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

7th Semi-Annual Progress Report to the Great Lakes Boards and the
International Joint Commission
Covering the period March 1, 2019 to August 31, 2019

October 10, 2019



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Cover photo: All photos from Environment and Climate Change Canada.

Top left: Lake St. Louis, June 17, 2019

Top Right: Toronto waterfront (Lake Ontario), July 1, 2019

Bottom: Port Dalhousie (Lake Ontario), July 12, 2019

GLAM Committee Membership

Blue text identifies other International Joint Commission Board and Committee affiliations

United States	Canada
John Allis, Co-Chair (as of July 9, 2019) US Army Corps of Engineers – Detroit District International Lake Superior Board of Control Alternate Regulation Representative	Wendy Leger, Co-Chair Environment and Climate Change Canada
Don Zelazny New York Department of Environmental Conservation	Jonathan Staples Ontario Ministry of Natural Resources and Forestry International Niagara Working Committee Member
David Hamilton The Nature Conservancy - Michigan	Patricia Clavet Ministère de l'Environnement et de la Lutte contre les changements climatiques (Quebec) International Lake Ontario - St. Lawrence River Board Member
Kevin O'Donnell US Environmental Protection Agency (Appointed December 3, 2018)	Susan Doka Fisheries and Oceans Canada
Deborah Lee (as of July 9, 2019) Great Lakes Environmental Research Laboratory - NOAA	Frank Seglenieks Environment and Climate Change Canada International Niagara Working Committee Co-Chair
Bill Werick	Jean Morin Environment and Climate Change Canada
Keith Koralewski US Army Corps of Engineers – Buffalo District International Lake Ontario - St. Lawrence River Board Alternate Regulation Representative	Rob Caldwell Environment and Climate Change Canada International Lake Ontario - St. Lawrence River Board Regulation Representative
Vacant	Jacob Bruxer Environment and Climate Change Canada International Lake Superior Board of Control Regulation Representative
<i>Bryce Carmichael, Co-Secretary</i> US Army Corps of Engineers – Great Lakes and Ohio River Division US Secretary, International Niagara Board of Control	<i>Mike Shantz, Co-Secretary</i> Environment and Climate Change Canada

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

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 seventh semi-annual report to the IJC and the Boards.

The committee's annual work plans cover the period of October 1 through to September 31 of each year. As a result, the March 1, 2019 through August 31, 2019 reporting period for this semi-annual update focuses on progress related to activities for the 2019 work plan. Additionally, record-high water level conditions were observed on Lake Ontario and the St. Lawrence River as well as many of the upper Great Lakes during the reporting period. A number of short-term tasks not previously included in the 2019 work plan were identified collectively by the GLAM Committee, the IJC and the Great Lakes Boards for immediate attention in response to the high water conditions. Progress was made on a number of those new priority items, with some implication for progress on a few of the previously identified work plan tasks.

Due to record-high water level conditions on Lake Ontario and the St. Lawrence River during the reporting period, there has been considerable attention placed on the current outflow management plan (Plan 2014) and whether it continues to meet intended objectives as defined when the plan was approved in December of 2016. Given that record-high water levels have been observed in two of the past three years, the IJC asked the International Lake Ontario – St. Lawrence River Board (ILOSRLB) and the GLAM Committee to investigate options for reducing levels of Lake Ontario this year and to reduce the potential for record flooding again in 2020 and future years. The GLAM Committee has supported the work of the ILOSRLB through the development of an initial proposal for an expedited plan review, subject to available funding, focusing on a phase 1 component that helps contribute data in support of immediate ILOSRLB deviation decisions and a phase 2 component related to assessing regulation plan performance during extreme conditions (highs and lows).

The GLAM Committee was already focusing on the development of a 12 year strategy as part of its 2019 work plan. The components of the expedited review have been integrated into the first draft of the strategy that was prepared at the end of August 2019 in preparation for a workshop at the end of September. In addition to the drafting of the 12 year strategy, the GLAM Committee has put considerable attention on a number of the impact assessment tasks within the 2019 work plan. These tasks are all the more important given the need for better impact information to manage outflows during periods when the Board is under deviation authority and to assess the performance of the various regulation plans. Some of the highlights related to the work plan include the completion of surveys for both the marina/yacht club sector and the municipal and industrial water use sector of Lake Ontario and the St. Lawrence River related to high water impacts in 2017, the posting of an online questionnaire so shoreline property

owners can report their first-hand accounts of high water impacts in 2019, and the collection of additional substrate information in the St. Marys River to support ecohydraulic modelling efforts related to dam operations of the ILSBC.

With the additional attention placed on understanding and documenting high water impacts in 2019 and developing plans for an expedited review of Plan 2014, the GLAM Committee did not have the resources to make significant progress on work plan items related to performance indicator reviews. Such a review remains a critical piece of the long-term adaptive management effort and the committee hopes to move those review tasks forward in the next reporting period. In addition, operational requirements in 2019 limited the time staff could spend reviewing Plan 2014 operations during 2018, particularly the concerns in some sections of the upper St. Lawrence regarding low water levels in the late summer and early fall of that year. Because the 2018 operations are partially linked to observed conditions in 2019, the intent is to include that work in the broader expedited review effort should resources become available.

Resourcing continues to be a challenge for the GLAM Committee, particularly during periods of extreme water levels as have been observed during the reporting period. The GLAM Committee relies primarily on fixed in-kind agency contributions for its day-to-day operations and to implement many of the work plan tasks. As priorities have shifted during the reporting period in response to record-high water levels on many of the Great Lakes, the GLAM Committee has had to reduce the effort on a number of tasks to ensure resources are available for emerging priorities (such as the request for an expedited review). Support for a number of projects through the IJC's International Watersheds Initiative (IWI) has been especially critical during this high water period and the GLAM Committee is excited to pursue a number of additional priority items in the coming months to support the implementation of a portion of the phase 1 expedited review. As the draft 12 year strategy has been developed over the past few month, it has served to highlight the resourcing challenges facing the GLAM Committee in its pursuit of a long-term adaptive management process. The additional pressures of the expedited Plan 2014 review only add to the resourcing challenges and the GLAM Committee will continue to work with the IJC and its Boards to effectively deliver on collective priorities as new items emerge.

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, and Lake Ontario-St. Lawrence River Boards’ regulation plans and Niagara River Board 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 US co-chair, as well as members from government agencies, the Great Lakes Water Management Boards (Boards), and technical experts. The committee is supported on an on-going basis by an appointed Canadian and US secretary.

As defined in its directive from the IJC, 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.

This seventh semi-annual report will highlight GLAM Committee progress and accomplishments for the reporting period of March 1, 2019 to August 31, 2019.

2.0 Work Plan Progress and Emerging Priorities

The GLAM Committee’s annual work plans cover the October 1 to September 30 time period, consistent with the US fiscal year. This semi-annual report discusses efforts to deliver on items in the GLAM Committee’s Fiscal Year (FY) 2019 work plan starting in October 1, 2018. The FY19 work plan is divided into sections. Section A is the Plan Review and Evaluation section where the core technical work is identified while Section B covers overarching oversight and administration functions (Figure 1). Within Section A, tasks related to the ongoing regulation plan monitoring, modelling, and assessment are separated based on three tiers. Tier 1 covers ongoing foundational analyses, primarily focused on the preparation of annual conditions, impacts, and operations. Tier 2 covers a broader suite of targeted studies to support longer-term data acquisition and plan review requirements. There are no tier 3 (Strategic

Improvement Study) tasks in the FY19 work plans. This third tier will be initiated if and when there is an examination of potential improvements to the regulation plan.

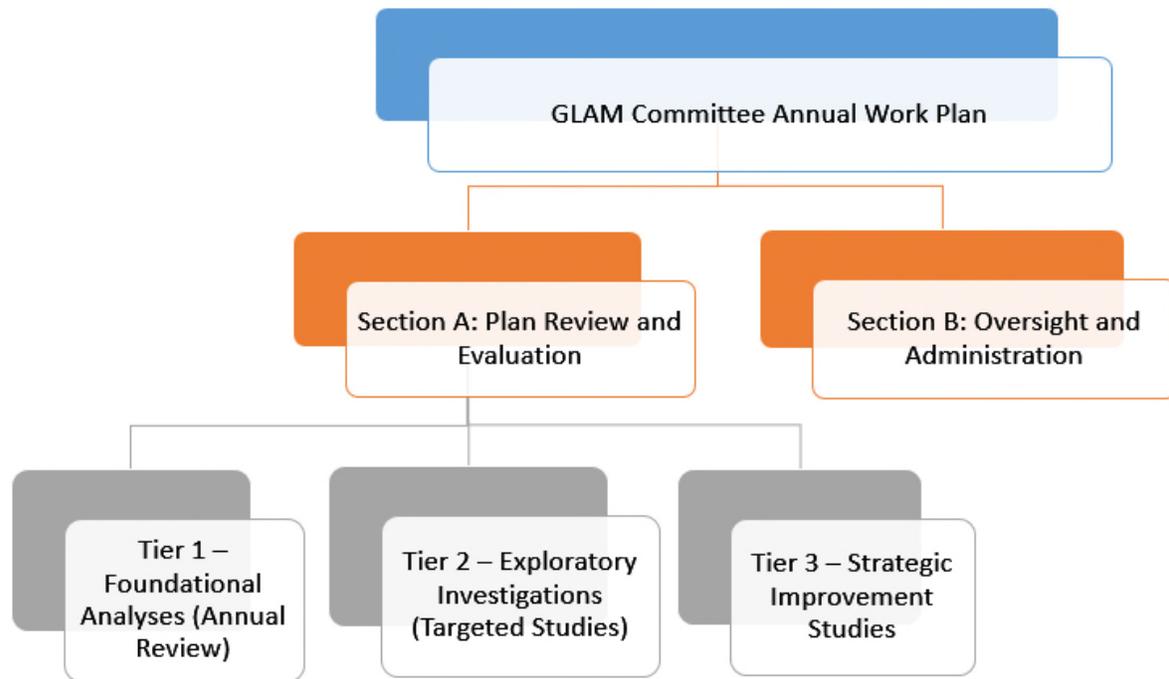


Figure 1: GLAM Work Plan structure

The GLAM Committee’s work plans are developed annually, and identify key priorities for the upcoming year as envisioned by the committee at that time (typically late summer or early fall of each year). In consultation with the Great Lakes Boards, the GLAM Committee tries hard to match available resources to expected needs in the coming year and to anticipate priorities. However, conditions in the Great Lakes basin can change dramatically after the work plans are prepared and that impacts GLAM Committee activities. The current reporting period was no exception with record-high or near record-high water levels observed on each Great Lake in recent months. For the GLAM Committee, conditions in the Lake Ontario – St. Lawrence River basin had a critical impact on the ability to deliver on FY19 work plan priorities identified back in the fall of 2018. With the continued high water levels in the Lake Ontario – St. Lawrence River system, there has been particular attention paid to the operation of Plan 2014. The IJC has asked both the International Lake Ontario – St. Lawrence River Board (ILOSLRB) and the GLAM Committee to adapt its work plan priorities over the past few months to consider options for an expedited assessment of Plan 2014. In response, the GLAM Committee has reduced focus on some previously identified work plan items while placing greater attention on developing datasets that directly support the short-term needs of the ILOSLRB. Progress made on work plan tasks, as well as emerging priorities, are discussed in 2.1 and 2.2 below.

2.1 Section A: Plan review and evaluation

Section A tasks are led by the ad-hoc hydroclimate, impact assessment, and plan review working groups made up from members of the GLAM Committee and technical associates. These tasks are primarily undertaken using in-kind agency contributions as well as project specific support through the International Watersheds Initiative (IWI). During the reporting period, a primary focus was the implementation of a few of the critical tier 2 activities in the FY19 work plan. As well, some new activities emerged in response to high water level conditions. Highlights of progress on both the work plan tasks and the emerging items are discussed below and task-specific details of FY19 work plan items are provided in *Appendix A*.

2.1.1 Tier 1 activities – foundational analyses (annual review)

During the previous reporting period (September 2018 to February 2019), the GLAM Committee finalized an extensive report on the 2017 high water level conditions with particular emphasis on Lake Ontario and the St. Lawrence River. Within the GLAM Committee FY19 work plan, the intent was to continue on in the development of a brief annual review of 2018 operations and possible questions that emerged. Tier 1 (annual review) activities of the GLAM Committee are broadly intended to provide a structured foundation for identifying and documenting information on outflow management and water level impacts in any given year. Information contained in the annual review will contribute to the longer-term activities of the GLAM Committee, helping identify key priorities for further review. However, the 2017 report was unique given the extreme conditions of that year and while the GLAM Committee had intended to prepare a briefer and much simpler summary of 2018 operations within the reporting period, the record-high water levels that occurred in 2019 reduced the resources available to complete the 2018 summary over the past few months. In addition, operational concerns in 2019 were a much higher priority of the Great Lakes boards and the IJC during the reporting period and the GLAM Committee prioritized its efforts accordingly.

The GLAM Committee intends to carry the 2018 summary forward as part of anticipated broader documentation on 2019 plan operations. In many ways, linking 2018 and 2019 operations is important because some of the observed operational challenges in the Lake Ontario – St. Lawrence River system in 2018 (e.g. high outflows and extreme low levels in portions of the upper St. Lawrence River) are directly linked to plan operation in 2019. Some aspects have already been integrated into the committee's FY19 work plan. The GLAM Committee is looking at options to make the tier 1 summaries more efficient and useful to a range of audiences. As well, some of this information is likely to be included as part of the next triennial report required by the GLAM Committee directive, due sometime in 2020.

2.1.2 Tier 2 activities - exploratory investigations (targeted studies)

2.1.2.1 Hydroclimate

There are two priority tier 2 hydroclimate activities within the GLAM Committee's FY19 work plan. The one project is an IWI supported project to develop a precipitation anomaly dataset for the Great Lakes basin. The project merges Canadian Precipitation Analysis (CaPA) and US National Weather Service Multi Precipitation Estimates (MPE) products to produce a blended Great Lakes basin precipitation anomaly product that includes overlake precipitation (i.e. not just absolute precipitation amounts but anomalies from a long-term condition). The work is being done through an agreement with the University of Illinois. The IJC extended the agreement to October 31, 2019 and the final datasets are expected to be available at that time. The GLAM Committee hydroclimate work group has been reviewing the interim products during the reporting period and looks forward to the final product in the fall.

The other major tier 2 hydroclimate work plan task for was the development of an overall hydroclimate strategy to support the long-term plan review and evaluation efforts of the GLAM Committee. That work was broadly wrapped into the development of the 12 year strategy document discussed below in Section 2.2.

GLAM Committee members of the hydroclimate group are also connected with or tracking a number of related hydroclimate activities that will support longer-term efforts that are not directly led by the committee or identified on the FY19 work plan. For example, staff from Environment and Climate Change Canada (ECCC) are working on climate change simulations of Great Lakes water levels to support a wetland vulnerability study and those water level simulations will be of value to the GLAM Committee. As well, ECCC scientists are continuing efforts to undertake 38 year hindcasts of Great Lakes Basin net basin supply components through efforts initially supported by the GLAM Committee and the IJC (through IWI funding). These long-term simulation datasets will be important for the GLAM Committee in better understanding water supply conditions in the Great Lakes basin. GLAM Committee members are also active participants in the Coordinating Committee on Great Lakes Basic Hydrologic and Hydraulic Data and work to identify areas of common interest regarding basic Great Lakes data. The GLAM Committee benefits considerably from work done through the coordinating committee which also contributes to the GLAM Committee priorities including the application of the statistical water balance model developed as part of earlier GLAM Committee work plans.

2.1.2.2 Impact assessment

The impact assessment activities within the GLAM Committee work plans 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 interests 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. In the FY19 work plan, tier 2 impact assessment tasks have been separated into Lake Ontario – St. Lawrence River ecosystem, Lake Ontario – St. Lawrence River socio-economic, and upper Great Lakes activities. As reported earlier, the record-high water levels across the Great Lakes basin in 2019 have put additional emphasis on gathering observations of water level impacts to various stakeholder groups under extreme conditions. Some of these activities go beyond what was initially identified within the FY19 work plan. These new activities will be integrated into the reporting for the impact assessment tasks identified within the work plan.

Lake Ontario – St. Lawrence River Ecosystem Activities:

The GLAM Committee continues to plan and engage in ecosystem activities for the Lake Ontario – St. Lawrence River system, with particular attention on the wetlands performance indicator for Lake Ontario. During the reporting period, the final deliverables for an IWI supported wetland monitoring project were received by the GLAM Committee. The monitoring was done in September 2018 with the data processing over the winter. Similar monitoring has been ongoing for Lake Ontario coastal wetlands for the past few years at different frequencies and scales. Data from earlier years has already been used by the committee in initial attempts to compare model results to field observations. While the intent was to integrate the 2018 monitoring data into the model comparison over the reporting period, GLAM Committee resources were re-prioritized to other impact assessment activities during the high water period of the past few months.

The GLAM Committee also received IWI support during the reporting period to undertake further coastal wetland vegetation monitoring in September of 2019. Planning has been underway during the reporting period with field visits to start in early September. As a conditional part of the IWI funding (which runs to March 31 2020), the GLAM Committee will also be looking to develop a preliminary longer-term coastal wetland monitoring strategy that combines recent GLAM Committee work related to on-the-ground field monitoring as well as recent research and vegetation assessment approaches using remote sensing technologies including UAV/Drone with optical and hyperspectral imagery, aerial imagery, and satellite based data sources. The intent is to improve the scale and coverage of the wetland monitoring activities and better define uncertainties in monitoring approaches. The work combines a number of FY19 work plan tasks related to the wetland algorithm review (meadow marsh), further wetland monitoring, and following up on the state of science work related to wetland remote sensing. In the FY19 work plan, some of the initial planning was also expected to occur during the current reporting period. Funding through the IWI was conditionally approved to support the project but that work is now expected to take place into 2020 due to the re-prioritizing of GLAM Committee in-kind resources to other activities during the high water period of 2019.

One of the FY19 GLAM Committee work plan priorities related to the Lake Ontario – St. Lawrence River ecosystem activities for the impact assessment group was a broader review and

prioritization of ecosystem indicators. When the FY19 work plan was developed, this was considered a high priority but GLAM Committee resources were subsequently diverted to completing the 2017 report (in the fall of 2018) and then prioritizing other data collection activities during the reporting period. As such, the GLAM Committee did not make much progress on the ecosystem indicator review in recent months. The GLAM Committee did receive conditional approval from the IJC through the IWI to support this effort and the committee is in discussion with IJC staff on how best to move this forward in the coming months.

Lake Ontario – St. Lawrence River Socio-Economic Activities:

Tier 2 socio-economic impact assessment tasks for the Lake Ontario – St. Lawrence River System within the FY19 work plan are intended to provide information to support the review and validation of existing performance indicators related to municipal and industrial water uses, commercial navigation, hydropower production, coastal property owners, and recreational boating impacts.

Key FY19 work plan items identified back in late summer 2018 included gathering further information on marina/yacht club impacts as well as municipal and industrial water use impacts associated with high water levels in 2017. These two projects followed a similar strategy of designing and implementing a targeted survey for each sector and the work was supported through IWI funding. The surveys were implemented by LURA Consulting in the winter of 2019 (prior to the new record-high water levels of June 2019) and their final contractor reports were prepared and delivered to the GLAM Committee and IJC at the end of May 2019. The reports are being reviewed by the IJC prior to their posting to the GLAM Committee website. These reports provide considerable information on the type and extent of impacts observed by these sectors during 2017. The information will support the GLAM Committee as it moves forward with a review of the existing performance indicators for those sectors to understand how well they reflect the types of impacts being reported.

The committee also made some progress on an IWI supported project through the US Section of the IJC related to reviewing the condition of select shore protection structures on the shoreline of Lake Ontario. The work is being led by the survey office of USACE Buffalo under an agreement with the IJC. Initially, the project was expected to be completed in the reporting period but progress on the project has been hampered by challenges in accessing private property to assess the structures and by the high water level conditions. Project staff continue efforts to overcome these challenges and obtain the necessary number of site visits. The project agreement between USACE Buffalo survey office and the IJC has been extended to later in 2019 to account for the challenges getting site access.

Further work was also undertaken during the reporting period related to information gathered in 2017 through an online shoreline property owner questionnaire. While some of the information was previously reported through the GLAM Committee's 2017 report (released in

November 2018), further work was done in the reporting period to finalize a shorter “fact sheet” product that identified a few of the highlights of the questionnaire results. The fact sheet has been posted to the [GLAM Committee webpage](#). While the original data collection was supported through the IJC, the GLAM Committee has been leading the processing of the results through in-kind agency resources. In addition to the fact sheet, initial efforts are underway to compare results from the 2017 questionnaire to performance indicators incorporated within the Flood and Erosion Prediction System (FEPS), particularly the flooding performance indicator. This work is a first step in the performance indicator review that the GLAM Committee intends to undertake in a broader way moving forward.

Due to the high water conditions in the Lake Ontario – St. Lawrence system in 2019, the GLAM Committee decided to pursue another online questionnaire for shoreline property owners. Using in-kind agency resources, the new questionnaire (based on the 2017 version) was developed and released through the GLAM Committee website at the end of August 2019. The questionnaire is available to all Great Lakes shoreline residents and will be open through the fall of 2019. Like the 2017 questionnaire, a primary goal for the GLAM Committee is to gather first-hand accounts of high water impacts throughout the Great Lakes system to compare to previous model estimates and to provide information that can be used to assess the existing performance indicators, particularly whether the indicators capture the broad impacts being reported by stakeholders. The information from the questionnaire will also be reported back through the boards and the IJC. Other activities carried out by GLAM associates during the high water conditions in 2019 included a number of site visits along the Lake Ontario shoreline, continued tracking and archiving of media coverage, responding to requests from the Board for available economic information related to impacts (this included a number of presentations to the Board), and follow-up presentations with Conservation Authorities and discussions on impacts.

In consultation with the ILOSLRB and the IJC, the GLAM Committee also initiated planning for a number of short-term priority impact assessment tasks within the Lake Ontario-St. Lawrence River system in response to the high water levels of 2019 and a request from the IJC for an expedited review of Plan 2014. GLAM Committee members worked with IJC staff to develop draft scopes of work for possible IWI funding to fill data gaps associated with possible ILOSLRB deviation options to reduce high water levels on Lake Ontario in the short term. The projects were not previously identified on the GLAM Committee FY19 work plan. The scopes support further assessment of commercial navigation costs associated with possible short-term shut downs (L-limits), further gathering of impact information from US shoreline municipalities, and analysis of Lake St. Lawrence risks associated with high winter outflows above current plan I-limits. The scopes were finalized for the end of the reporting period and have since received IJC approval to proceed with the final contracting to initiate the work through IWR-USACE.

Due to the reprioritization of GLAM resources for further data collection related to record high water levels, little progress was made on socio-economic performance indicator review identified in the FY19 work plan. In the previous semi-annual update, the committee had anticipated moving forward on this item in the spring and summer of 2019 but this was not

possible given other data collection priorities in recent months during the high water period. As new projects are initiated around key plan limits (e.g. the navigation and municipal impact projects identified previously), the information and data gathered will support future performance indicator review efforts. Depending on resource availability, the GLAM Committee anticipates pushing the socio-economic performance indicator review effort to subsequent work plans.

Upper Great Lakes Ecosystem and Socio-Economic Activities:

The GLAM Committee's effort related to upper St. Lawrence ecosystem and socio-economic indicators continues to focus on the development of an ecohydraulic model for the St. Marys rapids and vicinity. The primary activity during the reporting period was the initiation of data collection for the St. Marys River. This is an IWI supported project in collaboration with staff of the US Army Corps of Engineers Detroit District office. Field visits were undertaken from June 6 to 11, 2019 to collect side scan sonar imagery for a portion of the St. Marys River including the area just downstream of the St. Marys Rapids and areas around Sugar Island. Due to the relatively high water levels, areas not typically accessed by boat could be reached. The intent was to gather the initial data prior to vegetation growth, which was in fact the case. The plan is to undertake further data collection later in September 2019 to estimate maximum vegetation coverage. The project agreement goes to April 2020 with further data processing anticipated over the coming months. The information will be used to improve the ecohydraulic model that was previously initiated by a collaborative effort between US Army Corps of Engineers Detroit District office and Environment and Climate Change staff in Quebec City.

The GLAM Committee's FY19 work plan also includes a task for the development of a flooding indicator for the St. Marys River including Whitefish Island and a task for further assessment of existing socio-economic and ecosystem performance indicators. Progress was limited on both these items during the reporting period. As the GLAM Committee develops its FY20 work plan, these tasks will be assessed in consultation with the ILSBC to determine whether they are priorities for the coming year given available resources and expectations of the board and IJC.

As with the hydroclimate activities, GLAM Committee members continue to seek out and be connected with related activities that support long-term adaptive management requirements but are not explicitly identified on the committee's FY19 work plan. For example, some members of the GLAM Committee are actively participating in an ECCC project looking at Great Lakes coastal wetland vulnerability to climate change which includes considering changes in water levels. Through that project, ecohydraulic models are being developed to simulate wetland response under different water level conditions and those models will be helpful for GLAM Committee assessments in the future as well.

2.1.2.3 Plan review

There are three main Plan Review tasks in the GLAM Committee's FY19 work plan including a review of Plan 2012 and Plan 2014 operations in 2018, a plan review gap analysis, and progress related updates for the Great Lakes routing model. The Plan 2012 review looks at operations as well as the deviation strategies that were employed by the International Lake Superior Board of Control. The review of Plan 2014 operations includes looking at how Plan 2014 and the previous regulation plan (Plan 1958-DD) responded under conditions similar to 2018 in the historical sequence. A critical priority is to determine whether actual operations in 2018 were consistent with expected plan response under similar observed conditions in past simulations. The plan review gap analysis is intended to consolidate critical regulation plan operation issues highlighted based on the 2017 (completed) and 2018 (anticipated) reviews and highlight priorities in terms of the GLAM Committee's longer-term requirements.

For all three FY19 work plan tasks, progress was hindered during the reporting period as the critical staff needed to support the efforts within the regulation representative offices were focused on operational board responsibilities, particularly assessing and implementing deviation decisions of the ILOSLRB. Despite these resource challenges, a preliminary assessment of Plan 2012 and Plan 2014 operations in 2018 was initiated. The Plan 2014 work in particular will support further plan review efforts and improvements to simulation models.

Progress on the Great Lakes routing model was based on combined efforts of GLAM Committee members and the Coordinating Committee for Great Lakes Basic Hydrologic and Hydraulic Data (there is overlap for a few members). Efforts continue to develop the coding necessary to simulate regulation of Lake Superior and Lake Ontario outflow that will be required by the GLAM Committee to compare regulation plan options. These updated models will ultimately replace the existing models used within the regulation offices.

2.2 Section B: Oversight and administration

Activities within the Oversight and Administration category include the overarching functions required to keep the committee on track. This includes ongoing chair and secretariat functions along with project management, reporting, communications and engagement, peer review, and information management.

The GLAM Committee continued to hold regular monthly conference calls to update members and discuss relevant items. The monthly calls were not held in July and August due to scheduling conflicts. The committee also held a face-to-face meeting on June 5 and 6, 2019 in Buffalo, New York. There were no IJC spring semi-annual meetings in 2019, although the GLAM Committee did submit a draft semi-annual update report for reference.

The highest priority oversight and administration work plan task in the reporting period was the development of the 12 year strategy document. A draft was prepared and distributed to the

committee in August 2019 in preparation for a workshop with the Great Lakes boards in September 2019. The draft document built on previous draft material prepared by the committee in the winter and spring of 2019.

The development of the 12 year strategy was being done in the midst of record-high water levels throughout the Great Lakes system including the Lake Ontario-St. Lawrence system. There has been considerable attention paid to the operations of Plan 2014 since its implementation and the record-high water levels in 2019 continue to cause concern for many stakeholders. In response, the IJC asked the ILOSLRB and the GLAM Committee to look at options for an expedited review of Plan 2014. The GLAM Committee drafted a phased proposal that focuses initially on gathering information that can be used by the ILOSLRB in support of its immediate and near-term deviation decisions. As discussed previously, these include further analysis of economic impacts to the navigation sector from high outflows, gathering further information on municipal impacts in US shoreline municipalities, and updates on critical winter low water limits on Lake St. Lawrence. The second phase includes a broader assessment of regulation performance under extreme water supply conditions. The expedited review proposal subsequently integrated as components of the draft 12 year strategy document that will be discussed with the Boards in September 2019. It is important to note that the GLAM Committee does not currently have the resources necessary to implement either aspect of the draft expedited review as proposed. In the meantime, the committee is moving forward with specific priority tasks as in-kind agency or IWI resources permit.

Outreach and engagement efforts of the GLAM Committee continue to be focused on the implementation of specific work plan tasks. For example, the marina/yacht club and municipal and industrial water use surveys were undertaken during the reporting period and involved developing a contact list for these two sectors in the Lake Ontario – St. Lawrence River System and engaging those contacts to support survey response. As well, the GLAM Committee developed an online questionnaire to allow shoreline property owners to directly report their high water impacts in 2019. The GLAM Committee works to coordinate any outreach or communication efforts with the ILOSLRB Communications Committee and a number of GLAM Committee members continue to participate in regular activities of that group to support coordination of broader communication and engagement efforts. In addition, some relationships have been established with various stakeholders over the past couple of years. For example, the GLAM Committee is regularly on the agenda at meetings of the Conservation Authorities organized through the provincial Surface Water Monitoring Centre. A presentation to this group occurred in May, 2019. As well, the GLAM Committee co-chairs continue their ongoing efforts of staying connected with both the Water Quality Board, the Science Advisory Board, and work under the GLWQA when possible, and membership on the GLWQA Annex 9 Climate Change Impacts Sub-Committee.

3.0 International Watersheds Initiative Projects

The GLAM Committee's FY19 work plan was developed based on available agency in-kind staff contributions and potential support through the IWI. In both cases, progress for each task is dependent on actual available resources when the project is initiated. The committee continues to be successful at receiving IWI support for a number of projects, although the timing of actual project implementation can be delayed depending on how long it takes to move from conditional approval to final contracting arrangements. In the FY19 work plan, there are 8 individual IWI projects that are either funded (full or partial) or conditionally approved for IWI funding. These projects are identified in Appendix A and specific progress was discussed previously in Section 2.0 as well as in Appendix A. In addition to the confirmed IWI projects, the GLAM Committee worked with the IJC over the summer to develop four additional scopes of work for immediate IWI priority projects identified in support of ILOSLRB deviation decisions. The IJC approved those projects at the end of this reporting period and they will be initiated right away as part of the GLAM Committee's FY20 work plan.

4.0 Funding and Resourcing

The GLAM Committee continues to appreciate the funding contributions of the IJC through the IWI program to support specific work plan tasks. These resources leverage considerable in-kind contributions from supporting agencies, including those represented through members of the GLAM Committee as identified on page 3 of this report, and allow the committee to pursue a wide range of initiatives to help deliver on its overall directive. The in-kind contributions from partner agencies have been critical to the progress that the GLAM Committee has made so far.

The GLAM Committee welcomes the appointment of Mr. John Allis as the US co-chair and Dr. Deborah Lee as a US member as of July 9, 2019. Both appointments bring considerable expertise in Great Lakes water resource science and management to the work of the GLAM Committee and we look forward to their continued contributions to the implementation of adaptive management efforts. As well, Melissa Kropfreiter from USACE – Detroit District is expected to replace Bryce Carmichael as the U.S. Secretary to the GLAM Committee beginning in the new fiscal year. The GLAM Committee wishes to thank Mr. Carmichael for his excellent service to the GLAM Committee over the number of years and hopes that Mr. Carmichael will stay engaged with GLAM Committee activities in his role as the U.S. Boards secretary.

The record-high water levels conditions during the reporting period and the considerable attention placed on outflow management, particularly Plan 2014, have highlighted some of the resourcing challenges facing the committee in effectively supporting the Great Lakes Boards and the IJC in assessing regulation plan performance as outlined in the committee's Directive. At the request of the IJC, the GLAM Committee and ILOSLRB have been working to develop an approach for an expedited review of Plan 2014 and fit this within the longer-term strategy for the on-going review of the regulation plans. While the GLAM Committee has tried to re-prioritize available in-kind resources to respond to immediate requirements, a number of FY19 work plan tasks could not be pursued as planned. The further addition of a number of tasks

related to the draft expedited review creates additional resourcing pressures. Despite these challenges, the GLAM Committee looks forward to continuing to make as much progress as possible with available resources and to work with the IJC to determine how to make the best use of available resources going forward. The draft 12 year strategy will be a starting point for those discussions in the coming months.

Respectfully Submitted,

Mr. John Allis
GLAM Committee US co-chair

Ms. Wendy Leger
GLAM Committee Canadian co-chair

Appendix A: Summary of FY19 Work Plan Progress (as of August 31, 2019)

SECTION A: Plan Review and Evaluation			
Tier 1: Foundational Analyses (Annual review of conditions)			
Hydroclimate Working Group			
Task	Task Title	Status	IWI
FY19-1.1	Prepare routine annual report material required for hydroclimate assessments	Following the completion of the 2017 summary in the previous reporting period, the Hydroclimate Working Group has initiated the development of the 2018 summary. However, progress was slowed as resources were redirected in response to record high water levels observed throughout the Great Lakes basin in the summer of 2019. Further updates for 2018 are expected as part of future GLAM Committee reporting.	No
Impact Assessment Working Group			
FY19-1.2	Prepare routine annual report material required for understanding baseline conditions and benefits of observed water levels and flows	Following the completion of the 2017 summary in the previous reporting period, the Impact Assessment Working Group initiated a brief summary of 2018 impacts, primarily related to Coastal Property Owners but with some consideration of impacts to other interests. However, progress was slowed as resources were redirected in response to record high water levels observed throughout the Great Lakes basin in the summer of 2019. Further updates for 2018 are expected as part of future GLAM Committee reporting.	No
Plan Review and Evaluation Working Group			
FY19-1.3	Prepare routine annual report material required for ongoing evaluations of existing regulation plan performance	Following the completion of the 2017 summary in the previous reporting period the Plan Review Working Group initiated a review of 2018 regulation plan operations for both Lake Superior and Lake Ontario outflows. However, progress was slowed as resources were redirected in response to record high water levels observed throughout the Great Lakes basin in the summer of 2019. Further updates for 2018 are expected as part of future GLAM Committee reporting.	No

SECTION A: Plan Review and Evaluation			
Tier 2: Exploratory Investigations (Priority Projects)			
Hydroclimate Working Group			
Task	Task Title	Status	IWI
FY19-2.1	Development of overall hydroclimate strategy to support long-term plan review and evaluation	The Hydroclimate Working Group contributed to the development of draft materials related to the 12-year strategy development.	No
FY19-2.2	Completion of NWS Multi-Precipitation Estimates (MPE)/CaPA merged baseline climatology development	Good progress was made related to the development of a merged CaPA/MPE anomaly product to support comparisons of current rainfall conditions to past conditions. Work was also done to prepare the material for eventual website release. The work supports the GLAM Committee in better understanding water supply conditions for the Great Lakes basin to support regulation plan testing. The contract is to be completed by October 31, 2019.	Yes
Impact Assessment Working Group – Lake Ontario and St. Lawrence River (ecosystem)			
FY19-2.3	Performance Indicator review and prioritization for Lake Ontario – St. Lawrence River Integrated Ecological Response Model (IERM)	The GLAM Committee was conditionally approved for an IWI project to support this effort. Initial planning occurred during the reporting period but further work is expected in the fall of 2019 and winter of 2020.	Yes (part)
FY19-2.4	Continued Evaluation of Meadow Marsh Algorithm	The GLAM Committee initiated the process of integrating 2018 monitoring data (collected by the Canadian Wildlife Service with IWI support) during the reporting period to support model comparison.	No
FY19-2.5	Monitoring of Lake Ontario Coastal Wetlands on the Canadian Shoreline	The final data from the September 2018 field monitoring of 16 Canadian sites on the Lake Ontario shoreline was undertaken delivered by the Canadian Wildlife Service in March 2019. Planning for September 2019 monitoring was initiated.	Yes
FY19-2.6	Follow up to State of Science Assessment of Remote Sensing for Great Lakes Coastal Wetlands - possible collaboration from Mar 2018 workshop	There has been some coordination with a related US Army Corps of Engineers/US Environmental Protection Agency project over the reporting period. However, resources were not available to make much progress on this task and further work is expected in the next reporting period.	No

Task	Task Title	Status	IWI
FY19-2.7	Wetland monitoring and ecosystem indicator development (muskrat and Northern Pike)	<p><i>** this project is being undertaken through partner agencies but directly contributes to long-term GLAM Committee objectives</i></p> <p><i>This is a NYDEC project that also contributes to GLAM priorities. The muskrat and Northern Pike monitoring and data processing for this multi-year project continue with final reporting not expected until the end of the project.</i></p>	No
FY19-2.8	Wetland imagery interpretation	<p><i>** this project is being undertaken through partner agencies but directly contributes to long-term GLAM Committee objectives</i></p> <p><i>This is an OMNRF project that also contributes to GLAM priorities. High resolution air photos are being used to delineate wetland vegetation areas.</i></p>	No
Impact Assessment Working Group – Lake Ontario and St. Lawrence River (socio-economic)			
FY19-2.9	Socio-economic Performance Indicator review and prioritization for Lake Ontario – St. Lawrence River Shared Vision Model	Resources were diverted from this task as efforts were re-prioritized to gathering information during the high water period in 2019. Some initial effort was put into comparing some 2017 information with the flood prediction model and further progress on the overall performance indicator review is expected later in 2019 and early 2020. It was always expected that this project would extend beyond the FY19 work plan but the events of 2019 reduced the level of support that could be provided to the project when it was initially identified late in 2018.	No
FY19-2.10	Revisit shore protection that was surveyed by either NYDEC (2011) or USACE (2015) to assess response to high water conditions	The IWI project was conditionally approved as of January 11 th , 2018 and funding arrangements were made through the IJC Section of the IJC in September 2018. The US Army Corps of Engineers in Buffalo initiated work on the project during the previous reporting period and carried that forward to through the current reporting period, primarily seeking site access permission.. However, there have been challenges in achieving site access approvals from many property owners and this has slowed the progress for the Buffalo District survey team. The project deadline has been extended to later in 2019 to reflect the challenges being experienced.	Yes
FY19-2.11	Implementation of Shoreline Damage Survey for the Canadian Shoreline of Lake Ontario and the Upper St. Lawrence River	The GLAM Committee completed and posted a fact sheet product highlighting some of the key results from the 2017 questionnaire. In response to the extremely high water conditions observed during the reporting period, the GLAM Committee also developed and posted a new high water impact questionnaire through the GLAM Committee website.	No
FY19-2.12	Survey and review of operational impacts on marinas due to 2017 water levels	LURA Consulting completed this project, under contract with the Canadian Section of the IJC. The final contract deliverables were prepared during the reporting period and the GLAM Committee is awaiting IJC approval before posted to the GLAM Committee website.	Yes

Task	Task Title	Status	IWI
FY19-2.13	Survey and review of operational impacts on Municipal and Industrial infrastructure due to 2017 water levels	This project was undertaken jointly with FY19-2.12 discussed previously as part of a single contract with LURA Consulting. The timelines and approaches were similar. The GLAM Committee is awaiting IJC approval before posting to the committee website.	Yes
FY19-2.14	<i>Erosion and inundation vulnerability assessment along the lower St. Lawrence River</i>	<i>** this project is being undertaken through partner agencies but directly contributes to long-term GLAM Committee objectives</i> <i>This is a multi-year, Province of Quebec project that also contributes to GLAM priorities. When completed, the information from the project will be of benefit to the GLAM Committee in terms of improving understanding of vulnerabilities associated with river flooding and high water.</i>	No
Impact Assessment Working Group – Upper Great Lakes			
FY19-2.15	Upper Great Lakes Integrated Ecological Response Model (IERM) and Shared Vision Model Performance Indicator status review and prioritization	Resources were diverted from this task as efforts were re-prioritized to gathering information during the high water period in 2019. The GLAM Committee did apply for and receive condition approval from the IJC for an IWI project to support this task. However, the GLAM Committee is still determining a preferred method to move this item forward given new emerging priorities associated with the high water conditions in 2019 and the IJC request related to an expedited review.	No
FY19-2.16	St. Marys River IERM Rapids Data	Field visits were undertaken by the Detroit District of US Army Corps of Engineers from June 6 to 11, 2019 to collect side scan sonar imagery for a portion of the St. Marys River including the area just downstream of the St. Marys Rapids and areas around Sugar Island. Due to the relatively high water levels, areas not typically accessed by boat could be reached. The intent was to gather the initial data prior to vegetation growth, which was in fact the case. The plan is to undertake further data collection later in September 2019 to estimate maximum vegetation coverage. The project agreement goes to April 2020.	Yes
FY19-2.17	St. Marys River IERM Expansion	This task will not move forward until after the additional St. Marys River data collection (FY19-2.16) has taken place and been processed.	No
FY19-2.18	Assimilate St. Marys River IERM into SVM	This task will not move forward until after the additional St. Marys River data collection (FY19-2.16) has taken place and been processed.	No
FY19-2.19	Development of initial flooding performance indicator for the St. Marys River	The GLAM Committee did not have the resources to pursue this project in FY19. As part of upcoming FY20 work planning, the committee will revisit whether there are resources to make progress on this in the short term (FY20) or whether this should be diverted to a future year.	No

Plan Review Working Group			
FY19-2.20	Review of Plan 2014 operations in 2018 (including high outflow/low Lake St. Lawrence conditions)	The GLAM Committee made some small progress on this item in the context of operational reviews during the high water period. There have been a number of questions as to whether more could have been done to reduce Lake Ontario water levels in preparation for 2019 so a brief review of operations has occurred, with attention paid to high outflows during the summer/fall and the associated impacts in the Lake St. Lawrence area.	No
FY19-2.21	Plan Review gap analysis	Some initial work took place on this item with a further summary expected in the fall of 2019 or early in 2020	No
FY18-2.22	Routing model update	This work is now being led by the Coordinating Committee of Great Lakes Hydraulic and Hydrologic Data, with close collaboration with a number of GLAM Committee members. Progress has been made on the upper Great Lakes portion of the model, with further progress on the Lake Ontario-St. Lawrence River portion expected in the coming months.	Yes

SECTION B: GLAM Oversight and Administration			
Task	Task Title	Status	IWI
FY19-3.1	GLAM Committee Coordination, Management, and Reporting	The spring semi-annual update was provided to the IJC in early May 2019. There were not semi-annual IJC meetings in the spring so the report was not formally approved by the IJC.	No
FY19-3.2	Monitoring of Work Plan Delivery	Monitoring of work plan delivery was undertaken to support annual report development and semi-annual reporting.	No
FY19-3.3	GLAM Information Management Needs including file sharing and data/model management strategies.	The GLAM Committee discussed Information Management needs at the June 2019 meeting in Buffalo within the context of the 12-year strategy development and the IJC also developed a broader white paper in support Information Management activities for a range of IJC activities. The GLAM Committee will be integrating some of these ideas into the draft 12 year strategy.	No
FY19-3.4	Maintain engagement with GLWQA activities	The Canadian and US co-chairs continue informal interactions with the IJCs Water Quality Board and Science Advisory Board and periodically update them on GLAM work plans and any areas of common interest.	No
FY19-3.5	Develop and initiate an engagement plan for advisory networks	The GLAM co-chairs and secretaries continued to participate on the Communications Committee of the International Lake Ontario – St. Lawrence River Board. Committee members continue to maintain various levels of informal discussions with relevant stakeholders on relevant FY19 work plan items (e.g. the Marina/Yacht club survey and the posting of the 2019 high water questionnaire). The committee is considering longer-term engagement requirements in the context of the 12 year strategy development.	No
FY19-3.6	Development of 12-year strategy	The GLAM Committee co-chairs, secretaries, and working group leads continued work on the draft strategy during the reporting period. Planning also took place for a workshop to be held in late September with the IJC's Great Lakes Boards.	No

