

# **Phosphorus Loading in Missisquoi Bay**



**Statement and Report  
to the  
Governments of the United States and Canada  
on the  
Missisquoi Bay Critical Source Area Study**

**September, 2012**



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**International Joint Commission  
Canada and United States**

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September 28, 2012

Ms. Lee Martinez  
Director,  
Office of Canadian Affairs  
WHA/CAN  
United States Department of State  
2201 C St., NW, Room  
Washington, D.C. 20520

Mr. Neal Burnham  
Acting Director  
Canada-U.S. Transboundary Division  
Foreign Affairs and International Trade  
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3917 125 Sussex Dr.  
Ottawa, Canada K1A 0G2

Dear Ms. Martinez and Mr. Burnham:

Under the Reference of August 1, 2008, the Governments of the United States and Canada requested the International Joint Commission to assist in the coordination on the U.S. side of the border with a transboundary initiative to reduce phosphorous loading in the Missisquoi Bay of Lake Champlain. Specifically, the IJC was asked to help organize a critical source area management workshop, to acquire, compile and use LiDAR data, to conduct a short term tributary monitoring program, and to compile and analyze information on critical sources of phosphorous loading of the tributary drainage in the Vermont sector of Missisquoi Bay. The goal of the study was to provide an adequate transboundary picture of the watershed when combining this IJC work with work undertaken in Quebec.

The Commission's studies under this Reference were carried out through the work of the International Missisquoi Bay Study Board. The Study Board's Final Report was submitted to the Commission on February 15, 2012 and the Commission held public meetings on the study report in St. Armand Quebec and Swanton Vermont on May 1 and 2 respectively.

The Commission urges the governments to act upon the recommendations of the International Missisquoi Bay Study Board report along with the Commission's own summary statement containing further comments and recommendations. The Board's report includes the Missisquoi Bay Critical Source Area Study which gives a detailed analysis of the sources of phosphorous in Missisquoi Bay and provides recommendations to improve phosphorous reduction efforts. This constitutes the final report with recommendations of the Commission under the International Missisquoi Bay Study Board reference of August 1, 2008.

Yours sincerely,



Dr. Charles A. Lawson  
Secretary, U.S. Section



Camille Mageau  
Secretary, Canadian Section

Enclosure: as stated.

cc: David White, Chief, NRCS,  
David Mears, Commissioner, Department of Environmental Conservation, Vermont  
Chuck Ross, Secretary for Agriculture, Vermont  
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Gouvernement du Québec  
M. François Gendron, Ministre de l'Agriculture, des Pêcheries et de l'Alimentation  
Vice-premier ministre, Gouvernement du Québec

## Letter of Reference

This summary statement along with the final report of the Commission's International Missisquoi Bay Study Board is submitted to the Governments of Canada and the United States pursuant to the Reference to this Commission embodied in identical letters dated August 1, 2008 and signed by the Director of U.S. Transboundary Affairs for Foreign Affairs and Trade Canada and the Director of the Office of Canadian Affairs of the U.S. Department of State, respectively. The text of the 2008 reference, quoted below, provides the context and background of the study.

*The Province of Quebec and the State of Vermont are working both individually and jointly, through their transboundary partnership in the Lake Champlain Basin Program (LCBP), to further reduce phosphorus concentrations in Missisquoi Bay. While these important efforts have reduced the phosphorus loads of some tributary streams, there is still room for improvement to reach acceptable in-lake concentrations of phosphorus.*

*Special challenges of phosphorus reduction in the Missisquoi River Basin are described in the 2002 Memorandum of Agreement between the Province of Quebec and the State of Vermont that apportions responsibility for phosphorus load reduction as 40% and 60% respectively. Recent monitoring data indicates that load reductions have been very difficult to achieve. There has been a reduction in phosphorus concentration in the Quebec sector (Pike River) but the comparatively larger Vermont sector of the Missisquoi River drainage basin is particularly problematic.*

*All parties wish to accelerate load reductions through effective management planning and implementation of pollution prevention actions, especially concerning non-point source nutrient loading. From 2004 to 2007, acting in an area of its jurisdiction, the Province of Quebec has invested more than \$1 million in research, monitoring and modeling of agricultural non-point loading to identify sensitive areas and critical sources of nutrient loads and the effectiveness of best management practices. Management planning in critical source areas of the Quebec sector of the watershed is supported by hydrologic modeling techniques, detailed soil information, microtopographic terrain analysis based on LIDAR elevation data, together with multispectral remote sensing imagery and program and regulation enforcement. Plan implementation efforts benefit greatly from the research, monitoring and modeling on which Quebec's management plan is particularly based.*

*In the Vermont sector of the Missisquoi Bay watershed the non-point source nutrient loading challenge is greater (60%) in part due to its greater areal extent. In order for nutrient management planning to be effective in the Vermont sector of the Missisquoi Bay watershed similar research, monitoring and modeling of agricultural non-point loading to identify sensitive areas and critical sources of nutrient loads is required.*

*In accordance with Article IX of the Boundary Waters Treaty, the Governments of Canada and the United States request that the International Joint Commission assist in the implementation of this complementary transboundary initiative to reduce phosphorus loading. Recognizing the recent advances made by the Province of Quebec*

*within its areas of jurisdiction, the Commission is requested to coordinate the following tasks on the US side of the border, in close partnership with the Lake Champlain Basin Program.*

*i. Organization of a critical source area management workshop to explore the optimal parameters for identification and definition of critical source areas, specific algorithmic options available for the use of SWAT and related geographical analysis techniques in the US sector of the Missisquoi watershed, and the methodology for projecting the spatial extent and nutrient loading significance of spring flooding and tributary monitoring needs through the year.*

*ii. Acquisition and compilation of LiDAR and digital photographic imagery over the watersheds draining into Missisquoi Bay.*

*iii. Oversight of short-term synoptic tributary monitoring over a two-year period at ten or more new monitoring stations in Vermont sector.*

*iv. Compilation and analysis of information on critical sources of phosphorus loading of tributary drainage in Vermont sector in order to consider and characterize all major phosphorus sources, as well as sources of dissolved phosphorus, nitrogen and suspended sediments.*

*The Commission is then asked to compile the outcomes of this work with the outcomes of the work undertaken in Quebec to provide a transboundary picture of the watershed that complements the efforts of Quebec and Vermont in this region.*

*The Commission is requested to produce a final report of their work by December 2011. The Governments request the Commission to pursue its activities and examinations expeditiously, and to make periodic reports to the Governments as appropriate. Reporting should include an initial work plan in December 2008 and an interim report towards study goals in December 2009. The Commission is requested to consider the annexed Concept Paper in designing and carrying out the above tasks.*

*The Governments further request the Commission to initiate its work on these tasks acknowledging the work already undertaken in Quebec as Canada's contribution and aiming to recognise this contribution through spending of US funds on the Vermont portion of Missisquoi Bay. US Federal appropriations to the Commission may be applied to assist this work in the Vermont sector of the Missisquoi Bay watershed. The Governments of Canada and Quebec have already provided the full commitment of research and funds.*

## Study Process

On September 15, 2008, the International Joint Commission created the International Missisquoi Bay Study Board to coordinate the activities as requested in the reference and to report to the Commission with recommendations on possible future actions to enhance the joint program to reduce phosphorous inputs to Missisquoi Bay. The International Missisquoi Bay Study Board consisted of four members, two each from the U.S. and Canada. The members of the Board are listed below.

### Canadian Membership

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### U.S. Membership

**Mr. Erik H. Beck**  
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**Mr. Eric Smeltzer**  
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The IJC engaged the Lake Champlain Basin Program to carry out much of the detailed work of the study, in close cooperation with the Study Board. In the course of the study, the Study Board held several public meetings and workshops which are noted in detail in their report. In addition, after the submission of the Board's study, the International Joint Commission held public meetings on the Board's final report on May 1 and 2, 2012, in St. Armand, Quebec and Swanton, Vermont respectively. Additional public comment online was encouraged.

## Study Board Findings and Recommendations

The International Missisquoi Bay Study Board submitted the following findings and recommendations in its final report to the International Joint Commission dated February 15, 2012.

1. The study was competently executed and the results were generally supported by the peer reviews. We believe the results are valid although limitations on the P source estimations have to be taken into account as previously discussed. The study results should be put to use by resource management agencies in the Missisquoi Bay watershed.
2. The project has brought the scientific capability in Vermont up to a comparable level to what exists in Québec with respect to watershed modeling and critical source area analysis in the Missisquoi Bay watershed. Complementary research in the Québec portion of the watershed arrived at similar conclusions regarding the high percentage of the phosphorus load that is coming from a small percentage of the land area.
3. The United States Department of Agriculture (USDA) should make sure that state Natural Resources Conservation Service (NRCS) offices retain the flexibility to apply local ranking criteria that give high weight to sites having critical source area characteristics when making funding decisions for applications under EQIP and other programs. National standards for ranking criteria should not be imposed in a way that limits the ability of local offices to target critical source areas. The need to make maximum use of the available dollars to reduce phosphorus loading to Missisquoi Bay should outweigh concerns about inequities in funding allocations when applying a critical source area targeting approach.
4. Critical source area targeting should be implemented at two spatial scales:
  - *Sub-watershed scale:* Separate Environmental Quality Incentive Program (EQIP) funding pools should be established for areas identified as critical sub-watersheds, as has been done for the Rock River and Lewis Creek watersheds in Vermont.
  - *Farm scale:* Ranking of funding applications should be based on site physical characteristics (e.g., slope, topographic index, soil group, proximity to water) available from this study and accurate site information on land use and cropping patterns, management practices in place, and soil phosphorus tests (STP) obtained by field surveys. Resource management agencies should be proactive in their outreach, targeting landowners where potential critical source areas have been identified by this study, rather than passively responding to applications for funding.
5. More management attention should be paid to reducing phosphorus loads from streambank erosion caused by channel disequilibrium, since this process represents a high percentage of the phosphorus load delivered to the Missisquoi River. Resource management must promote strategies to regain and maintain the stream channel's equilibrium conditions, such as the restoration of a channel's access to the floodplain and the restoration of a stable slope and planform, in order to achieve phosphorus load reductions over the long

term.

6. The long-term goal of state and federal resource management agencies should be to limit or mitigate the effects of intensive cropping and animal use in critical source areas. This should be accomplished by educational outreach and technical assistance, financial incentives for mitigating practices such as cover cropping, multi-crop grain rotations, changes in tilling practices, and conservation buffers, and a structure of those incentives to place greater value on the areas that pose the greatest risk of export. Stronger regulatory approaches should be used where voluntary incentives are not working or are not being applied on the critical source areas. It is likely that much of these efforts will need to be focused on small farms in Vermont since medium and large farms already fall under higher levels of state water quality regulation.
7. The maps and other supporting GIS data files from this study should be made available to resource management agencies in the basin for placement on agency computer servers and at the Vermont Center for Geographic Information. Field staff should make use of these files to prioritize site visits and to support more in-depth farm assessments at the field and sub-field levels. Field tablet technology under development by NRCS to support on-site BMP analysis and scenario testing with farmers should incorporate the critical source area data produced by this study. Public notice should be provided before critical source areas maps are made broadly available so that landowners are not caught by surprise and appropriate disclaimers about the limitations of the analysis should be included.
8. The Partner Liaison position established under the President's America's Great Outdoors Initiative in Vermont will support coordination among water quality management agencies in implementing an agricultural-based critical source area targeting approach in the Lake Champlain Basin. Funding for this new position should be sustained in the future.
9. Tactical basin plans developed as part of the Vermont Surface Water Management Strategy should incorporate the findings of this analysis into their priorities.
10. The newly revised USDA national conservation practice standard on nutrient management in order to help producers better manage the application of nutrients on agricultural land should be used in priority in the Missisquoi Bay Basin as it has shown significant results in other watersheds such as the Upper Mississippi Basin, the Chesapeake Bay Watershed and the Great Lakes Basin. The nutrient management standard provides a roadmap for NRCS staff and others to help producers apply available nutrient sources in the right amount, from the right source, in the right place, at the right time for maximum agricultural and environmental benefits:  
  
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/npm>
11. There is a need for further research on the relationship between soil P concentrations (STP) and P concentrations in field runoff for Missisquoi Bay Basin agricultural soils to better rank critical source areas in terms of risk of soil P desorption (soil P release in

runoff).

12. Vermont AAFM should compile and retain soil phosphorus concentration data available from farm nutrient management plans and other sources in a database for use in making more accurate critical source area assessments. These data could be aggregated if necessary to preserve farmer confidentiality.
13. The IJC has made valuable contributions to phosphorus and water quality management in Missisquoi Bay in recent years through involvement in the causeway issue, support for small farm nutrient management planning, and the present critical source area analysis. Future involvement by the IJC in specific study issues such as these would be very welcome. The Missisquoi Study Board has considered the topic of future involvement by the IJC at a broader oversight level for the Lake Champlain Basin. We have concluded that broad IJC oversight is not warranted because of the strong bilateral presence of the Lake Champlain Basin Program. Through the existing MOU between Vermont, Québec, and New York, and the involvement of US and Provincial partners on the Lake Champlain Basin Program's Steering Committee, considerable coordination and collaboration between partners and across the border regularly occur. We feel that adding a permanent monitoring board to this existing structure would be redundant.
14. The critical source area modeling approach is fundamentally sound, particularly when used over the short term, and should be applied throughout the Lake Champlain Basin, in Vermont, New York, and Québec. Development of supporting data and refinements of the methods to better address developed land and in-stream sources will be needed in applying the approach to other watersheds. Nevertheless, water quality improvements from long-term critical source area management remain difficult to estimate due to spatial complexity and variability of large watershed systems.

## IJC Discussion and Recommendations

The International Joint Commission endorses the Findings and Recommendations of the Missisquoi Bay Study Board. The Study Board notes that the study has built upon and improved the existing beneficial cooperation between Vermont and Quebec and between the state and province and the federal levels on both sides. The International Missisquoi Bay Critical Source Assessment Study assures that Vermont's analysis of the Missisquoi Bay basin sources is at the level of assessment of the Quebec portion of the basin.

The focus now should shift from a study of the phosphorous problem to using the data in Vermont's ongoing efforts to reduce phosphorous loading into Missisquoi Bay. The study's identification of stream bed erosion and the relative phosphorous loading levels of specific crop rotations as key factors in nutrient transport give a focus to ongoing phosphorous load reduction work in the basin.

Along with supporting the recommendations of the Study Board listed above, the Commission recommends the following closing points:

1. The true long term nature of excessive nutrient loading to Missisquoi Bay should be emphasized for all involved. This includes the recognition that there are nutrient transport time lags and heritage issues of phosphorus rich sediments in streams and on the lake bottom.
2. The IJC urges Governments at both Federal and State levels to recognize the need for their long-term commitment to Government-funded phosphorous load reduction programs, including support for the use of best management practices for till practices, nutrient management plans, and runoff management with a focus on limiting erosion.
3. Government programs should be proactive and targeted to those areas most in need of education and outreach; mindful, of course, of privacy or regulatory boundaries, and best methods of inviting cooperation from within the agricultural sector.
4. The Commission encourages continued and new cooperative arrangements with NGOs, and programs such as the Lake Champlain Basin Program.
5. The Commission strongly encourages ongoing monitoring and coordinated data collection on both sides of the border within the Missisquoi Bay watershed. The quantitative measurement of the effectiveness of current phosphorous reduction programs is essential. The Commission emphasizes the board's call for additional and ongoing research for effective management efforts to reduce streambank erosion and the role of legacy phosphorous in Missisquoi Bay sediments.
6. Governments should carefully consider the Missisquoi Study Board's recommendation number six suggesting that if the voluntary programs in place are ineffective then stronger regulatory approaches should be considered.

In the context of climate change, progressive increases in water temperatures, and the strength of storms e.g. the 2011 flooding events, the battle to reduce blue-green algae blooms in Missisquoi Bay will necessarily be ongoing and long term

In regards to an ongoing International Joint Commission role in the basin as requested in the reference, the Study Board recommends against this as it would be duplicative of the Lake Champlain Basin Program (LCBP). The IJC supports this recommendation and remains committed to working with the LCBP and the governments in the Lake Champlain - Richelieu River basin when requested.

Finally, the Commission would like to impress upon the Governments that the excess phosphorous problem concerns multiple basins along the border and many areas of both Canada and the United States. Coordination among those agencies and offices fighting the battle particularly at the state and provincial levels needs to be improved.

Signed this 26th day of September, 2012 as the International Joint Commission's Statement and Report to the Governments of Canada and the United States pursuant to the August 1, 2008 Reference to study critical sources of phosphorous in Lake Champlain's Missisquoi Bay.



Hon. Lana Pollack  
Chair, United States Section



Hon. Joseph Comuzzi  
Chair, Canadian Section



Rich Moy  
Commissioner



Lyall Knott  
Commissioner



Dereth Glance  
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