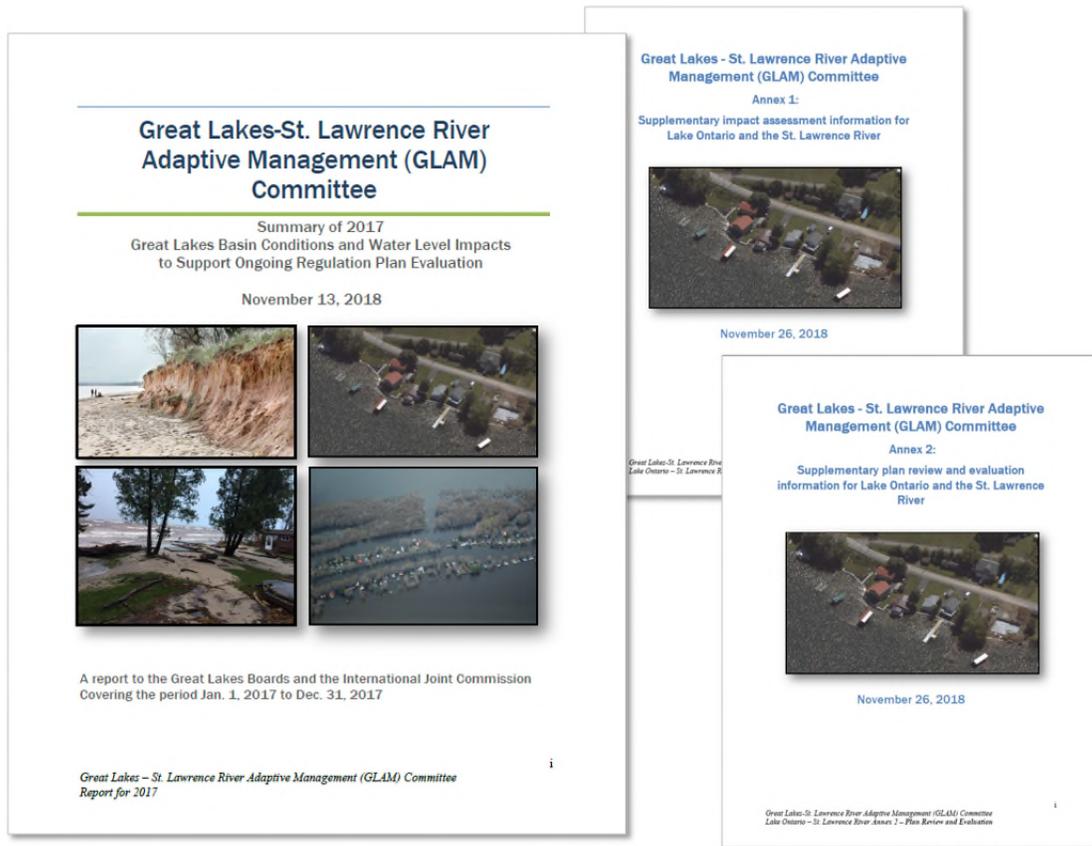

Great Lakes-St. Lawrence River Adaptive Management Committee (GLAM)

6th Semi-Annual Progress Report to the Great Lakes Boards and the
International Joint Commission
Covering the period September 1, 2018 to February 28, 2019

May 13, 2019



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Cover photo: Covers from the GLAM 2017 report and associated annexes

GLAM Committee Membership

Blue text identifies other International Joint Commission Board and Committee affiliations

United States	Canada
<p>Arun Heer¹, Co-Chair (Vacant as of December 31, 2018) US Army Corps of Engineers – Great Lakes and Ohio River Division US Secretary, International Lake Ontario – St. Lawrence River Board, International Lake Superior Board of Control</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 International Niagara Working Committee Member</p>
<p>David Hamilton The Nature Conservancy - Michigan</p>	<p>Patricia Clavet Ministère de l'Environnement et de la Lutte contre les changements climatiques (Quebec) International Lake Ontario - St. Lawrence River Board Member</p>
<p>Kevin O'Donnell² US Environmental Protection Agency (Appointed December 3, 2018)</p>	<p>Susan Doka Fisheries and Oceans Canada</p>
<p>Drew Gronewold³ (Vacant as of January 14, 2019) Great Lakes Environmental Research Laboratory - NOAA</p>	<p>Frank Seglenieks Environment and Climate Change Canada International Niagara Working Committee Co-Chair</p>
<p>Bill Werick</p>	<p>Jean Morin Environment and Climate Change Canada</p>
<p>Keith Koralewski US Army Corps of Engineers – Buffalo District International Lake Ontario - St. Lawrence River Board Alternate Regulation Representative</p>	<p>Rob Caldwell Environment and Climate Change Canada International Lake Ontario - St. Lawrence River Board Regulation Representative</p>
<p>John Allis US Army Corps of Engineers – Detroit District International Lake Superior Board of Control Alternate Regulation Representative</p>	<p>Jacob Bruxer Environment and Climate Change Canada International Lake Superior Board of Control Regulation Representative</p>

¹ Arun Heer resigned as GLAM Committee Co-Chair on December 31, 2018 after accepting a position with the U.S. Army Corps of Engineers in New York City. A replacement has not yet been appointed by the IJC.

² Kevin O'Donnell was appointed by the IJC on December 3, 2018. He replaces Fred Luckey who retired in August 2018.

³ Drew Gronewold resigned from the GLAM Committee on January 14, 2019 after accepting a position with the University of Michigan. His replacement has not yet been appointed by the IJC.

Bryce Carmichael, Co-Secretary
US Army Corps of Engineers – Great Lakes and Ohio River
Division
[US Secretary, International Niagara Board of Control](#)

Mike Shantz, Co-Secretary
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.*

Note Regarding GLAM Committee Vacancies: *It is important to highlight that the GLAM Committee US co-chair position has been vacant since the beginning of January 2019 and another committee membership position has been vacant since that time as well. These positions are appointed by the IJC and cannot be filled until there is commissioner quorum.*

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 sixth 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 September 1, 2018 through February 28, 2019 reporting period for this semi-annual focuses on the completion of activities for the 2018 work plan as well the first few months of the 2019 work plan.

A highlight of the reporting period was the finalization of the GLAM Committee's report covering the exceptional conditions of 2017 titled "Summary of 2017 Great Lakes Basin Conditions and Water Level Impacts in Support of Ongoing Regulation Plan Evaluation". The final report was provided to the IJC on November 19, 2018 and was endorsed by the Board and IJC and posted to the GLAM Committee website November 29, 2018. The report included information on water level impacts in 2017 as well as the unprecedented hydroclimate conditions observed. The report also detailed the results of a range of simulations completed by the plan review working group to better understand how the Lake Superior and Lake Ontario outflow regulation plans operated. Information from the report will be used by the GLAM Committee as part of its long-term regulation plan review efforts.

In addition to the preparation of the report on 2017 conditions, the GLAM Committee moved forward on a number of key tasks identified in its 2019 work plan including additional data collection efforts in the Lake Ontario – St. Lawrence River basin. The GLAM Committee also initiated efforts to develop a 12 year strategy to guide activities within the context of the 15 year review timelines outlined in the updated Orders of Approval for both Plan 2012 and Plan 2014, the outflow regulation plans for Lake Superior and Lake Ontario respectively.

As with previous semi-annual updates, activities of the GLAM Committee were primarily undertaken based on in-kind agency contributions. This was particularly the case for the development of the report on 2017 where significant contributions were made by GLAM Committee members and associates, exceeding the resources that would typically be available to the committee in any given year. In addition to the in-kind contributions that supported the 2017 report preparation, a number of targeted, bi-national data collection work plan activities were supported through the International Watersheds Initiative (IWI). The GLAM Committee continues to look for ways to deliver on work plan priorities within the context of existing resource limitations. The development of the 12 year strategy initiated during the reporting period will ultimately be used by the GLAM Committee to better identify resource requirements needed to ensure successful long-term implementation of the adaptive management process.

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 sixth semi-annual report will highlight GLAM Committee progress and accomplishments for the reporting period of September 1, 2018 to February 28, 2019.

2.0 Work Plan Progress

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) 2018 work plan ending September 30, 2018 as well as items initiated under the new FY19 work plan starting in October 1, 2018. The FY18 and FY19 work plans are 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 FY18 or FY19 work plans. This third tier will be initiated if and when there is an examination of potential improvements to the regulation plan.

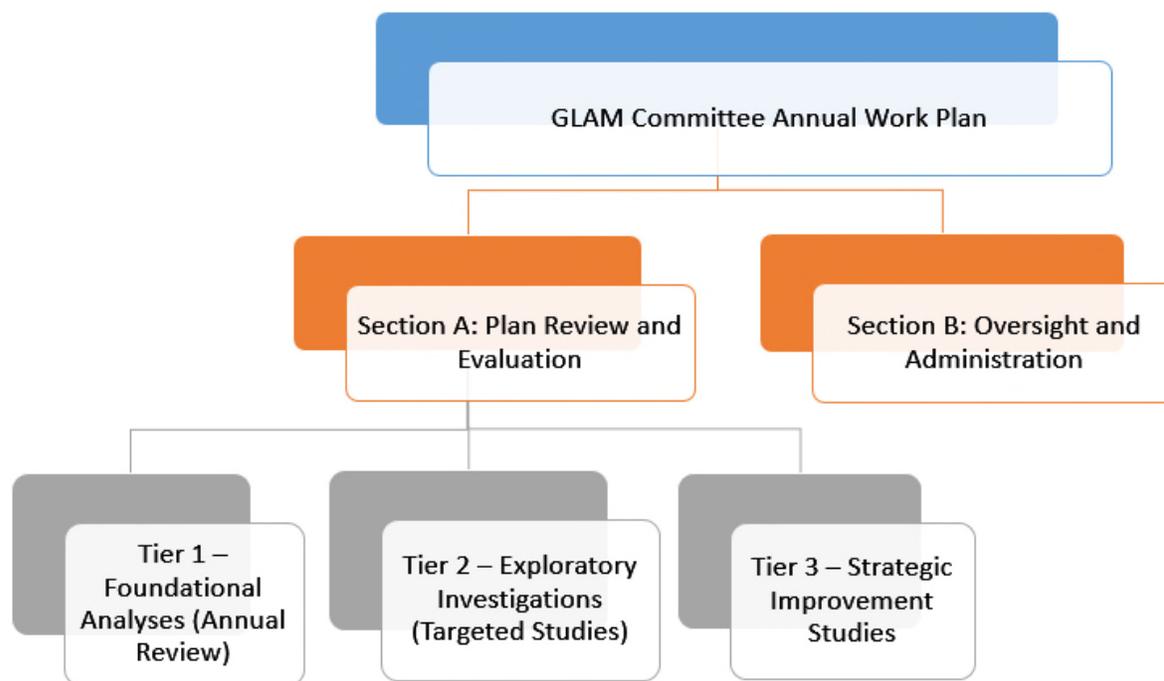


Figure 1: GLAM Work Plan structure

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. Efforts are supported in large part by in-kind agency contributions as well as project specific support through the International Watersheds Initiative (IWI). A particular focus during the first part of the reporting period (fall 2018) was the completion of the report on 2017 conditions. This took significant effort from the committee and required considerable in-kind contributions from GLAM Committee members and associates through to its completion at the end of November, 2018. Moving into December, 2018 and the early part of 2019, focus shifted to implementing a variety of targeted tier 2 projects to fill data gaps and support long-term regulation plan assessment efforts. Highlights of progress are discussed below and task-specific details of FY18 and FY19 work plan items are provided in *Appendix A*.

2.1.1 Tier 1 activities – foundational analyses (annual review)

The GLAM Committee finalized an extensive annual review on 2017 conditions related to regulation plan operations and performance for the Boards and the IJC during the reporting

period. The report covered both Lake Superior and Lake Ontario outflows. Given the record high water levels observed in the Lake Ontario – St. Lawrence River basin in 2017, annexes were included to cover additional material for that portion of the system. The draft report was reviewed by the Boards and discussed at their September 2018 meetings in Cornwall, ON. All Board members had the opportunity to review, edit, and approve the updated version submitted to the IJC in October 2018 ahead of the fall semi-annual appearances in Ottawa. The GLAM Committee discussed the draft report with IJC Commissioners at the appearances on October 25, 2018 and following additional feedback from committee members, more updates and changes were made and a final version was submitted on November 19, 2018. The report was endorsed by the IJC and posted to the GLAM website on November 29, 2018.

The GLAM Committee’s analyses support the finding of a [report issued by the International Lake Ontario-St. Lawrence River Board](#) in May 2018 that record-breaking precipitation in the Lake Ontario – St. Lawrence River basin was the primary driver of high water levels in 2017 and that Plan 2014, the plan used to regulate Lake Ontario outflows, did not cause, nor meaningfully exacerbate the flooding and associated damages that occurred. The committee also examined potential changes to the rules in Plan 2014, including the maximum flow limits and high-water trigger levels, and found that the changes would not have significantly reduced water levels in 2017 and, in some cases, would have only shifted the damaging impacts from one geographic location or interest to another. Overall, the analyses reinforce the fact that regulation of outflows alone cannot eliminate severe impacts during such prolonged periods of extreme water supplies.

The GLAM report included considerable information on water level impacts, particularly in the Lake Ontario – St. Lawrence River basin. Data was gathered from a wide variety of sources, including projects led by the GLAM Committee such as an online survey of shoreline property owners and analysis of aerial imagery and site photos acquired during 2017 when water levels were near their peak. The report also relied heavily on information gathered by other agencies and it was noted that in some cases, there may be additional information available that was not yet released by those agencies. For example, there may be information available through the State of New York and requests were made through the IJC (letter of March 27th, 2018) but the GLAM Committee is not aware of a response to that IJC request and data was not made available for use in the report. The GLAM Committee will continue to pursue additional data and information on 2017 impacts that may be available through other agencies as part of its long-term efforts. In addition, the GLAM Committee has initiated efforts to fill data gaps including Tier 2 initiatives within the FY19 work plan and discussion in Section 2.1.2 below.

The report also discussed 2017 conditions in the upper Great Lakes basin as they relate to Lake Superior outflow regulation. Above average water levels were observed on the upper Great Lakes and related impacts were observed on Lakes Superior, Michigan-Huron and Erie. Water levels from June to December 2017 on Lake Superior approached the recorded monthly maximums set in 1985. Lake Michigan-Huron had a higher than average rise from April through July, and Lake Erie came within 15 cm (5.9 in) of its 1986 monthly record high level for May. However, the regulation of flows from Lake Superior had a limited impact on water levels on Lake Superior,

Lakes Michigan-Huron and no discernable impact on Lake Erie. One exception, though, is the St. Marys River, where water levels are more sensitive to changes in the outflow from Lake Superior and, as a result, regulation decisions can significantly change impacts. In recent years, including 2017, the board has deviated from Plan 2012 in order to accommodate expected temporary reductions in hydropower plant capacity on the St. Marys River and reduce the potential that these reductions may have in causing adverse impacts related to high and fluctuating flows in the St. Marys Rapids.

Tier 1 (annual review) activities of the GLAM Committee are 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. Some aspects have already been integrated into the committee's FY19 work plan. The 2017 report is considered a "special report" prepared due to the exceptional conditions. While it provides a useful reference for similar reviews of extremes in the future, it is clear that the GLAM Committee does not have the resources, nor does it intend, to produce reports similar to the extent of the 2017 unless extreme conditions warrant it. The GLAM Committee is looking at ways to implement a far simpler and more efficient annual review process on an ongoing basis to help keep the Boards informed.

2.1.2 Tier 2 activities - exploratory investigations (targeted studies)

2.1.2.1 Hydroclimate

Aside from the considerable effort related to the report on 2017 conditions, the hydroclimate group also pursued a project related to the 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 product that includes overlake precipitation. However, a longer duration dataset is required to allow precipitation anomalies to be developed (i.e. not just absolute precipitation amounts but anomalies from a long-term condition). The GLAM Committee submitted a request for funding to support the project. During the reporting period, the IJC entered an agreement with University of Illinois to develop the historical precipitation products and the work was initiated during the reporting period. The project is supposed to be completed by June 2019.

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. These long-term

simulation datasets will be important for the GLAM Committee in better understanding water supply conditions in the Great Lakes basin.

2.1.2.2 Impact assessment

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 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 both the FY18 and 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.

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. The wetlands performance indicator for Lake Ontario remains a priority and the committee has continued monitoring changes in wetland vegetation and related model validation efforts. Using support from the IJC through the IWI, the Canadian Wildlife Service undertook sampling at 16 Canadian wetland sites in September of 2018 (see Figure 2). The sampling approach is consistent with past methods for both the Canadian and US shoreline and includes sampling vegetation at different elevations throughout the sites. The data processing took place throughout the reporting period with final project deliverables expected at the end of March 2019. The 2018 sampling was not included in the report on 2017 conditions.

In addition to the IWI supported wetland monitoring, further work has taken place in the upper St. Lawrence River related to fish, and muskrat indicator monitoring. This is in the early stages of a multi-year effort so only interim results are available at this time. The data from these indicators will help the GLAM Committee track the ecosystem response for the Lake Ontario shoreline and other areas. Preliminary findings based on 2017 and 2018 monitoring indicate an increase in Northern Pike young-of-year in the upper St. Lawrence River, but further monitoring of this year class is required in future years to determine if a measurable response is observed. The monitoring of muskrat house location and occupation is ongoing.

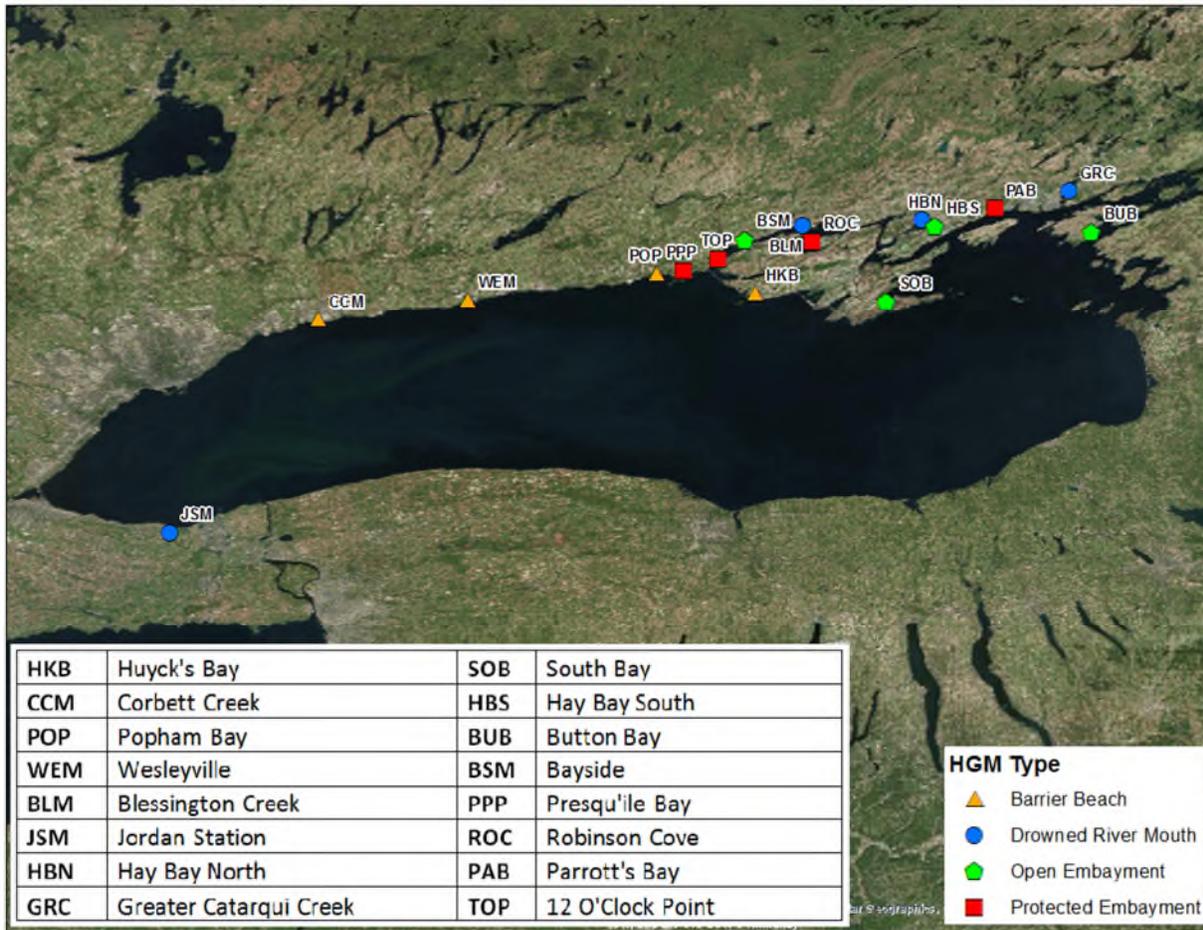


Figure 2: Wetlands sites sampled by Canadian Wildlife Service in 2018

Progress continued on related ecosystem work plan items to support longer-term efforts of the committee. However, due to priorities related to the 2017 report and the need to wait on other available data, progress was reduced on a few of these items. For example, the GLAM Committee is waiting for the 2018 wetland monitoring data to be delivered by the Canadian Wildlife Service before continuing on with model comparison related to the meadow marsh performance indicator. As well, the GLAM Committee identified a number of relevant items as part of a previous wetland remote sensing contract but has not been able to pursue specific follow up actions yet. Follow up work related to a wetland remote sensing workshop has been identified on the FY19 work plan and further updates are expected in future reporting periods.

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 FY18 and FY19 work plans are intended to provide information to support the review and validation of existing performance indicators related to municipal and industrial, commercial navigation, hydropower production, coastal property owners, and recreational boating impacts.

During the reporting period, the GLAM Committee finalized impact assessment material for use in the 2017 report, particularly summarizing results from the 2017 Conservation Ontario survey of shoreline property owners as well as review of oblique and ortho-photography related to shoreline impacts on Lake Ontario and the St. Lawrence River during 2017. While the IJC provided support for the 2017 shoreline survey, the data processing for both tasks has largely been done with in-kind agency resources primarily out of ECCC. Following the completion of the 2017 report, the GLAM Committee has also been preparing a draft fact sheet related to the survey results to highlight some of the relevant findings for a general audience. A draft of the fact sheet was prepared in the reporting period and will undergo further review in spring 2019.

Through the support of the IWI and the US Section of the IJC, funding arrangements were finalized in the fall of 2018 to revisit a number of shore protection structures that were previously inventoried prior to the implementation of Plan 2014 to determine their general conditions following the high water levels of 2017. The funding arrangements were made with the US Army Corps of Engineers survey office in Buffalo, NY. The survey office initiated the planning process for the project over the winter, including starting the process of obtaining site access permissions, intends to initiate field data collection in the spring of 2019, and complete the project by the end of FY19.

The GLAM Committee also made considerable progress in gathering further information from the municipal and industrial water use sector as well as marinas and yacht clubs along the Lake Ontario – St. Lawrence River shoreline. Based on the information available for the report on 2017 conditions, the committee determined that further input from these sectors would be helpful to understand and document high water impacts and those tasks were identified in both the FY18 and FY19 work plans. The committee received support from the IWI and the Canadian Section of the IJC issued a contract to LURA Consulting in the fall of 2018 to undertake the work. LURA Consulting has worked closely with representatives of the GLAM Committee to identify contact lists for related facilities within the study area and to develop and implement the data gathering process which included both phone and online survey formats. Data collection was initiated during the reporting period and was expected to continue through March 2019 with a summary of the results due to the IJC and GLAM Committee in May 2019.

The GLAM Committee's FY19 work plan also identified the need to initiate a general review of the socio-economic performance indicators for Lake Ontario and the St. Lawrence River. This work was not intended to be initiated in earnest until after the 2017 report was finalized and it is expected the review will carry over into the GLAM Committee's FY20 work plan. The committee intends to initiate progress on this task starting in later spring 2019, building on some of the information gathered for the 2017 report as well as additional information gathered in the FY19 work plan tasks described earlier.

Upper Great Lakes Ecosystem and Socio-Economic Activities:

Much of the GLAM Committee's effort related to upper St. Lawrence ecosystem and socio-economic indicators has been in the development of an ecohydraulic model for the St. Marys

rapids and vicinity and further such tasks were identified in both the FY18 and FY19 work plans. The intent of the model is to be able to better understand how flow changes in the St. Marys rapids may impact aquatic habitat for critical species. The initial effort was a coordinated project between the US Army Corps of Engineers in Detroit and Environment and Climate Change Canada staff in Quebec City. The IJC had previously (January 2018) approved an IWI proposal to collect further substrate data in the St. Marys rapids to support model enhancements but had asked to defer funding into US FY19. During the current reporting period, the GLAM Committee renewed efforts to finalize funding arrangements for that project, including revising the detailed scope of work and the geographic boundaries for the data collection effort.

In addition to the ecohydraulic model development, the GLAM Committee has identified the importance of developing a flooding indicator for the St. Marys River including Whitefish Island. This was on the FY18 work plan and was pushed to the FY19 work plan. There was no progress on this project during the reporting period due to focused efforts on preparing the report on 2017 conditions and the Committee hopes to initiate work later in FY19. Like the Lake Ontario – St. Lawrence River priorities, the GLAM Committee’s FY19 work plan also identified the need for a status review of upper Great Lakes performance indicators to determine gaps and critical next steps. The GLAM Committee discussed this indicator review task at their February 2019 technical meeting and expected to make further progress in the later spring or summer of FY19.

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 (in progress) reviews and highlight priorities in terms of the GLAM Committee’s longer-term requirements. Progress on these first two tasks was limited during the reporting period while the 2017 report was finalized. Further

progress is expected in the late spring and summer of 2019 (subject to available resources and operational requirements) to support reporting to the boards in the fall of 2019. The GLAM Committee did finalize its portion of the IWI supported project related to the coordinated routing model. That project included the development of front end data handling routines to support updates to the routing model which is used to simulate water levels and flows within the Great Lakes. Following the GLAM Committee's effort, the next phase of the project is now being led by the Coordinating Committee on Great Lakes Basic Hydrologic and Hydraulic Data (note that there is considerable overlap of membership between the GLAM Committee and the Coordinating Committee).

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 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 committee also held a face-to-face meeting on February 20 and 21, 2019 in Burlington, Ontario. The GLAM Committee also finalized its fall 2018 semi-annual update and presented to the IJC Commissioners in Ottawa at the fall semi-annual meetings.

Following the finalization of the report on 2017 conditions in late November, a priority of the GLAM Committee was to revisit the initial highlights of the 12 year strategy discussed at the June 2018 work planning meeting. The GLAM co-chairs and secretaries drafted a working document which was discussed by the committee at its February 2019 meeting. The committee identified leads to work with various sections of the draft and improve the material with the goal of having a refined document ahead of the June 2019 work planning meeting. Through these discussions, the committee identified the need for additional support related to information management and peer review requirements. The IJC has agreed to provide additional support related to developing the information management component of the long-term strategy and the committee has identified leads to better define the peer review/scientific engagement strategy moving forward. The committee also discussed the idea of a joint workshop with the boards in September 2019 to discuss the longer-term strategy and identified GLAM priorities. That proposal was taken to the boards at their March 2019 meetings for discussion.

Implementation of an effective engagement strategy continues to be a challenge for the GLAM Committee. A number of GLAM Committee members participate in regular activities of the International Lake Ontario – St. Lawrence River Boards communications committee so there is considerable coordination there. However, the GLAM Committee continues to work on a reasonable strategy that balances engagement needs with available resources and time. In the meantime, GLAM Committee members continue to promote the work of the committee

through specific work plan tasks (e.g. the marina/yacht club and municipal and industrial water use survey) as well as contributing pieces to targeted outreach activities. For example, a presentation related discussing the GLAM Committee and its activities was made at the A.D. Latornell Conservation Symposium in November 2018. The GLAM Committee co-chairs also continue their ongoing efforts of staying connected with both the Water Quality Board, the Science Advisory Board, and work under the GLWQA through participation in calls, meetings, and membership on the GLWQA Annex 9 Climate Change Impacts Sub-Committee.

3.0 International Watersheds Initiative Projects

The GLAM Committee's FY18 and FY19 work plans were 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 7 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.

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 would like to acknowledge the contributions of both Arun Heer and Dr. Andrew Gronewold to the work of the committee since 2015. Mr. Heer accepted another position with the US Army Corps of Engineers and finished his time with the GLAM Committee at the end of 2018 while Dr. Gronewold accepted a faculty position at the University of Michigan and resigned from the GLAM Committee in early 2019. Both Mr. Heer and Dr. Gronewold made important contributions to the GLAM Committee over the years, including Mr. Heer as the US co-chair. Their technical expertise, guidance, and constructive feedback has been important in these initial years as the GLAM Committee develops and formalizes its activities and the committee wishes them the best in their new endeavors. **It is important to highlight that neither of the committee membership positions vacated by these two individuals, including that of the US co-chair position, has been filled as of the time of this report preparation.**

The GLAM Committee would also like to welcome Dr. Kevin O'Donnell as a new member of the Committee based on confirmation by the Commissioners on December 3, 2018. He replaced Mr. Fred Luckey who had retired during the previous reporting period.

As mentioned previously, the development and finalization of the 2017 report by the GLAM Committee was very resource intensive. In discussions at the GLAM Committee meeting in February 2019, there was general agreement that such an effort would not likely be feasible in future years and that reporting options would need to be adjusted in the context of available resources. In developing its annual work plan, the GLAM Committee makes every effort to align work plan expectations with anticipated resources. However, as noted in previous updates, many committee members and technical support staff play important operational roles with the various Great Lakes boards and are sometimes required to defer expected contributions to specific GLAM Committee work plan tasks. As the GLAM Committee works to refine its longer-term (12 year) strategy over the next number of months, every effort will be made to align expectations with a reasonable understanding of expected resources.

Respectfully Submitted,

Vacant since December 31, 2018
GLAM Committee US co-chair

Ms. Wendy Leger
GLAM Committee Canadian co-chair

Appendix A: Summary of FY19 Work Plan Progress (as of February 28, 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	The Hydroclimate Working Group finalized the 2017 summary as part of the 2017 report submitted to the IJC by the GLAM Committee in November 2018. The working group has initiated the development of the 2018 summary and will be moving that forward later in spring 2019.	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	The Impact Assessment Working Group finalized the 2017 summary as it relates to Hydropower, Municipal and Industrial Water Uses, Commercial Navigation, Coastal Property Owner, Recreational Boating and Tourism, and Ecosystem as part of the 2017 report submitted to the IJC by the GLAM Committee in November 2018. The working group has initiated the development of the 2018 summary and will be moving that forward later in spring 2019.	No
Plan Review and Evaluation Working Group			
FY19-1.3	Prepare routine annual report material required for ongoing evaluations of existing regulation plan performance	The Plan Review Working Group finalized water level and flow simulations for the 2017 report related to Lake Ontario – St. Lawrence River and Lake Superior outflows as part of the 2017 report submitted to the IJC by the GLAM Committee in November 2018. The working group has initiated the development of the 2018 summary and will be moving that forward later in spring 2019.	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 has been reviewing initial draft materials related to the 12-year strategy development and will be further developing the strategy over the coming months.	No
FY19-2.2	Completion of NWS Multi-Precipitation Estimates (MPE)/CaPA merged baseline climatology development	Funding arrangements were finalized between the IJC and the University of Illinois at the end of the previous reporting period. The intent is to develop a long-term climatology using the merged CaPA/MPE product to support comparisons of current rainfall conditions to past conditions and a related website. 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 December 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 discussed this item at the February 2019 meeting and agreed this would move forward following the 12 year strategy development, building on information gathered to-date for related GLAM activities. Further progress is expected later in Spring and Summer 2019.	No
FY19-2.4	Continued Evaluation of Meadow Marsh Algorithm	The GLAM Committee has been waiting for delivery of the 2018 monitoring data before undertaking further comparison with the wetland (meadow marsh) algorithm. The 2018 monitoring data by the Canadian Wildlife Service is expected at the end of March 2019.	No
FY19-2.5	Monitoring of Lake Ontario Coastal Wetlands on the Canadian Shoreline	The field monitoring of 16 Canadian sites on the Lake Ontario shoreline was undertaken by the Canadian Wildlife Service in early fall of 2018. The data was reviewed and processed in the late fall and early winter and is expected to be delivered to the GLAM Committee by the end of March 2019.	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 was little progress on this item during the reporting period. However, further progress is expected in the coming months based on a related wetlands project being undertaken by Environment and Climate Change Canada as well as using hyperspectral wetland data collected in late summer 2018 by the US Army Corps of Engineers in support of a US Environmental Protection Agency effort.	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	The GLAM Committee discussed this item at the February 2019 meeting and agreed this would move forward following the 12 year strategy development, building on information gathered to-date for related GLAM activities. Further progress is expected later in Spring and Summer 2019.	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 reporting period, primarily seeking site access permission over the winter in anticipation of spring 2019 field data collection. The full project results are to be delivered by September 2019.	Yes
FY19-2.11	Implementation of Shoreline Damage Survey for the Canadian Shoreline of Lake Ontario and the Upper St. Lawrence River	The survey implementation was largely undertaken prior to the most recent reporting period. However, considerable effort was put into consolidating some of the results for the 2017 report released in November 2018. More recently, the GLAM Committee has been working on a simpler fact sheet highlighting some of the results. That fact sheet was still under review at the end of the reporting period.	No
FY19-2.12	Survey and review of operational impacts on marinas due to 2017 water levels	Contracting arrangements were finalized during the reporting period and the project initiated. In collaboration with GLAM Committee representatives, LURA Consulting developed the questionnaire and finalized their engagement strategy. LURA Consulting initiated their outreach efforts in late January 2019 and the online survey will remain accessible through late March, 2019. The final project report by LURA Consulting will be delivered to the GLAM Committee in May 2019. The GLAM Committee sought input and support from the International Lake Ontario – St. Lawrence River Board to connect with potential respondents.	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 is being done jointly with FY19-2.12 discussed previously as part of a single contract with LURA Consulting. The timelines and approaches are similar, although LURA Consulting has been using phone interviews for the M&I responses.	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	The GLAM Committee discussed this item at the February 2019 meeting and agreed this would move forward following the 12 year strategy development, building on information gathered to-date for related GLAM activities. An updated report will be provided by the end of FY19.	No
FY19-2.16	St. Marys River IERM Rapids Data	The IWI project was conditionally approved as of January 11 th , 2018. At the request of the IJC due to funding availability, this project was deferred with data collection expected in the summer of 2019. During the most recent reporting period, the GLAM Committee worked with the IJC to refine and finalize the Scope of Work for the project to support necessary inter-agency agreements.	Yes
FY19-2.17	St. Marys River IERM Expansion	This task will not move forward until after the additional St. Marys River data collection 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 has taken place and been processed.	No
FY19-2.19	Development of initial flooding performance indicator for the St. Marys River	Progress on this task is expected later in FY19.	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 discussed this item at the February 2019 meeting as part of the broader 12 year strategy development as well as preparing material for the annual review. The Committee expects this work to occur in the spring and summer of 2019 in preparation for the fall board meetings.	No

FY19-2.21	Plan Review gap analysis	The plan review gap analysis is intended to consolidate critical regulation plan operation issues highlighted based on the 2017 (completed) and 2018 (in progress) reviews and highlight priorities in terms of the GLAM Committee's longer-term requirements. This work will move forward later in spring and summer of 2019.	No
FY18-2.22	Routing model update	Final documentation for the GLAM Committee portion of this project was received in the fall of 2018. The next step of the effort is now being led by the Coordinating Committee of Great Lakes Hydraulic and Hydrologic Data, closely collaborating with a number of GLAM Committee members.	Yes

SECTION B: GLAM Oversight and Administration

Task	Task Title	Status	IWI
FY19-3.1	GLAM Committee Coordination, Management, and Reporting	The fall semi-annual update was provided to the IJC in early October 2018 and approved by the IJC at the October, 2018 semi-annual appearances in Ottawa. The semi-annual report had previously been reviewed by the International Lake Ontario – St. Lawrence River, Niagara, and Lake Superior boards.	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 February 2019 meeting within the context of the 12-year strategy development. IJC liaisons participated in the meeting and agreed to follow up to determine whether IJC resources could be leveraged to move this item forward.	No
FY19-3.4	Maintain engagement with GLWQA activities	The Canadian and US co-chairs share information 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 FY18 and FY19 work plan items. For example, considerable outreach was undertaken on behalf of the committee in support of the municipal and industrial water use surveys as well as the marina and yacht club surveys on Lake Ontario and the St. Lawrence River throughout the reporting period.	No
FY19-3.6	Development of 12-year strategy	The GLAM Committee co-chairs and secretaries drafted initial material for discussion by the Committee at the February 2019 meeting. Following review at the meeting, leads were identified for various sections of the document and tasked with updating and improving the material later in spring 2019. The GLAM Committee felt it would be helpful to have a workshop with the regulation boards in September 2019 to discuss the long-term strategy and agreed to present it as an option for discussion at the boards spring meetings in March 2019.	No

