

Annual Work Plan

Fiscal Year

2018

Annual Work Plan towards building a long-term vision and adaptive management strategy for the on-going review and evaluation of the regulation plans.

Covering
October 1, 2017 to September
30, 2018

October 11th, 2017

WORK PLAN

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Blue text identifies other International Joint Commission Board and Committee affiliations

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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.

Purpose

This work plan includes the priority activities to be carried out by the GLAM Committee in the period covering October 1, 2017 through September 30, 2018 toward building a long-term vision and work plan for the on-going review and evaluation of the regulation plans.

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Introduction

On January 16, 2015 the International Joint Commission (IJC) issued a Directive establishing the Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee which reports to the three Great Lakes-St. Lawrence River Boards (Superior, Niagara and St. Lawrence (Boards)). The GLAM Committee is to carry out the required monitoring, modelling and assessment related to on-going evaluation of the regulation plans and address other questions that may arise due to changing conditions, in consultation with the Boards. This document presents the third annual work plan of the GLAM Committee covering Fiscal Year 2018 (FY18) from October 1, 2017 through September 30, 2018.

Purpose and Objectives

As outlined in the January 2015 GLAM Directive, the overall objective of the GLAM Committee is to provide information to the Boards and advise them and the IJC regarding the effects that the control structures approved in the Commission's Orders of Approval and Directives have on levels and flows in boundary waters and the impacts the regulation plans have on the affected interests. This includes the on-going review and evaluation of regulation plans related to:

- a) the effectiveness of the existing regulation plans in managing water levels and flows in the Lake Ontario-St. Lawrence River system and Lake Superior.
- 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 Directive tasks the GLAM Committee to design a work plan that assists the Boards by addressing these questions:

1. How well are the impacts of levels and flows represented by current data and models used in the evaluation?
2. How will future water supplies differ from those used to test the current management of levels and flows?
3. How are other physical, chemical, biological, and/or socio-economic conditions of the system changing over time?
4. How can the management of levels and flows benefit other physical, chemical, biological and/or socio-economic conditions?

The 2018 GLAM work plan builds on activities undertaken in the Committee's 2016 and 2017 work plans.

Scope and Timeline

This is the third work plan prepared by the GLAM Committee and it builds on work initiated in the [2016](#) and [2017](#) work plans and is nested within the context of a broader 3-5 year mid-term strategy document developed as part of Year 1 activities and presented as part of the GLAM Triennial Report submitted to the IJC in May, 2017. The 3-5 year mid-term strategy document provides an overview of a three tiered framework and the organizational structure for how GLAM will achieve the on-going review of the regulation plans. It provides the broader context and the annual work plans provide the details of what will be carried out in a specific year towards meeting the broader objectives of the 3-5 year mid-term strategy. The annual work plan coincides with the U.S. fiscal year and this 2018 plan covers October 1, 2017 through September 30, 2018. The FY18 work plan includes a mixture of carry over items from the FY17 work plan as well as new and emerging activities that fit within the context of the 3-5 year mid-term strategy. The 3-5 year strategy summarized in the Committee's first Triennial Report outlines a 3 tiered approach that is used to organize work plan tasks. The three tiers include:

Tier 1: Foundational Analyses: An annual review of foundational requirements for the on-going review of the regulation plans and an assessment of priorities for the coming year.

Tier 2: Exploratory Investigations: Targeted studies for investigating specific aspects of a regulation plan and for improving the performance indicators, tools, and processes to support the Strategic Improvement Studies and feedback into the Foundational Analysis.

Tier 3: Strategic Improvement Studies: Comprehensive assessment of the relative performance of a set of alternative regulation strategies to achieve improved outcomes.

GLAM Organization, Roles, and Responsibilities

GLAM is organized based on the structure outlined in the 3-5 year mid-term strategy. There are three integrated working groups that lead and undertake specific activities within the three tiers. They include the following:

1. **Hydroclimate Working Group** – Focuses on understanding and reducing uncertainty in the primary “driver,” that being the dynamics of the hydroclimate system, the impacts on water supplies and other secondary factors (i.e., winds, waves, etc.), and the resulting water level and flow response.
2. **Impact Assessment Working Group** – Structured to ensure outcomes of water level and flow scenarios on the various interests can be measured and assessed. These interest categories include commercial navigation, hydropower, municipal and industrial water uses, coastal, recreational boating and tourism, and environmental.
3. **Plan Review Working Group:** This group will augment, enhance, update and run the models and tools used in reviewing and evaluating regulation plan performance. This group integrates all of

the data and science to allow the assessment of regulation plan performance. Collectively, this working group supports the activities needed to understand whether the management of levels and flows can benefit other physical, chemical, biological, and/or socio-economic conditions.

In addition to the working groups, GLAM Committee members integrate the available information and provide **Decision Support** to the Boards to articulate regulation plan objectives and decision criteria for recommending when and how a decision should be made by the Boards to propose a change of the regulation plan to the IJC.

The GLAM Committee as a whole provides oversight to the working groups as well as guidance and support related to cross-cutting issues including providing strategic direction, collaboration with the Boards and the IJC to understand the implication of GLAM products and findings, liaising related to Great Lakes Water Quality Agreement (GLWQA) activities, supporting external communications with key stakeholders through outreach and engagement, managing information, and ensuring quality control. Figure 1 illustrates the current structure.



Figure 1: GLAM organizational and reporting structure

Fiscal Year 2018 Work Plan - Product Descriptions, Timelines and Resources

The adaptive management process is an on-going effort that recognizes the dynamics of the system. This work plan is based in the context of a long-term initiative and the 15 year reporting period, but it also represents a summary of priority adaptive management products and tasks to be executed or initiated within the period covering October 1, 2017 through September 30, 2018 and builds upon the previous work of the GLAM Committee. The tasks and products are a mixture of carry over items from the 2017 work plan as well as new and emerging activities, particularly as they relate to the record high water level conditions observed within the Lake Ontario-St. Lawrence River system during 2017.

The Work Plan is divided into two sections. **Section A** identifies work projects to be undertaken by the working groups in support of plan review and evaluation. The individual tasks are organized based on the tier and the working group. **Section B** outlines GLAM oversight and administrative activities needed to manage the GLAM Committee and support all work projects and long-term efficiencies.

Specific tasks identified in the work plan represent activities the GLAM Committee has identified as priorities and which the GLAM Committee believes can be resourced with one of the following options:

- 1) Available staff and/or assigned resources given current expectations for the coming year, or
- 2) Are already receiving financial support through the through International Watershed Initiative (IWI), or
- 3) Are the highest priority for seeking funding support through the IWI or other funding opportunities and are therefore dependent on the GLAM Committee’s ability to secure those funds.

Table 1 summarizes current expectations regarding identified resources available to the GLAM Committee in FY 2018. Note that a number of IWI projects are continuing from the FY17 work plan and the identified support includes the total project support and not just the FY18 portion. In addition, agencies are providing in-kind staff contributions. These in-kind staff contributions have been divided amongst all of the identified tasks.

Agency	\$US	\$CDN
IJC support (includes proposals submitted under International Watersheds Initiative (IWI) ***)	\$187K	\$145K
Total:	\$187K	\$145K

Table 1: Summary of currently identified resources (\$) for GLAM activities in FY 2018 (includes full support for tasks that may have been partially completed in FY17. Therefore these totals include support that was previously in FY17 work plan and not just the incremental FY18 component)**

***** Resources identified as under the IWI are based on proposals that have been approved by the IJC. However, formal arrangements are required for individual projects before the funds can be allocated. If formal arrangements cannot be made, the funding would not occur.**

Section A – Plan Review and Evaluation

Tier 1: Foundational Analyses

The primary tier 1 objective for the FY18 work plan is to undertake an annual review of 2017 conditions related to regulation plan operations and performance for reporting to the Boards and the IJC. This review will include a hydroclimate component, impact assessment component, and plan review component. Such reviews are expected to be undertaken annually, although particular priority and added emphasis is being assigned to the current review due to the extreme conditions observed in 2017 in the Lake Ontario – St. Lawrence River system. The primary product from the Tier 1 analysis will be a draft GLAM Committee Annual Report for calendar year 2017 on what occurred over the past year and lessons learned. The key components of the annual review, and specific sub-components are identified below:

Hydroclimate Working Group

FY18-1.1: Prepare foundational hydroclimate analysis for calendar year 2017

The priority for the Hydroclimate Working Group (HWG) is to undertake a 2017 annual review. Given the extreme hydrological conditions observed in 2017, there is expected to be considerable material to integrate and synthesize. The HWG will work closely with other GLAM Work Groups as well as with the regulation representative offices for the various Boards to ensure coordination, consistency, and efficiency. Activities will be in support of the main categories proposed for the annual report and include:

- Characterization of key hydrological variables;
- Climatological drivers behind the key hydrological variables;
- Assessment of forecasting accuracy;
- Historical context (i.e. were hydrological conditions consistent with historical/future climate expectations?)

The HWG leads will be coordinating the effort and will be drawing on appropriate agency resources were necessary through the GLAM Committee as well as through collaboration with the Coordinating Committee on Great Lakes Basic Hydrologic and Hydraulic Data. As this is the first iteration of a GLAM annual review and the hydrological conditions are particularly unique, it is expected that this effort will take some time and considerable effort. It is anticipated that some of the processes undertaken to develop the 2017 report can be replicated in future years with reduced effort.

The goal is to have a complete draft of the hydroclimate analysis available for Board review ahead of the March 2018 meetings.

Proposed Products:

- Draft document outlining processes for tier 1 annual hydroclimate foundational analyses for GLAM purposes.
- Draft year-end hydroclimate analysis to be incorporated into annual report for Board review.

*Impact Assessment Working Group***FY18-1.2: Prepare foundational impact assessment analysis for calendar year 2017**

The priority for the Impact Assessment Working Group (IAWG) is to undertake a 2017 annual review. Given the record high water levels observed in 2017 for the Lake Ontario – St. Lawrence River system, the impact assessment teams will need to integrate a range of available information to support the reporting. The IAWG will work closely other GLAM Work Groups to ensure coordination, consistency, and efficiency. The IAWG will be reporting on benefits/impacts observed in 2017 for both the Lake Ontario – St. Lawrence River System and the Upper Great Lakes. The following categories will be addressed:

- Coastal Riparian
- Recreational Boating and Tourism
- Commercial Navigation
- Municipal and Industrial Water Uses
- Hydropower
- Environment

For each category, the annual report will strive to include information related to:

- Summary of GLAM work and other agency activities to assess impacts/benefits
 - o Who's collecting info, and what info is being collected?
 - o Media coverage
- Impacts/Benefits of current water conditions (i.e. what have we found out based on available information? Where were the vulnerable places, and under what conditions?)
- Progress on model/PI validation (run SVM and compare to reported impacts, noting caveats)
- Adaptive responses
- General Surveillance - Impacts/benefits not captured by PIs and what could be improved in model simulations (pulled out to Gap analysis), may also include general trends in the sector if that information is available.

The IAWG will be relying on information and data gathered through primarily external sources. As such, it is not expected that each of the impact categories will be able to be addressed to the same level of detail and/or completeness. Nevertheless, the groups will do their best to collect and report on as much information as is available. As this is the first iteration of a GLAM annual review and the 2017 conditions are particularly unique, it is expected that this effort will take some time and considerable effort not expected every year. It is anticipated that some of the processes undertaken to develop the 2017 report can be replicated in future years with reduced effort. The following categories of work will serve to focus the Committee's efforts on different aspects of the report:

1. Track and synthesize available impact information (i.e. damage/benefit reports) and agency responses to high water conditions (by impact category).

It is important to understand how various agencies that directly or indirectly support each impact category have responded in 2017. The GLAM Committee is interested in knowing what data was being gathered by those agencies, by whom, and for what purposes. The impact assessment teams will then be able to consider how the information will support the evaluation of regulation plan performance. The GLAM Committee recognizes the need to leverage available information on observed benefits and impacts within each impact category. Teams for each impact category will undertake efforts to identify such damage reports and synthesize critical information that can support plan evaluation. The results will be summarized within the overall annual. Where possible, information will be managed in an internal spatial database, particularly to track and map damage reports. This information will be synthesized to look at the types of impacts being reported as well as where critical "hot spots" can be identified. This is primarily expected to be an internal (GLAM, Board, IJC) product with the synthesis material summarized within the overall annual report.

2. Summarize media coverage

There has been considerable media coverage in 2017 due to high water levels in the Lake Ontario-St. Lawrence River system. Much of this coverage has been tracked as part of the Daily Briefing reports but the GLAM needs to undertake a further review of the reports. Information on the types and location of impacts will be included in the overall annual report.

3. Compare observed benefits/impacts with available plan evaluation tools

Plan evaluation tools were previously developed as part of the IJC's Lake Ontario-St. Lawrence River Study and International Upper Great Lakes Study. A long-term requirement of the GLAM Committee is to see how these tools compare with benefits/impacts under observed water level conditions. Detailed projects to review and update plan evaluation tools will primarily occur as Tier 2 tasks. However the GLAM Committee hopes that some initial effort can be conducted for some performance indicators to support the Tier 1 annual report. Any results that are obtained would be summarized within the overall annual report as part of Task FY18-1.2.

The goal is to have a complete draft of the impact assessment analysis available for Board review as part of the overall annual report ahead of the March 2018 meetings.

Proposed Products:

- Draft document outlining processes for tier 1 annual performance indicator foundational analyses for GLAM purposes.
- Draft year-end impact assessment analysis to be incorporated into annual report for Board review.

Plan Review Working Group

FY18-1.3: Prepare foundational plan review analysis for calendar year 2017

The priority for the Plan Review Working Group is to undertake a 2017 annual review. There are important plan performance questions that need to be considered for both the Lake Superior and Lake Ontario outflows. The plan review team will be undertaking simulations of water levels and flows to address specific operational questions that have emerged in 2017 for Lake Ontario outflows and over the past few years for Lake Superior outflows. Over the longer-term, it is hoped that the plan review will include not only water level and flow results, but also results from the plan evaluation tools as well. For the 2017 report, the primary focus will be on the water level and flow results with plan evaluation tool results included where feasible.

For Lake Ontario, some of the key plan review simulations will include comparison of operations with simulations of Plan 1985DD, alternative F and L limits, alternative trigger levels, ice limits and conditions, different Net Basin Supplies and Ottawa River discharge, different starting levels and potentially other simulations as resources are available. For Lake Superior, there will be comparisons with Plan 77A as well as comparisons between simulated plan flows as actual plan flows due to deviations. The Plan review analysis for the 2017 report is likely to identify critical areas that require further detailed analysis as part of a subsequent Tier 2 task.

Conducting the simulations will require data pre-processing and other modelling requirements. These activities will be undertaken within the overall FY18-1.3 task and have not been pulled out as separate sub-tasks for this work plan.

The goal is to have a complete draft of the plan analysis available for Board review as part of the overall annual report ahead of the March 2018 meetings.

Proposed Products:

- Draft document outlining processes for tier 1 annual plan review and evaluation foundational analyses for GLAM purposes.
- Draft year-end plan review and evaluation analysis to be incorporated into annual report for Board review.

Tier 2: Exploratory Investigations

Tier 2 work plan tasks defined for FY18 focus on reducing uncertainty in estimates of Net Basin Supplies (NBS) across the Great Lakes, undertaking field data collection to gather baseline data and to validate existing models, developing new performance indicators for the upper Great Lakes, and evaluating specific aspects of regulation plan performance along the St. Marys River. Some of these tasks carry over from the FY17 work plan while others are new projects. These tasks are meant to support the longer term evaluation of regulation plan performance and are geared towards priority items for improving the

data, tools, models and reporting mechanisms needed for the on-going performance evaluations of the regulation plans. These tasks change from year to year depending on priority and available resources. A number will span more than one year. They are categorized by GLAM Committee sub-groups. Each is focussed on making improvements to address the key questions of the GLAM Directive. Details are provided in the following task descriptions.

Hydroclimate Working Group

The HWG is focussed on the question in the Directive related to assessing whether future water supplies will be different from those used to test the current management of levels and flows. To understand how the Great Lakes system is changing over time it is important to understand how all of the components that drive the NBS are changing. The priority Tier 2 items of the HWG are primarily related to reducing uncertainty in estimates of NBS components. In the future it is expected that additional emphasis will also be placed on improving forecasting and on generating plausible future water supply scenarios.

FY18-2.1: Extended CaPA and GEM hindcasts of water supply components over Canada-US transboundary watersheds based on CaPA, CaLDAS and GEM systems and coordination with NWS Multi-Precipitation Estimates (MPE) (IWI)

This work may provide insights that allow rectification of differences in NBS determined by the component and residual methods. That in turn would improve the ability to notice changes in connecting channel conveyance and the onset of climate change and to produce more useful hydrologic data and models for the evaluation of regulation plans.

This task represents an interim step in a multi-year project to use the Canadian Precipitation Analysis (CaPA) system, the Canadian Land Data Assimilation System (CaLDAS) and the Global Environmental Multiscale (GEM) model to generate and evaluate a gridded dataset of water supply components over most of North America (including all Canada/U.S. transboundary watersheds). This dataset, which will cover a period of 35 years, will include daily estimates of precipitation, evaporation and runoff, as well as many other atmospheric and surface variables such as water equivalent of snow on the ground and soil moisture on a 15-km horizontal resolution grid. This proposal focuses on important interim validation, verification, and tech-transfer requirements based on the initial 5-year simulation that must be undertaken before the full 35-year simulations can be run and the final datasets produced, likely in FY18-19.

In addition, it is proposed to start work on the development of a coordinated Canada/US precipitation climatology for transboundary watersheds based on CaPA data and the National Weather Service Multi-Precipitation Estimates (MPE). CaPA data is being merged with U.S. MPE data currently, but no climatology of the merged product is available. To be useful to end users such as the Coordinating Committee, USACE, NOAA/GLERL, ECCC, precipitation anomalies are required for the merged product

and a mechanism to disseminate them is needed. The Bi-National Precipitation Tool is available currently at <http://mrcc.isws.illinois.edu/gismaps/naprecip.htm> to view and download a coordinated precipitation analysis product. This initial work was done in kind through the NOAA Midwest Regional Climate Center (MRCC). The goal for FY17-18 is to develop a 2004-2017 precipitation anomaly tool to support the full use of the CaPA and MPE data, using a process that would allow updating the climatology when the CaPA reanalysis becomes available and as years pass.

This project has received conditional approval from the IWI team. The project directly supports GLAM Committee efforts to improve measurement and understanding of the individual components of the water supply and reduce uncertainty in hydrological conditions which could lead to better forecasting and improvements to regulation rules.

At the request of the IJC, the project methodology will also be applied outside the Great Lakes basin in other transboundary watersheds along the Canadian-U.S. border.

Proposed Products:

- Technical documentation with detailed instructions on how to run the reanalysis system at CMC operations
- Report presenting the final system and an evaluation of its results over the time period from 2010 to 2015, including an evaluation of Great Lakes Net Basin Supply simulations
- Technical documentation presenting the method used to compute the climatology of a merged CaPA/MPE product and how to access it on the NOAA/MRCC website

FY18-2.2: Development of a statistical model to close the water balance of the Great Lakes (IWI)

This task was initially included in the FY17 work plan as FY17-2.2 and is being supported through the IWI. Due to the timing of work agreements being finalized between the U.S. Section of the IJC and NOAA, the project will be finalized in FY18. The project is intended to develop a new historical record of monthly runoff, over-lake evaporation, over-lake precipitation, and connecting channel flows for each of the Great Lakes using a novel statistical model that (through an explicit acknowledgment of bias and uncertainty) reconciles discrepancies between model- and measurement-based estimates of each component while closing the Great Lakes water balance. The proposed project will help understand key uncertainties in model- and measurement-based estimates of each water supply component. Outcomes from this project will improve the underlying understanding of how each NBS component contributes to observed water levels. In turn, the project will provide important direction to support more focused research on factors that drive the observed contributions. The work will help the GLAM Committee to define better ways to use water supply information and model output (including climate change models) in the testing of existing and alternative water management scenarios throughout the Great Lakes Basin.

This project is expected to result in the first comprehensive water budget estimates for the Great Lakes that systematically close the entire water balance while addressing both measurement bias and uncertainty. Perhaps more importantly, in addition to leading to a novel set of new estimates, this

project will lead to a modelling framework that is designed to incorporate qualitative perceptions of measurement uncertainties that can be incorporated, through a process of Bayesian updating, into the final estimates. Furthermore, the newly-developed water budget estimates are expected to provide a much more robust basis (relative to previous estimates) for decision making not only because they include an expression of uncertainty (a gap in decision making that has been evident for decades) but also because they provide a full explanation for changes in water levels from month-to-month. Similar modelling approaches have not been systematically applied to the Great Lakes over any historical period.

The project will help in resolving the regional water budget across monthly and inter-annual time scales and represents an important stepping stone towards addressing a long-standing need in the Great Lakes for clear and defensible differentiation between hydrological, climatological, geological, and anthropogenic drivers behind seasonal and long-term changes in Great Lakes water.

Proposed Products:

- Monthly time-series data set of runoff, over-lake evaporation, over-lake precipitation, and connecting channel flow component supplies for each lake back to approximately 1950.
- Summary report outlining project process, description of statistical model, stakeholder input, results and implications, and possible future application.

Impact Assessment Working Group

The IAWG is focussed on the question in the Directive related to how well are the impacts of levels and flows are represented by current data and models used in the evaluation of the management of levels and flows and how the physical, biological, and/or socio-economic conditions of the system may be changing over time. A priority of this group is on challenging the modelling assumptions used in the plan evaluation and to identify the areas that have the greatest sensitivity, significance and/or impact on certainty that could help to improve the ability to adequately assess impacts in evaluating regulation plans. The following tasks have been identified as priorities for FY18.

Lake Ontario and St. Lawrence River (Ecosystem)

FY18-2.3: Continued Evaluation of Meadow Marsh Algorithm

This is an extension of a task that was originally undertaken as part of GLAM's FY2016 and FY17 work plans (Tasks FY17-2.3) using a combination of in-kind agency resources and funding from the U.S. Section of the IJC under the IWI. The wetlands meadow marsh performance indicator has been a critical component of the evaluation of water level regulation plan options for the Lake Ontario-St. Lawrence River system and it is important to validate and improve the modelling approach.

In FY17, an Excel based model of the wetland algorithm used in the LOSLRS was developed and an initial comparison was undertaken using model results and previously organized field monitoring data. The draft results were presented at a wetland experts meeting in Burlington, Ontario in April 2017. Feedback

was received from the invited experts as well as from a peer review organized through the IJC. One outcome from the workshop was the identified need to wait until water levels were more extreme from years where the monitoring took place (2009-2016) before a true “test” could take place. Extreme high water levels in the summer of 2017 may provide that test and wetland monitoring will be occurring in 2017. For FY18, the project team will be developing a response to the peer review and will be integrating the 2017 monitoring data into the analysis.

Proposed Products:

- An updated report integrating 2017 field data into the comparison of the wetlands algorithm

FY18-2.4: Monitoring Lake Ontario – St. Lawrence River coastal wetland habitat in New York State – site surveys (IWI)

This task was originally FY17-2.4. An agreement was signed between the U.S. Section of the IJC and the contractor in early 2017 and the work initiated. The site surveys will take place in August/September 2017 and the processing of the field data will carry over into FY18. Monitoring how coastal wetland habitats change with respect to elevation is important for teasing apart the influence of water-level management and other factors that play a role in habitat change, such as invasive species, alterations to adjacent upland areas, or other changes in hydrologic inputs. Monitoring wetland-elevation dynamics allows for improved models of how wetlands respond to water-level management by better refining the amount of delay in vegetation response and the magnitude of effect of flooding or dewatering events. This project will provide greater understanding of the relationship among elevation, vegetation, and time and higher precision.

This IWI supported project will result in detailed vegetation community information referenced to elevation in sixteen Lake Ontario and St. Lawrence River coastal wetlands on the U.S. side, complementing previous efforts in Canada (e.g. GLAM Task FY16-1.1). The proposed work conforms to related work in Ontario wetlands and will allow the development of a lake-wide, binational assessment of wetland status. These data can be used to support adaptive management of lake level dynamics and can integrate into wetland vegetation community modelling (i.e., refine Integrated Ecological Response Model (IERM) inputs and validate outputs) that was developed for the IJC’s LOSLRS.

Proposed Products:

- Summary report outlining field sampling methods, sites and results for wetland site survey analysis.

FY18-2.5: Monitoring of Lake Ontario – St. Lawrence River coastal wetland habitat in New York State – Imagery (IWI)

This task was originally FY17-2.5. An agreement was signed between the U.S. Section of the IJC and the contractor in early 2017 and the work initiated. The imagery collection will take place in August/September 2017 and the processing of the field data will carry over into FY18. The goals of this

IWI supported project are to acquire high-resolution aerial imagery in maximum-vegetation condition for sixteen Lake Ontario and St. Lawrence River coastal wetlands, use GIS to map the vegetation types within these wetlands, and then assess similarities and differences in wetland extent from equivalent mapping products from 2012 and 2014. This work will complement the planned collection of coastal wetland aerial imagery on the Ontario side to allow the development of a lake-wide, binational assessment of the current status of Lake Ontario and St. Lawrence River coastal wetlands. These data can be used to support adaptive management of lake level dynamics and integrate into wetland vegetation community modelling of the meadow marsh extent indicator for the LOSLR area. The LOSLRS identified the meadow marsh performance indicator as one of the primary metrics for assessing the environment. Therefore, monitoring this indicator is an important part of water-level adaptive management. Monitoring change in the *extent* of coastal wetland habitats is important for understanding the magnitude of change occurring on the landscape and how this change may be linked to lake-level regulation. Tracking changes spatially also helps us understand how local forces (such as wave action, sedimentation, or invasive species expansion) may be influencing the changes detected.

Proposed Products:

- Summary report outlining field sampling methods, sites and results for wetland imagery analysis.

FY18-2.6: Monitoring of Lake Ontario Coastal Wetlands on the Canadian Shoreline (IWI)

This is a follow up to monitoring of Canadian Lake Ontario coastal wetlands that took place in the summer of 2015 (Task FY16-1.1) and is complementary to wetland monitoring that will take place in August and September of 2017 on the U.S. shoreline (Task FY18-2.4). Collectively, the 2017 monitoring of Canadian and U.S. wetlands will be important in understanding wetland vegetation response to extreme high water levels during the growing season. The Canadian monitoring will be undertaken by the Canadian Wildlife Service using in-kind resources and additional IWI funding.

Proposed Products:

- Summary report and monitoring data for use in model validation

FY18-2.7: State of Science Assessment of Remote Sensing for Great Lakes Coastal Wetlands (IWI)

One outcome from the April 2017 wetlands experts workshop held in Burlington, Ontario was that further consideration should be given to remote sensing options for assessing the extent of various wetland types and extent on Lake Ontario and the upper St. Lawrence River and their change over time. Tracking changes in Great Lakes coastal wetland vegetation, particularly the meadow marsh community, is critical to validate existing models and to assess how changes in water level regulation plans may be impacting vegetation response. Remote sensing approaches for characterizing vegetation and topography/bathymetry of coastal wetlands represent an important opportunity to assess change over a large area and improve existing predictive models and the state of science is evolving rapidly. This project aims to capture the current state of data collection and processing that can be used to guide GLAM efforts in developing a long-term, cost effective strategy to assess water level driven change in wetland

vegetation. Support for this project was conditionally approved as part of the IWI process. Formal project agreements still need to be put in place.

Proposed Products:

- A summary report identifying the current state of remote sensing options for assessing changes in Great Lakes coastal wetlands.

FY18-2.8: Wetland Monitoring and Ecosystem Indicator Development (Muskrat and Northern Pike)

There is an ongoing need to gather field data to support environmental indicator validation. The New York Department of Environmental Conservation (NYDEC) is supporting monitoring in the upper St. Lawrence River that contributes to adaptive management activities related to water level regulation policy and the impacts of climate change. NYDEC is funding a multi-year project (2016-2021) that focuses on critical monitoring related to:

- Coastal wetland monitoring and indicator development for long-term assessment (includes Muskrat response)
- Northern pike and Muskellunge recruitment and population dynamics in the upper St. Lawrence River;

The project has only recently been initiated and will run over a number of years. GLAM will only be able to report on interim information as part of its FY18 work plan and the results will be used to complement the other coastal wetland monitoring on the New York and Canadian shoreline of Lake Ontario being undertaken in other work plan tasks.

Proposed Products:

- This is part of a multi-year effort with only interim products expected this year

FY18-2.9: Wetland Imagery Interpretation

Field monitoring of plant communities and land elevations were initiated in 2009 by Environment and Climate Change Canada (ECCC) to help verify the IJC's water level-wetland modelling results. The GLAM Committee continues to work with various partners to support ongoing monitoring, including a number of specific tasks in the FY18 work plan. To support this work, in July 2016 the Ontario Ministry of Natural Resources and Forestry (OMNRF) collected 8 cm Ground Sample Distance (GSD) imagery of wetland monitoring areas in an effort to help further validate the field data and predictive modelling results, and to potentially extend the validation beyond field monitored areas. OMNRF staff are now working with the imagery to support interpretation and testing of vegetation classification methods. They will also be looking at other remote sensing methods/products that may be used to support the imagery interpretation methods and will compare the results to determine how the various methods perform.

Proposed Products:

- Processing and interpretation of high resolution aerial imagery for up to 17 Canadian wetland sites

Lake Ontario and St. Lawrence River (Socio-Economic)**FY18-2.10: Revisit shore protection that was surveyed by either NYDEC (2011) or USACE (2015) to assess response to high water conditions**

Visual assessment of shore protection structures were undertaken by NYDEC (2011) and USACE (2015) as part of a survey effort to determine the top elevation of shoreline protection structures as part of a review of assumptions within the FEPS model. It is known that some shore protection structures have failed in 2017 under high water conditions and there is value in re-assessing previously reviewed structures to determine their status. As part of the initial surveys, a photo inventory and classification was developed which could be revisited for a subset of structures based on the current structure condition. ***There is currently no funding or resources allocated to this task, but it is considered a high priority item for submission to the IWI.***

Proposed Products:

- An assessment of a subset of shore protection structures previously surveyed by NYDEC and/or USACE to determine condition following 2017 high water levels.

FY18-2.11: Implementation of Shoreline Damage Survey for the Canadian Shoreline of Lake Ontario and the Upper St. Lawrence River

In response to the 2017 high water conditions on Lake Ontario and the upper St. Lawrence River, the New York Sea Grant and Cornell University are undertaking an online survey of shoreline property owners. The NY Sea Grant/Cornell project is independent of the GLAM Committee. However, the Committee expects that the reported information will be critical in comparing to the existing performance indicators and developing new performance indicators. The survey includes questions related to private riparian property owners as well as waterfront businesses owners (e.g. restaurants).

Since the NY Sea Grant/Cornell project is only collecting data on the U.S. side, the GLAM Committee is supporting the implementation of a similar survey for the Canadian shoreline of Lake Ontario and the upper St. Lawrence River. The survey will be implemented in the fall of 2017 with a preliminary assessment of results available for the 2017 annual report. A similar survey will not be conducted for the lower St. Lawrence at this time as the Province of Quebec is undertaking data collection as part of their flood damage relief program. It will be possible to determine if there are gaps once the extent and availability of that data is known.

Proposed Products:

- Summary within annual report, for each impact category, of key benefits/impacts of 2017 water levels to critical areas
- Stand-alone report on Canadian responses

FY18-2.12: Oblique Imagery of Lake Ontario and St. Lawrence River Shoreline

The U.S. Army Corps of Engineers acquired oblique and ortho-rectified imagery of the U.S. shoreline of Lake Ontario as part of the response to record high water levels in 2017. The majority of the initial round of imagery was collected between June 2nd, 2017 and July 5th, 2017 when the Lake level was within 11 cm of the peak elevation of 75.88 m (IGLD 1985). Due to inclement weather conditions the final lift was performed on July 19th, 2017 collecting the last 11 transects at a lake elevation of 75.68 m (IGLD 1985) or 20 cm below the peak elevation. A subsequent round of imagery will be collected again later in 2017 or early in 2018 once water levels have receded to 74.8 m (IGLD 1985) or lower. In addition, oblique imagery was also collected by Transport Canada for much of the Canadian shoreline of Lake Ontario and the St. Lawrence River downstream of Montreal, although at a lower resolution than the U.S. imagery.

The oblique imagery is valuable in undertaking qualitative assessments of high water impacts on a regional scale (e.g. locations of sandbagging, submerged infrastructure, actively eroding shoreline, etc.). For FY18, the remaining U.S. imagery will be acquired and an initial assessment of all the imagery will take place. The goal is to have some initial findings in time to integrate into the 2017 annual report and a more comprehensive assessment by September 2018.

Proposed Products:

- Review of oblique imagery from high water period to qualitatively identify observed impacts.

FY18-2.13: Survey and review of operational impacts on marinas due to 2017 water levels

There have been numerous media reports of marina impacts due to extreme high water levels on Lake Ontario and the St. Lawrence River in 2017. A comprehensive assessment of marina impacts would be helpful to understand the type and distribution of impacts in the system as well as thresholds. The information would help in the validation of the existing performance indicator. The impact assessment team will be undertaking some initial efforts in this area as part of the Annual Report activities. However, a more comprehensive assessment is warranted. ***There is currently no funding or resources allocated to this task, but it is considered a high priority item for submission to the IWI.***

Proposed Products:

- An assessment of marina impacts during 2017 high water levels.

FY18-2.14: Survey and review of operational impacts on municipal and industrial infrastructure due to 2017 water levels

Extreme high water levels on Lake Ontario and the St. Lawrence River in 2017 has led to a range of problems associated with municipal infrastructure. Examples include flooding of storm sewers, flooding of roads, reduced capacity for storm water management systems, etc. A comprehensive assessment would be helpful to understand the type and distribution of impacts in the system as well as thresholds. The information would help in the development of a performance indicator to capture such conditions. The impact assessment team will be reaching out to municipalities for some initial information as part of the annual report activities. However, a more comprehensive assessment is warranted. ***There is currently no funding or resources allocated to this task, but it is considered a high priority item for submission to the IWI.***

Proposed Products:

- An assessment of municipal and industrial infrastructure impacts during 2017 high water levels.

Impact Assessment Working Group – Upper Great Lakes**FY18-2.15: St. Marys River IERM Rapids Data**

Following the initial development of the IERM 2D model for the St. Marys rapids, the need for further substrate data in the St. Marys River rapids was identified. Improved substrate data should support improved model calibration. One option is to gather in-situ substrate information during low flow (1/2 gate open) conditions. The Detroit District office of the USACE is looking at options for acquiring substrate data in FY18, should flow conditions allow and an IWI submission is being considered.

Proposed Products:

- Improved substrate data for the St. Marys Rapids to support IERM model development.

FY18-2.16: St. Marys River IERM Calibration Data

To expand the IERM further downstream on the St. Marys River below the rapids, further data will be needed to support calibration. Some potential key parameters include side scan sonar, substrate information, and vegetation classification information. It would be helpful to further define some of these parameters and start to gather data in FY18. The Detroit District office of the USACE is looking at options for acquiring the side scan sonar data and will work with partners to see about options for acquiring the other data

Proposed Products:

- Additional calibration data downstream of the St. Marys Rapids to support further IERM model development and calibration.

FY18-2.17: Assimilate St. Marys River IERM into SVM

Eventually, the St. Marys River IERM will need to be integrated into the SVM to make plan evaluations more efficient. If this effort is initiated at all in as part of the FY18 work plan, it likely won't be until near the end of the FY and will carry over into FY19.

Proposed Products:

- IERM2D integrated within the upper Great Lake SVM.

FY18-2.18: Development of Flood Metric for the St. Marys River

With the development of the IERM2D for the St. Marys River, it would help to also have a flood impact metric particularly related to Whitefish Island. The USACE has the LiDAR and hydraulic models to support this but an impact metric would need to be created. The Detroit District of the USACE along with the coastal impacts assessment team will initiate planning for a St. Marys River flood metric that could be integrated in the SVM.

Proposed Products:

- Flood metric for the St. Marys River.

Plan Review Working Group

The Plan Review Working Group (PRWG) is focussed on the question in the Directive related to whether improvements can be made to the management of levels and flows to benefit other physical, chemical, biological and/or socio-economic conditions. Their priority is on improving the tools and methods for the integration and interpretation of data and science for the on-going review and evaluation of the regulation plans under actual and potential future conditions.

FY18-2.19: Programming support for update to Coordinated Great Lakes Regulation and Routing Model

****Note*** This item is being carried over from the FY17 work plan (FY17-2.11). Due to the timing of work agreements being finalized between the U.S. Section of the IJC and NOAA, the project will be finalized in FY18.*

The overall objective of this IWI supported project is to develop a new, authoritative, coordinated numerical modelling framework that will allow efficient and accurate simulations of water levels and connecting channel flows in the Great Lakes system given user-specified net basin supply scenarios and alternative flow regulation strategies. A related and important secondary objective of this work is to ensure the new model is well-documented and easily accessible, and that it can be readily employed for a

wide variety of operational and research purposes, and by a wide variety of potential users, including government agencies, academic researchers, private sector consultants, etc.

The new regulation and routing model would replace the current Coordinated Great Lakes Regulation and Routing Model (CGLRRM), which has been employed since the 1990s, but which is poorly documented and becoming increasingly outdated and difficult to use.

The new model will be developed to meet the needs of a variety of users. It will be used by GLAM members to simulate Great Lakes water levels and flows under alternative regulation strategies and future water supply scenarios and changing climate conditions and evaluate their impacts, all of which are key provisions of GLAM's Directive from the IJC. The framework will be fully documented in a technical design and user manual for the RRM subcommittee, GLAM, the Boards of Control. Furthermore, academic and other researchers will be able to access the new model and its documentation, and use it for their own research initiatives and/or those in support of GLAM, the Great Lakes Boards, and relevant government agencies.

Proposed Products:

- Model code.
- Final summary report including executive summary and lessons learned.

FY18-2.20: St. Marys River – Review impacts of reductions in maximum side channel capacity

****Note*** This item is being carried over from the FY17 work plan (FY17-2.12). Since the project was initially proposed, it has become clear that further St. Marys River performance indicators are required before evaluations can take place. As such, work has slowed on this task while the St. Marys River IERM is being developed. The intent is to revisit this task later in FY18 as new metrics become available.*

Plan 2012 was developed and tested during the IUGLS, assuming a maximum side channel capacity of 2320 m³/s, and this assumption has carried through to the operational implementation of Plan 2012 as well. However, this constant value is based on a number of assumptions that are essentially representative of a specific set of near "ideal" conditions, and often these conditions do not exist. In particular, these assumptions do not reflect actual operational conditions in two important ways:

i. Hydropower outages

The maximum side-channel capacity of 2320 m³/s is based on the assumption that all three of the hydropower plants are running all generating units at full capacity, but the reality is that most years there are a number of scheduled and unscheduled outages at the hydropower plants that result in unit outages and a reduction in the maximum capacity of the plants.

ii. Variations in hydrologic conditions

Even when all hydropower generating units are available and running, the flow capacity of these units varies as a result of variations in hydrologic conditions, most notably changes in water levels and ice conditions. There is also a specific concern that because side-channel capacity is often limited in winter that the maximum winter flow of 2410 m³/s prescribed by Plan 2012 is unattainable (under the normal one-half gate equivalent winter setting), and this may have consequences in terms of high water levels during the following spring and summer.

Work on this project will continue into FY18 with the priority to investigate the impacts of hydrologic conditions on maximum hydropower plant capacity and develop mathematical relationships that relate the two, which can then be incorporated into evaluation and operational models/tools. It will also be used to review the impacts of reduced side-channel capacity in winter, notably the potential for higher Lake Superior levels in spring/summer than were estimated during IUGLS plan formulation and evaluation, and how to address this issue. Finally, this task will include a study of the impacts of large and fluctuating flows in the St. Marys River due to varying maximum side-channel capacity, and develop and evaluate methods to address these impacts. This analysis should consider the positive and negative impacts on stakeholder groups. Recommendations should include rules, limits, and/or guidelines that the Board could follow in addressing these issues, including the potential use of deviations from Plan 2012 or permanent changes to Plan 2012 itself. Staff of the Lake Superior Board at ECCC and USACE have begun to investigate the relationships between hydropower capacity and hydrologic conditions using limited data when the plants were running at full capacity recently. This analysis would benefit from additional data (both from the past or available in the near future) and from involvement of the hydropower operators themselves. This task will continue be conducted with GLAM Committee staff at ECCC and USACE through the Board regulation representative offices.

Proposed Products:

- Report on varying hydropower plant capacity due to hydrologic conditions.
- Evaluation and initial report on impacts and potential strategies to address reductions in hydropower capacity.

FY18-2.21: St. Marys River – Review multiple partially open gate settings at the Compensating Works

****Note*** This item is being carried over from the FY17 work plan (FY17-2.13). Since the project was initially proposed, it has become clear that further St. Marys River performance indicators are required before evaluations can take place. As such, work has slowed on this task while the St. Marys River IERM is being developed. The intent is to revisit this task later in FY18 as new metrics become available.*

As a result of the recent rise in upper Great Lakes water levels, regulated outflows from Lake Superior through the St. Marys River have also increased, and this has required the gate setting of the Compensating Works at the head of the St. Marys Rapids to be increased above the minimum one-half gate equivalent. A number of concerns have been raised in using fully open gates including the impacts of higher flows and levels on the St. Marys Rapids fishery and recreational anglers, potential flooding of

Whitefish Island, the risk of ice damage to the Compensating Works and structures in the lower St. Marys River, the impacts of “spilled” water on hydropower production, and impacts to commercial navigation due to reduced levels in the lower St. Marys River if gate settings were reduced. Since May 2014 the Lake Superior Board began employing multiple partially open gates in lieu of fully open gates in order to provide a number of potential benefits in the St. Marys Rapids. One issue with this new approach is that the existing hydraulic relationships and the flow measurements used to verify the relationships are applicable to flow through fully open gates at the Compensating Works only, and cannot be applied to partially open gate settings. Flows through the partially open gates have been calculated using standard, textbook gated flow equations. Flows through the Compensating Works constitute a significant component of the overall flow through the St. Marys River, particularly during periods of high flows when they make up a greater proportion of the total. Therefore, understanding the relationships between water levels and flows through partially open gates is critical to the operation of the Compensating Works and to the determination and regulation of the total outflow from Lake Superior.

Proposed Products:

- Initial report on benefits/disadvantages to stakeholders of partially open gate settings.
- Initial joint report with Lake Superior Board on partially open gate setting flow relationships for operational implementation and incorporation into CGLRRM.

Tier 3: Strategic Improvement Studies

The GLAM Committee does not currently expect to undertake any tier 3 type analyses in FY18.

Section B – GLAM Oversight and Administration**FY18-3.1: GLAM Committee Coordination, Management, and Reporting**

This is an on-going task that includes the coordination, management operation and oversight of GLAM Committee activities and working groups. It includes primarily the work of the co-chairs, secretaries and their staff who help support the operation of the GLAM Committee. This activity is supported primarily through USACE and ECCC with some operation and maintenance funds provided by IJC-Ottawa.

There are three specific products for this task. The first is that each year the GLAM Committee will prepare an annual work plan for submission to the Boards outlining the activities to be carried out and products to be delivered in support of the adaptive management process. The work plan will identify the priority work items, the project leads, timeline, any external costs, GLAM Committee contributions and product deliverables. This will be submitted to the Boards in advance of their fall semi-annual meeting and presented to the Boards at their fall meeting. The Boards will present the work plan to the IJC during the Semi-Annual IJC Board Appearances. The Boards may request the GLAM Committee co-chairs to present the work plan on their behalf to the IJC.

The second product, as per the IJC Directive, will be for the GLAM Committee to prepare semi-annual progress reports outlining the status of the GLAM Committee in meeting the commitments of its annual work plan. These progress reports will be prepared by the GLAM Committee secretaries and co-chairs and presented to the Boards at their March and September meetings in advance of the IJC Semi-Annual Meetings. The Boards will report on progress to the IJC or may ask the GLAM Committee co-chairs to present on their behalf.

The final product is the coordination and oversight of the draft annual report (the Tier 1 activities) that will be prepared in draft form ahead of the March Board meetings.

Proposed Product:

- Annual work plan for FY18 for submission to the Boards.
- Semi-annual progress reports for submission to the Boards in March 2018 and September 2018.
- Coordination and oversight of draft annual report preparation.

FY18-3.2: Monitoring of the work plan delivery

The GLAM Committee secretaries in conjunction with the GLAM Co-chairs will track work plan progress. This is an ongoing committee requirement and contributes to semi-annual progress reporting.

Proposed Product:

- Task descriptions and periodic updates on progress that contribute to semi-annual reporting.

FY18-3.3: GLAM Information Management Needs

The GLAM Committee has already leveraged available IJC support to establish a high level website along with making use of Sharepoint and File Transfer Protocol (FTP) resources to communicate internally and manage products and information. GLAM continues to face challenges collaborating between agencies when using larger datasets and models as well as some files and documents already managed through existing IM/IT infrastructure. Further direction is needed to identify appropriate approaches for handling future IM requirements. This is a recognized need of GLAM (see FY17-3.5) but implementation has been delayed due to resource limitations. The GLAM Committee hopes to make further progress on defining IM/IT needs and solutions in the coming FY and will leverage other IJC opportunities including those developed through the Lake Champlain-Richelieu River Study.

Proposed Product:

- Analysis of GLAM IM/IT opportunities and needs within context of available IJC IM/IT resources and capacity.

FY18-3.4: Maintain engagement with Great Lakes Water Quality Agreement activities

The IJC Directive to the GLAM Committee specifically highlights the importance of ensuring coordination and liaison between the Great Lakes Control Boards and the Boards created by the Great Lakes Water Quality Agreement (GLWQA) – the Great Lakes Water Quality Board (WQB) and Science Advisory Board (SAB). To better link water levels and flows regulation with water quality considerations, the GLAM Committee is requested to engage in outreach activities with the WQB and SAB. The GLAM Committee co-chairs are participating in joint meetings of the WQB and SAB.

Additionally, the GLAM Committee has started the process of drafting a strategy to engage with specific Annex committees of the GLWQA. GLAM Committee members will continue to work within their Annex subcommittees to introduce the work of the GLAM Committee and discuss potential areas for collaboration within the context of the Annexes with a focus on Annexes 2, 4, 6, 7, 9 and 10. The GLAM Committee leads also presented as part of the GLEC meeting in June 2017 to promote collaboration of items of joint interest.

Proposed Product:

- Ongoing GLAM co-chair participation in meetings of the IJC's WQB and SAB.
- Interaction with GLWQA annexes to further potential common objectives.

FY17-3.5: Develop and initiate an engagement plan for advisory networks

The GLAM Committee has slowly pursued the development of an engagement plan in both the FY16 and FY17 work plans to support its activities. Some of the actual engagement activities are being pursued at the working group level. As well, the GLAM Co-chairs and secretaries now participate on the International Lake Ontario – St. Lawrence River Board Communications Committee to support coordination where necessary. However, there continues to be a need for higher level coordination of all of the GLAM Committee's outreach and engagement activities that may be conducted to support work plan implementation or promotion of the Committee's activities. The GLAM Committee intends to further develop such as strategy in FY18. Progress will be limited by available resources. The GLAM Committee will seek Board input on the proposal and/or approval from the Boards as appropriate.

Proposed Product:

- Proposed engagement strategy of GLAM advisory networks.

Work Plan Table of Proposed Tasks

SECTION A: Plan Review and Evaluation				
Tier 1: Foundational Analyses				
Hydroclimate Working Group				
Task	Task Title	Proposed Products	Resources	Estimated Delivery
FY18-1.1	Test established processes for performing annual, routine foundational analyses required for hydroclimate assessments	1) Draft document outlining processes for tier 1 annual hydroclimate foundational analyses for GLAM purposes. 2) <u>Draft</u> year-end hydroclimate analysis to be incorporated into annual report for Board review.	In-kind	Mar-18
Impact Assessment Working Group				
FY18-1.2	Test established processes for performing routine assessments required for understanding baseline conditions and benefits of observed water levels and flows	1) Draft document outlining processes for tier 1 annual performance indicator foundational analyses for GLAM purposes. 2) <u>Draft</u> year-end impact assessment analysis to be incorporated into annual report for Board review.	In-kind	Mar-18
Plan Review Working Group				
FY18-1.3	Test established processes for performing annual, routine foundational analyses required for ongoing evaluations of existing regulation plan performance	1) Draft document outlining processes for tier 1 annual plan review and evaluation foundational analyses for GLAM purposes. 2) <u>Draft</u> year-end plan review and evaluation analysis to be incorporated into annual report for Board review.	In-kind	Mar-18

SECTION A: Plan Review and Evaluation				
Tier 2: Exploratory Investigations				
Hydroclimate Working Group				
Task	Task Title	Proposed Products	Resources	Estimated Delivery
FY18-2.1	Extended hindcast of Water Supply Components over Canada/U.S. Transboundary Watersheds based on the CaPA, CaLDAS and GEM systems and coordination with NWS Multi-Precipitation Estimates (MPE)	1) Technical documentation with detailed instructions on how to run the reanalysis system at CMC operations 2) Report presenting the final system and an evaluation of its results over the time period from 2010 to 2015, including an evaluation of Great Lakes Net Basin Supply simulations 3) Technical documentation presenting the method used to compute the climatology of a merged CaPA/MPE product and how to access on website	IWI	Mar-18
FY18-2.2	Development of a statistical model to close the water balance of the Great Lakes	1) Monthly time-series data set of runoff, over-lake evaporation, over-lake precipitation, and connecting channel flow component supplies for each lake back to approximately 1950. 2) Summary report outlining project process, description of statistical model, stakeholder input, results and implications, and possible future application.	IWI	Mar-18
Impact Assessment Working Group – Lake Ontario and St. Lawrence River (Ecosystem)				
FY18-2.3	Continued Evaluation of Meadow Marsh Algorithm	1) An updated report integrating 2017 field data into the comparison of the wetlands algorithm	In-kind	Sept-18
FY18-2.4	Monitoring of Lake Ontario – St. Lawrence River coastal wetland habitat in New York State – site surveys	1) Summary report outlining field sampling methods, sites and results for wetland site survey analysis	IWI	Mar-18
FY18-2.5	Monitoring of Lake Ontario – St. Lawrence River coastal wetland habitat in New York State – Imagery	1) Summary report outlining field sampling methods, sites and results for wetland imagery analysis.	IWI	Mar-18
FY18-2.6	Monitoring of Lake Ontario Coastal Wetlands on the Canadian Shoreline (IWI)	1) Summary report and monitoring data for use in model validation	IWI	Mar-18
FY17-2.7	State of Science Assessment of Remote Sensing for Great Lakes Coastal Wetlands	1) A summary report identifying the current state of remote sensing options for assessing changes in Great Lakes coastal wetlands.	IWI	Mar-18

Task	Task Title	Proposed Products	Resources	Estimated Delivery
FY18-2.8	Wetland monitoring and ecosystem indicator development (muskrat and Northern Pike)	This is part of a multi-year effort with only interim products expected this year	In-kind	TBD
FY18-2.9	Wetland imagery interpretation	1) Processing and interpretation of high resolution aerial imagery for up to 17 Canadian wetland sites	In-kind	TBD
Impact Assessment Working Group – Lake Ontario and St. Lawrence River (Socio-Economic)				
FY18-2.10	Revisit shore protection that was surveyed by either NYDEC (2011) or USACE (2015) to assess response to high water conditions	1) An assessment of a subset of shore protection structures previously surveyed by NYDEC and/or USACE to determine condition following 2017 high water levels.	to be submitted for fall IWI	TBD
FY18-2.11	Implementation of Shoreline Damage Survey for the Canadian Shoreline of Lake Ontario and the Upper St. Lawrence River	1) summary <u>within annual report</u> , for each impact category, of key benefits/impacts of 2017 water levels to critical areas 2) stand-alone report on Canadian responses	In-kind	Feb-18
FY18-2.12	Oblique Imagery of Lake Ontario and St. Lawrence River Shoreline	1) Review of oblique imagery from high water period to qualitatively identify observed impacts.	TBD	TBD
FY18-2.13	Survey and review of operational impacts on marinas due to 2017 water levels	1) An assessment of marina impacts during 2017 high water levels.	to be submitted for fall IWI	TBD
FY18-2.14	Survey and review of operational impacts on M&I infrastructure due to 2017 water levels	1) An assessment of municipal and industrial infrastructure impacts during 2017 high water levels.	to be submitted for fall IWI	TBD
Impact Assessment Working Group – Upper Great Lakes				
FY18-2.15	St. Marys River IERM Rapids Data	1) Improved substrate data for the St. Marys Rapids to support IERM model development.	to be submitted for fall IWI	Sept-18
FY18-2.16	St. Marys River IERM Calibration	1) Additional calibration data downstream of the St. Marys Rapids to support further IERM model development and calibration	In-kind	Sept-18
FY18-2.17	Assimilate St. Marys River IERM into SVM	1) IERM2D integrated within the upper Great Lake SVM.	In-kind	Sept-18
FY18-2.18	Development of initial flooding performance indicator for the St. Marys River	1) Preliminary development of flooding performance indicator for the St. Marys River.	In-kind	Sept-18

GLAM Committee Annual Work Plan for 2018

Created/updated 11/10/17

Task	Task Title	Proposed Products	Resources	Estimated Delivery
Plan Review Working Group				
FY18-2.19	Routing model update	1) Model code. 2) Final summary report including executive summary and lessons learned.	IWI	Sept-18
FY18-2.20	St. Marys River – Review impacts of reductions in maximum side channel capacity	1) Report on varying hydropower plant capacity due to hydrologic conditions. 2) Evaluation and initial report on impacts and potential strategies to address reductions in hydropower capacity.	In-kind	Sept-18
FY18-2.21	St. Marys River – Review multiple partially open gate settings at the Compensating Works	1) Initial report on benefits/disadvantages to stakeholders of partially open gate settings. 2) Initial joint report with Superior Board on partially open gate setting flow relationships for operational implementation and incorporation into CGLRRM.	In-kind	Sept-18

SECTION B: GLAM Oversight and Administration				
FY18-3.1	GLAM Committee Coordination, Management, and Reporting	1) Annual work plan for FY18 for submission to the Boards. 2) Semi-annual progress reports for submission to the Boards in March 2018 and September 2018. 3) Coordination and oversight of draft annual report preparation.	In-kind	Sept-18
FY18-3.2	Monitoring of Work Plan Delivery	1) task descriptions and periodic updates on progress that contribute to semi-annual reporting.	In-kind	Sept-18
FY18-3.3	GLAM Information Management Needs including file sharing and data/model management strategies.	1) Analysis of GLAM IM/IT opportunities and needs within the context of available IJC IM/IT resources and capacity.	In-kind	Sept-18
FY17-3.4	Maintain engagement with GLWQA activities	1) Ongoing GLAM co-chair participation in meetings of the IJC's WQB and SAB. 2) Interaction with GLWQA annexes to further potential common objectives.	In-kind	Sept-18
FY17-3.5	Develop and initiate an engagement plan for advisory networks	1) Proposed engagement strategy of GLAM advisory networks.	In-kind	June-18

Work Plan Prerequisites and External Dependencies

Prerequisites required to ensure the success of this work plan include the on-going annual support of the agencies represented on the GLAM Committee along with additional staff support as identified by those agencies. It also assumes that necessary implementation and contract arrangements can be made for IWI-endorsed projects.

As this is an on-going effort, the priorities set and commitments made are estimates based on what the committee understands to be the resources available. The expertise available through the partner agencies continues to be evaluated relative to the priorities identified. There may in fact be a need to readjust proposed products depending on the expertise required and available to complete the task. These assessments will occur throughout the year as the work plan progresses. The GLAM Committee will keep the Boards aware of progress through semi-annual reporting.

Revision History

Date of next revision:

Revision Date	Previous Revision Date	Summary of Changes	Changes Marked