge the appointment of Mr. Arun Heer as the new U.S. co-chair as well as Dr. Susan Doka as a new Canadian member and thank Mr. Kyle McCune and Dr. Gavin Christie for their contributions during their time on the committee.

The committee makes every effort to design its annual work plans based on the resource availability expected for that year recognizing that the in-kind nature of the resource commitments can limit delivery of specific items if resources need to be directed to other priorities. This was particularly the case during the reporting period where high water levels in the Lake Ontario – St. Lawrence River put extreme pressure on staff within the regulation representative offices for the International Lake Ontario-St. Lawrence River Board limiting the time they could commit to some previously identified GLAM Committee tasks.

The GLAM Committee will continue to rely heavily on in-kind support from contributing agencies as well as resource contributions from the IJC to successfully implement adaptive management approaches in the ongoing review of existing water level regulation plans through the Great Lakes water regulation Boards.

Respectfully Submitted,

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Mr. Arun Heer  
GLAM Committee U.S. co-chair

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Ms. Wendy Leger  
GLAM Committee Canadian co-chair

## Appendix A: Summary of FY17 Work Plan Progress

SECTION A: Plan Review and Evaluation		
Tier 1: Foundational Analyses		
Hydroclimate Working Group		
Task	Task Title	Status
FY17-1.1	Establish and test processes for performing annual, routine foundational analyses required for hydroclimate assessments	The Hydroclimate Working Group developed a draft annual report outline, highlighting those areas where they could complement hydroclimate reporting efforts already done through the regulation representative offices for the various boards as well as the Coordinating Committee on Great Lakes Hydrologic and Hydraulic Data.
Impact Assessment Working Group		
FY17-1.2	Establish and test processes for performing routine assessments required for understanding baseline conditions and impacts/benefits of observed water levels and flows	The Impact Assessment Working Group met in February 2017 in Buffalo to coordinate efforts in developing routine processes. Working Group leads were identified for various interest groups and activities were initiated to become familiar with existing performance indicator tools. With high Lake Ontario-St. Lawrence River water levels, attention shifted to identifying critical data needs to support model validation and ways to fill gaps. The Working Group met monthly via conference calls to track progress and re-prioritize as necessary. The team also developed a draft annual report outline for their components.
Plan Review and Evaluation Working Group		
FY17-1.3	Establish and test processes for performing annual, routine foundational analyses required for ongoing evaluations of existing regulation plan performance	The Plan Review Working Group met concurrently with the Impact Assessment Working Group to ensure coordination. Like the other two Working Groups, a primary product regarding the annual processes was the initial development of a draft annual report outline.

<b>SECTION A: Plan Review and Evaluation</b>		
<b>Tier 2: Exploratory Investigations</b>		
Hydroclimate Working Group		
<b>Task</b>	<b>Task Title</b>	<b>Status</b>
FY17-2.1	Extended CaPA and GEM hindcasts of water supply components in the Great Lakes basin and Canada-US transboundary watersheds	Dr. Fortin and his team developed the processes to do 5 year hindcasts at the 50km and 15km scale. They continue to refine the processes and the remaining 30-year hindcast in 5-year portions will be run on the ECCC's new supercomputer by the CMC operations team. That process could take between four months and two years depending on the amount of CPU resources dedicated to the project.
FY17-2.2	Development of a statistical model to close the water balance of the Great Lakes	Agreement was signed Feb 8th, 2017 and it has an 8-month schedule, to be completed in October 2017. Updates: - initial kickoff meeting (complete) - include improved model algorithm for efficiency (complete) - summarize stakeholder input on uncertainties (input received, summary will be in final report) - generate monthly time series back to 1950 (initial run complete, finals runs expected by August) - prepare summary report and present to GLAM and others (on schedule for October 2017 or earlier)
Stakeholder Assessment Working Group		
FY17-2.3	Evaluate Meadow Marsh Algorithm	A draft report on the methods and findings was prepared by the project team in March 2017 and distributed to experts ahead of the April 2017 workshop held in Burlington, Ontario. The IJC hired an external expert to undertake a peer review of the process, and their report was provided to the project team in the summer. The feedback will be reviewed, along with new monitoring data being acquired in August/September, 2017 to see how the draft report needs to be updated.
FY17-2.4	Monitoring of Lake Ontario – St. Lawrence River coastal wetland habitat in New York State – <b>site surveys</b>	The contract for this project was established by the IJC in winter 2017. A kick-off call has been held and planning for field sampling that will occur in Aug/Sept 2017 has occurred. This includes staff hiring and site access authorization. This project will carry over into the FY18 work plan due to the timing of the agreement with the IJC.
FY17-2.5	Monitoring of Lake Ontario – St. Lawrence River coastal wetland habitat in New York State – <b>Imagery</b>	The contract for this project was established by the IJC in winter 2017. A kick-off call has been held and planning is underway for field sampling that will occur in Aug/Sept 2017. A partner for the air photo investigation has been identified and the work is ongoing with the project being completed in FY18.
FY17-2.6	Lower St. Lawrence River IERM code update	The model code has been updated and is ready for future model runs.
FY17-2.7	FEPS model - update based on shore protection information (PI verification)	ECCC has undertaken preliminary simulations with the FEPS model using the refined database and the draft results will be reviewed by the broader GLAM committee as time permits.

Task	Task Title	Proposed Products
FY17-2.8	Detailed scoping of requirements for developing an ecohydraulics model of the St. Marys River and prototype application to the St. Marys Rapids area	The project was initiated as outlined in the project agreement between ECCC and the Canadian Section of the IJC. The hydraulic modelling was undertaken by staff in the Detroit District of the USACE and the ecohydraulic model was developed through the ECCC office in Quebec City. This included the development of a Digital Elevation Model and the classification of substratum in the St. Marys rapids. Four Habitat Suitability Indices (HIS) have been developed and are ready to run in the IERM (Walleye, Lake Whitefish, Lake Sturgeon, and Sea Lamprey). Those models used thresholds for several physical variables such as bottom slope, bottom curvature, water velocity, water depth, etc. They allow the evaluation of where the habitat is suitable for the spawning of the different species according to the gate setting. The project team met with experts from various resource management agencies familiar with the St. Marys Rapids ecosystem to better understand the issues and available data. A project report is being finalized.
FY17-2.9	Baseline Common Reed (Phragmites) work on Lake Ontario (CWS)	This project was completed by CWS staff for the March 31 <sup>st</sup> , 2017 deadline. A draft report was provided to GLAM for review and feedback was provided to the project lead. A final report was then provided for committee review. Results were inconclusive, and GLAM members continue to be in discussion with the project leads to determine next steps.
FY17-2.10	Develop PI prioritization process to guide future performance indicator update efforts (integrated outcomes of Tier 1 testing)	A formal process has not been developed, however the GLAM Committee met in June, 2017 to discuss priorities for the FY18 work plan. The high water conditions on Lake Ontario and the St. Lawrence River added an additional factor to the prioritization process. Further work will be required once the first annual report is prepared early in 2018.
<b>Plan Review and Evaluation Working Group</b>		
FY17-2.11	Routing model update	The project agreement is in place with the IJC and the work is going forward.
FY17-2.12	St. Marys River – Review impacts of reductions in maximum side channel capacity	Progress on the plan review and evaluation activities has been limited by available performance indicators. The development of the ecohydraulic model in FY17-2.8 was identified as a priority prior to the plan review activities. Some work was undertaken to support the modelling of flow conditions under various reductions in side channel capacity.
FY17-2.13	St. Marys River – Review multiple partially open gate settings at the Compensating Works	Progress on the plan review and evaluation activities has been limited by available performance indicators. The development of the ecohydraulic model in FY17-2.8 was identified as a priority prior to the plan review activities. Some work was undertaken to support the modelling of flow conditions under various gate opening settings.

<b>SECTION B: GLAM Oversight and Administration</b>		
<b>Task</b>	<b>Task Title</b>	<b>Proposed Products</b>
FY17-3.1	GLAM Committee Coordination, Management, and Reporting	A draft annual work plan for FY18 was prepared and will be submitted to the Boards in the fall of 2017. A semi-annual report was not prepared in the spring of 2017 due to the preparation of the first Triennial report to the IJC which covered much of the reporting period.
FY17-3.2	Monitoring of Work Plan Delivery	Monitoring of work plan delivery was undertaken to support the development of the first triennial report to the IJC as well as the June work planning meeting.
FY17-3.3	Finalize mid-term strategic plan	A mid-term strategic plan was developed and integrated into the first GLAM triennial report.
FY17-3.4	Prepare first GLAM triennial progress report	The first GLAM triennial report was prepared and approved by the IJC in May 2017. The report was recently translated and will be posted to the GLAM website once reviewed by Francophone GLAM members.
FY17-3.5	Business analysis of future GLAM information management needs	There was limited progress on this task and it will be carried over in some form to the FY18 work plan.
FY17-3.6	Maintain engagement with GLWQA activities	The GLAM co-chairs presented at the Great Lakes Executive Committee (GLEC) meeting in June 2017 on GLAM and water level regulation and possible connections with the GLWQA Annexes. The Canadian and U.S. co-chairs remain connected with the IJCs Water Quality Board and Science Advisory Board and update them on GLAM work plans and any connections.
FY17-3.7	Develop and initiate an engagement plan for advisory networks	The GLAM co-chairs and secretaries participated on the Communications Committee of the International Lake Ontario – St. Lawrence River Board. Presentations were made to Le Regroupement des usagers du Saint-Laurent (RUSL), the Province of Ontario’s Surface Water Monitoring Centre, and various Ontario Conservation Authorities throughout the reporting period. As well, a presentation was made at the annual technical conferences of the Canadian Water Resources Association.