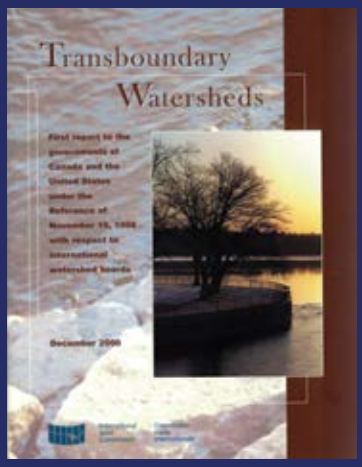
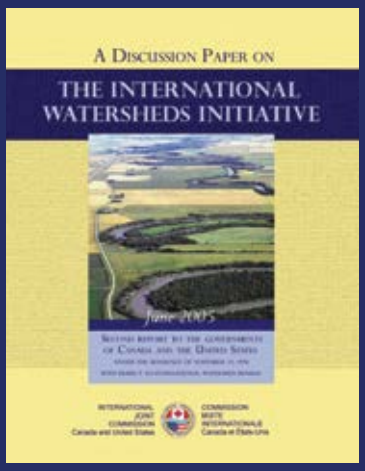
THE INTERNATIONAL WATERSHEDS INITIATIVE:

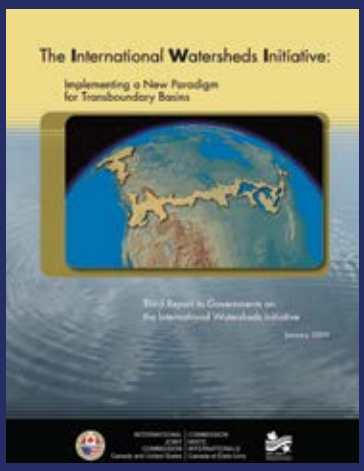
From Concept to Cornerstone of the International Joint Commission

A watershed approach for coordinated stewardship of shared Canada-U.S. waters

Fourth Report to Governments on the International Watersheds Initiative
October, 2015







Previous IWI reports

For more information on the International Watersheds Initiative or the International Joint Commission (IJC), please visit the IJC's website: www.ijc.org. Information also can be obtained by contacting any of the following IJC offices:

United States Section Office
2000 L Street, NW, Suite 615
Washington, DC 20440
Phone: 202-736-9000
Fax: 202-632-2006
commission@washington.ijc.org

Canadian Section Office
234 Laurier Avenue West, 22nd Floor
Ottawa, ON K1P 6K6
Phone: 613-995-2984
Fax: 613-993-5583
commission@ottawa.ijc.org

Great Lakes Regional Office
100 Ouellette Avenue 8th Floor
Windsor, ON N9A 6T3
Phone: 519-257-6700
Fax: 519-257-6740
OR
P.O. Box 32869
Detroit, MI 48232
Phone: 313-226-2170 x6733
commission@windsor.ijc.org

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ACKNOWLEDGMENTS

The International Joint Commission thanks the governments of Canada and the United States for their continued support for the International Watersheds Initiative (IWI). Without their funding, the breadth and depth of the accomplishments highlighted in this report would not have been possible. IJC boards deserve special recognition for embracing the IWI to help address the challenging binational water issues in their basins.

All Commissioners have shown a keen interest and have been actively involved in the IWI. However, the Commission particularly acknowledges former U.S. Commissioner Irene Brooks and former Canadian Commissioner Jack Blaney, who were instrumental in moving the IWI forward in its formative years.

The outstanding work of the Transboundary Hydrographic Harmonization Task Force and the Binational SPARROW Modelling Team exemplifies the importance and value of the IWI.

The Commission acknowledges the hard work and dedication of the IWI Coordinators over the past five years: Willem Brakel, Robert Reynolds, Anne Chick, Joe Babb and Mark Colosimo on the U.S. side; and Ted Yuzyk and Pierre-Yves Caux on the Canadian side.

The work of Michael Laitta from the U.S. Section of the IJC on all geospatial aspects of the IWI and work by Tara Buchanan of the Canadian Section on project administration greatly contributed to the overall success of the IWI.

The Commission would like to acknowledge the contributions to this final report of lead drafters David Dempsey and Ted Yuzyk, its staff and boards.

EXECUTIVE SUMMARY

The Boundary Waters Treaty of 1909 established the International Joint Commission (IJC or the Commission) and committed Canada and the United States to cooperatively address shared water concerns. More than a century later, the IJC continues to assist the Canadian and U.S. governments in preventing and resolving disputes along waterways shared by the two countries, finding success in new approaches as the issues, science and directives of the governments have evolved.

Water knows no political boundaries. Fostering the harmonization of environmental data and ecosystem management for shared watersheds is critical to binational water stewardship. The IJC is successfully answering this need through the International Watersheds Initiative (IWI).

The IWI is a watershed approach that helps address current and emerging environmental issues in transboundary basins in a holistic manner, enabling the IJC to better assist the governments. Over the past 17 years, the IWI has demonstrated its value to the governments, the IJC, agencies and communities in several major transboundary basins. This fourth report to governments highlights key activities, results and proposed next steps for the IWI.

Fundamental to the success of the IWI is the application of seven principles:

1. An integrated ecosystem approach to transboundary water issues;
2. Binational collaboration;
3. Involvement of local expertise;
4. Public engagement;
5. Balanced and inclusive board representation;
6. Open and respectful dialogue; and,
7. An adaptive management perspective.

IWI-funded projects have addressed specific board needs, including: water quantity and quality monitoring systems; field surveys; numerical modelling; scientific analyses; literature reviews; organization of science forums and outreach products. Communications and outreach have been an integral part of the IWI. Significant resources have been used to advance two highly successful IWI strategic priorities: transboundary hydrographic data harmonization and binational water quality modelling.

Since 2010, Canadian and U.S. governments have invested a total of approximately $5M in the IWI. This investment has provided capacity to address a number of binational water-related issues described in this report, such as: the reintroduction of native alewives in the St. Croix River system; whether or not flow releases from Devils Lake would introduce any new harmful fish pathogens and parasites into the Red River system; and how governments could proceed to better protect communities in the Souris, Red and Richelieu River-Lake Champlain basins from major floods.

The IWI supports a scientific foundation for addressing future environmental issues and establishing a more inclusive stakeholder framework for these important transboundary watersheds, which has led to greater public understanding and substantially more inter-agency cooperation. Federal, state and provincial agencies in Canada and the U.S. have incorporated and utilized IWI data harmonization and modelling to help fulfill their respective mandates. This work is considered a model for other countries that have shared basins with incongruent hydrographic data sets.

Since the last IWI report in 2009, much progress has been made on the IWI's initial strategic priorities. The need for active federal participation on the boards has been addressed. Vacancies on the boards have been filled with high calibre, dynamic and dedicated individuals and there has been considerable collaboration with federal agencies on both sides of the border. The IWI has matured and is recognized as an essential approach for the Commission and governments to effectively address transboundary issues.

Therefore, the Commission recommends the federal governments consider the value of new IWI priorities. Increasing challenges impacting on transboundary basins include: climate change impacts on water resources (quantity and quality); water quality stressors, in particular nutrient loading impacts on eutrophication/ harmful algae blooms in transboundary basins; and impacts on the quality of transboundary waters from heavy metals and associated contaminants. These issues all require binational attention to avoid major long-term environmental impacts on transboundary waters, consistent with Article IV of the Treaty. For each of these broad issues, the IJC is considering activities that could be undertaken consistent with its existing mandate.

The Commission is pleased with the support and written responses of the Canadian and U.S. governments to past IWI reports. The IJC has taken actions to address the two governments' previous recommendations. The Commission looks forward to a productive dialogue with the governments in response to this report on IWI developments.

For more than a century, the IJC has advised governments of Canada and the United States on shared water resource issues. During this period, water management has evolved in response to the population shifts, industry and agricultural development, public health concerns, climate change, progress in science and technology, invasive species and other factors. Through concerted actions, the IJC and the governments have been able to adjust to an evolving environment and their efforts to anticipate, avoid and resolve transboundary water conflicts. The IWI has contributed significantly to these efforts.

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1. OVERVIEW

This fourth report by the International Joint Commission (IJC or the Commission) to the Governments of Canada and the United States presents the key activities and achievements of the International Watersheds Initiative (IWI) from 2010 to 2015. It describes the significant progress toward the transboundary water stewardship objectives first envisioned by the governments and IJC nearly 20 years ago, and speaks to how the IWI will continue to help guide this stewardship in the future.

Water knows no political boundaries. *The Boundary Waters Treaty of 1909* (the Treaty) is a forward-looking agreement that has sustained peace and allowed the friendship between the United States and Canada to flourish over the last 100 years. About 43% of the 8,891-kilometre (5,525-mile) boundary between the two nations passes through water. This presents no shortage of challenges. Recognition of these challenges prompted the framers of the Treaty to establish the IJC to assist the countries by anticipating, avoiding, and resolving disputes affecting boundary waters. This work continues with IWI, which has evolved from a concept to a cornerstone of the Commission.

Since a reference from the Canadian and U.S. governments in 1998, the IWI has become integral to the IJC's collaborative approach to addressing transboundary water issues. Over the past 17 years, with the guidance and financial support of both the Canadian and U.S. governments, the IWI has helped inform, engage, and provide tools for decision makers at all levels to better address a broad range of contentious water-related issues along the Canada-U.S. border.

Prior to the IWI, Commission boards generally approached issues as either water quality or quantity matters. These binational boards were populated with mostly government agency personnel, and had limited funding to address complex water-related issues. There was also negligible interaction or knowledge exchange among the boards. The IWI offered a major paradigm shift, as noted in the third report to governments (IJC, 2009) and by others (Clamen, 2013). It transformed the Commission's approach to addressing transboundary water issues with an expanded ecosystem approach and more inclusive and diverse watershed board membership.

In addition to the ecosystem approach, an underlying premise of the IWI is that local people and institutions are often best placed to anticipate, prevent or resolve many problems related to water resources and the environment and to take shared actions towards sustainability objectives. Fundamental to achieving this goal is ensuring that the decision makers have the required data, tools and credible science with which to make sound environmental decisions in transboundary watersheds.

Addressing complex and often enduring transboundary environmental issues binationally depends on strong collaboration, credible science, and practical applications.

Through the IWI approach, the IJC is able to support a common forum for the two countries, as well as for the states and provinces, First Nations and American Tribes, local jurisdictions and local leaders in collaboration, sharing and binational learning. Promoting best water management practices and environmental approaches, the IWI focusses on the watershed as a whole, and on the human communities

that depend upon it. The IWI also promotes a continuous learning forum to apply adaptive management through monitoring, evaluating, and identifying opportunities to adapt as needed.

A Principled Approach to Shared Waters

The IWI supports activities that strengthen the capacity of its boards to deliver on their mandates through building partnerships and promoting sound water stewardship. The following principles guide the IWI:

1. Integrated ecosystem approach to transboundary water issues.

The rivers, lakes, and streams that define much of the Canada-U.S. boundary are influenced by the environment and human activities in the watershed. Local communities, flora, and fauna have a complex interdependence with these waters and derive a range of benefits that are considered in an integrated ecosystem approach that attempts to balance the needs of all interests.

2. Binational collaboration.

Equal participation from Canada and the U.S., as well as shared awareness and understanding of the issues influencing transboundary water quality and water flows are core elements of effective stewardship of these transboundary waters. Determining a common set of scientifically credible facts is essential and is achieved through binational collaboration in joint fact finding, monitoring, and reporting on the quality, conditions, threats, and opportunities for these shared waters.

3. Involvement of local expertise.

Each watershed has its unique geography, ecosystems and challenges that are understood by the local community. Local people and institutions are often the best placed to anticipate, prevent or resolve many problems related to water resources and the environment and to take shared actions towards sustainability. Engagement of local expertise is fundamental to effectively addressing any water issue.

4. Public engagement.

The waters in these transboundary basins belong to the people, and an informed and engaged public is critical for successful water stewardship. Watershed boards promote opportunities for the public to be continuously informed on the status of issues and results to date, and to share views and guidance on a regular basis. Hosting public meetings, distributing reports and holding informative water forums and workshops are essential for facilitating the exchange of ideas and provide a platform to share the latest scientific knowledge and best practices with everyone in the basin.

5. Balanced and inclusive board representation.

Transboundary water stewardship is strengthened through diverse perspectives, expertise, and frames of reference. Watershed boards are most effective when federal, state, and provincial members are joined by members from First Nation, American Tribes and Métis communities, as well as from local governments, non-governmental organizations, industry, and the private sector. Watershed boards must be representative of the watershed community and reflect diverse expertise, gender parity and geographic representation.

6. Open and respectful dialogue.

Diverse perspectives are respected and efforts are made to build trust and understanding while striving for consensus with the consideration of broad stakeholder engagement during deliberations. There will be times when consensus may not be achievable, and a majority may need to

choose the desired outcome, but all voices will have had the opportunity to be heard through a collaborative process.

7. Adaptive management perspective.

Transboundary water stewardship is an ongoing process with ecosystems in constant flux (*e.g.,* changing climate and land use practices), and stakeholder needs and concerns ever-evolving. Iteratively assessing the effectiveness of decisions over time with new data and science will enable actions to be identified that will lead to improved water stewardship.

The Process for Funding IWI Projects

Key watershed issues are identified by the IJC's various water management boards. A project proposal that addresses one or more of these issues is then developed by a board and submitted to the Commission for funding support consideration. These projects are reviewed by Commission staff and upon approval are funded.

The IJC reviews the proposals against defined IWI project criteria described in detail later in the report and assesses project feasibility. It also ensures that proposed projects employ a binational perspective and collaboration. IJC staff assists the boards in identifying mechanisms to facilitate work on approved projects.

Key issues or broader strategic projects that span multiple boards or the entire transboundary are led by the Commission (*e.g.,* transboundary hydrographic data harmonization). The IJC regularly updates the governments on this work at the Commission's semi-annual meetings and through other communications.

As noted, diverse membership on the watershed boards is a key element of the IWI. Many of these boards have traditionally addressed only water quantity or water quality (as a control board or pollution board). However, this focus has been changing over time through adoption of an ecosystem approach. Two boards, the International St. Croix River Watershed Board (ISCRWB) and the International Rainy-Lake of the Woods Watershed Board (IRLWWB) are now designated "international watershed boards." Designation as a watershed board requires adherence to IWI principles. Commission boards are also encouraged to include key stakeholders, including First Nations, Métis and American Tribal governments, and the public. Achieving international watershed board status is a lengthy process. The IJC works closely with both governments in the evolution and the designation of watershed boards.

2. BRIEF HISTORY OF THE IWI

2. BRIEF HISTORY OF THE IWI

The IWI concept emerged in response to a request from the Canadian and U.S. governments for a prospective look at the challenges likely to emerge in the 21st century. In its 1997 report, *The IJC and the 21st Century*, the Commission advised the governments that a watershed approach would help address current and emerging environmental issues in a holistic manner, enabling the IJC to better assist the governments in anticipating, avoiding, and resolving disputes related to their shared waters.

The governments responded with a reference dated November 19, 1998 in support of the Commission's recommendations and accepted in principle the proposal to establish international watershed boards that would adopt an integrated ecosystem approach to transboundary environmental issues. The reference described five tasks for the Commission:

- define the IWI framework;
- identify where the first watershed board could be established;
- recommend the structure and composition of watershed boards;
- provide cost projections; and,
- enter into consultations with the various stakeholders on the establishment of additional watershed boards.

In response to this charge, the Commission proceeded to develop the concept and report back to governments.

In December 2000, the IJC submitted its first IWI report, *Transboundary Watersheds* (IJC, 2000a). The Commission identified the Red River and St. Croix River boards as good candidates for implementation of a watershed concept and confirmed a willingness by the stakeholders in those basins to establish a watershed board. The IJC also identified the Rainy River and Souris River Boards as potential watershed board pilots. A notional budget for a watershed board was also established. The governments responded positively and provided special funding to facilitate further development of the concept.

In June 2005, the IJC submitted its second report, *The International Watersheds Initiative* (IJC, 2005). This report further promoted the establishment of watershed boards in the Rainy, Red and St. Croix basins. Funding required to undertake IWI projects and enhance the capabilities of these amalgamated water control and pollution boards was proposed as a notional budget. The IJC recommended that funding be used by these boards for outreach, education, partnership building and development of a better understanding of river systems and their contributing watersheds. Again, the governments were supportive and U.S. funding helped move the IWI concept forward.

In 2007, the Canadian government allocated funding for the IWI for the subsequent five years, enabling matching expenditures with the U.S. The year 2007 was also significant in that the St. Croix River Board was designated the first watershed board (the ISCRWB), and the Souris River Board was added to the list of pilot boards.

The Commission spent considerable effort in 2008 working with the boards. A series of workshops helped further develop the IWI framework and establish its operating principles.

In 2009, the IJC presented the third report to governments, *The International Watersheds*

Initiative: Implementing a New Paradigm for Transboundary Basins (2009). This report was completed a year early to coincide with the 100th anniversary of the *Boundary Waters Treaty*. The report highlighted considerable progress in many areas from board structure and membership to conflict resolution, all of which was made possible with funding from the two governments. It concluded with recommendations for actions that needed to be taken by the boards, IJC and governments to move the IWI concept forward.

Both governments provided their views on the third report in 2011. The U.S. letter, dated March 7, 2011, supported the Commission's IWI efforts and in particular its work related to the ongoing transboundary hydrographic data harmonization. The U.S. government recognized challenges related to the lack of sufficient IWI funding but reaffirmed the importance of the IWI to the government. The U.S. government encouraged the IJC to strengthen partnerships with American Tribal, First Nations and Métis governments.

The Canadian government's positive response, dated May 27, 2011, focussed on addressing the report's many recommendations and the government's views on specific aspects of the IWI from funding and the ecosystem approach to the expansion of watershed boards and board composition.

The IJC provided responses to the government letters in 2011 and is taking related actions that are described in this report.

The key work related to transboundary hydrographic data harmonization continued with the goal of completing this harmonization work in all the transboundary basins. Several workshops held in 2010 and 2012, with representation from most of the boards, were instrumental in launching the IJC's second strategic effort, which focusses on water quantity and water quality modelling. This led to the binational water quality modelling effort using the SPARROW model (Spatially-Referenced Regression on Watershed Attributes) and the expansion of its application into multiple basins. These two highly successful strategic priorities are highlighted in section 5 of this report.

In January 2013, the IRLWWB was established with the amalgamation of the International

> "Overall, the U.S. government is pleased with the excellent work the International Joint Commission has done in developing and implementing the International Watersheds Initiative within prevailing institutional and resource restraints."
>
> *— Viela M. De Pirro, Director,*
> *Office of Canadian Affairs, U.S. Department of State*

"The Government of Canada values the work of the International Joint Commission on the International Watersheds Initiative and looks forward to its continued success."

— Michael Rooney, Director, U.S. Transboundary Affairs Division, Foreign Affairs and International Trade Canada

Rainy Lake Board of Control and the International Rainy River Pollution Board, and with the addition of water quality responsibilities in Lake of the Woods. This was the second officially designated watershed board. This board was unique in terms of its large geographical coverage and its broad, inclusive membership and associated advisory groups.

The Commission completed an internal review of its IWI efforts in February 2013. A two-day retreat focussed on refinements to the IWI framework and on how the IJC could better assist the boards in recognizing the benefits of an IWI approach. These ideas were shared with the boards at the IJC October 2013 semi-annual meeting and received their support, along with their input on future strategic IWI priorities for the Commission.

3. IWI MANAGEMENT AND FUNDING FRAMEWORK

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The fundamental aim of the IWI is to facilitate watershed-level solutions to transboundary environmental challenges by promoting science, communication, collaboration and coordination among various stakeholders and interests, using an integrated ecosystem approach. The ecosystem approach recognizes that ecosystems function as whole entities and should be managed as such, looking beyond traditional jurisdictional boundaries. More detail on the ecosystem approach is provided in the third report to governments on the IWI (IJC, 2009).

Adaptive management is an essential element of best management practices and a strong contributor to addressing binational water stewardship challenges. The IJC has embraced adaptive management in its IWI principles. Adaptive management is a structured, iterative process for continually improving management results by learning from the outcomes of previous policies and practices (IJC, 2013a). Adaptive management recognizes that there is always some level of scientific uncertainty when addressing environmental issues. For example, knowledge of climate change and its impacts on water resources and aquatic ecosystems is constantly evolving. Adaptive management enables decision makers to better understand and deal with the consequences of uncertainty through ongoing monitoring and a structured evaluation approach that incorporates sound science and lessons learned.

The IJC recognizes that scientific rigor and credibility are critical to making sound decisions and achieving consensus among stakeholders with different perspectives. Over the last five years, the Commission has been increasingly employing external independent peer review, as well as extensive internal reviews, to ensure the scientific integrity of IWI reports. Under IJC funding criteria, IWI project proposals are required to address one or more of three overarching themes:

1. *Building a shared scientific understanding of the watershed issues* by harmonizing data and information, developing shared tools, knowledge and expertise, and expanding outreach to and cooperation among stakeholders.

2. *Communicating transboundary water issues* at the local, regional, and national levels, including First Nations, Métis and American Tribes, to increase awareness and understanding of these important issues.

3. *Contributing to the resolution of watershed issues* by facilitating discussions, participating in development of shared solutions, creating decision-making tools, fostering common ground, brokering resolutions, and bringing unresolved issues to the attention of the IJC.

Official calls for project proposals are sent to all boards twice a year (March and September). These dates correspond to the beginning of the fiscal years for Canada (April 1) and the U.S. (October 1). Recognizing the various board schedules, the IJC allows boards to submit proposals for consideration throughout the year. All projects submitted by the boards undergo a rigorous evaluation from the IWI Review Committee. The Committee is comprised of IJC staff that includes the Canadian and U.S. secretaries and legal, engineering, scientific and communications personnel from the Ottawa and Washington offices.

The Committee evaluates the proposals using the following criteria:

- Is the project within the board's existing mandate?
- Is the project clearly identified as a board priority in its approved work plan?
- Does the project have a clear binational perspective (involving collaboration on both sides of the border)?
- Are the proposed costs reasonable and substantiated?
- Does the project leverage funding with other agencies or is it linked to other projects?
- Are there clear deliverables?
- Is required expertise identified?
- Is the proposed methodology sound?
- Is the proposed time frame reasonable?

As well, important secondary factors are considered, including questions such as:

- Does the project require a competitive bidding process or can the work be facilitated through existing Memoranda of Understanding or other legal instruments?
- Would this work benefit from an independent peer review?
- Would the project benefit from applying an adaptive management approach?
- Can the knowledge from this project benefit other boards or watersheds?
- Does this work duplicate any other efforts going on in the basin?
- Are in-kind contributions identified?
- Are there opportunities for collaboration?
- Are there challenges or sensitivities associated with this work that may require further discussions with the governments?

Following this review, boards are notified whether their projects are approved, require revisions or need further input based on the Committee's assessment. Upon approval, the Commission works closely with each board in the delivery of its project(s). All contracting and financial transactions are handled directly by the Commission. In some cases, the Commission organizes an external peer review of the work. This project management system has been working well and promotes accountability for the IWI.

The boards report to the Commission on the status of their IWI projects, following their reporting schedules, during the IJC's semi-annual meetings, which are held twice a year in April and October. At these meetings, the Canadian and U.S. governments also are briefed on the status of key IWI work and potential issues. Upon approval by the Commission, the final IWI reports are posted on the IJC website (www.ijc.org) so that they are readily accessible.

Since 2010, the two governments have invested approximately $5M in the IWI (Table 1). Some $2M, or 40%, was spent on the two strategic IWI priorities: transboundary hydrographic data harmonization; and binational water quality modelling. Both of these priorities are described in detail in section 5 of this report.

The remaining IWI budget was used to address other important binational challenges. Projects have included the application of hydraulic and hydrological models, installation and maintenance of water quantity and quality monitoring systems, surveys, scientific analyses, literature reviews, support for science forums, and educational outreach products.

Table 1: IWI Expenditures, by Country

Canadian Fiscal Year	Canadian Expenditures (Cdn$)	U.S. Fiscal Year	U.S. Expenditures (U.S.$)
2010-2011	$436,500	2010	$238,900
2011-2012	$556,200	2011	$502,500
2012-2013	$652,200	2012	$788,000
2013-2014	$278,800	2013	$388,200
2014-2015	$465,700	2014	$630,900
TOTAL	**$2,389,400**		**$2,548,500**

The figures in this table include funding provided to the Commission by both governments and estimates of federal agencies' direct support for IWI activities.

4. INTERNATIONAL WATERSHED BOARD STRUCTURE

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The IWI recognizes that solutions to trans-boundary watershed problems often emerge from local communities. As a result, the IJC is committed to ensuring that the memberships of its watershed boards reflect the diversity of watershed stakeholders and interests. As each watershed is unique, achieving an appropriate level of diversity is a function of the various interests and consideration of the existing institutions and communities in the basin.

Even prior to the introduction of the IWI, the IJC had begun to emphasize appointment of local, non-governmental members to some of its control and pollution boards to assist the boards in understanding local concerns and to foster a better understanding of the role of the IJC in these local communities. This is consistent with IJC's commitment to public outreach, a value that arises from Article XII of the *Boundary Waters Treaty*. Working to implement IWI principles has helped the IJC accelerate and strengthen this effort through expanded membership on its watershed boards.

Increased diversity is being achieved in part through broadening board membership to include representatives of First Nations, Métis, and American Tribes, which is supportive of recommendations from the Canadian and U.S. governments.

The IJC has set a goal of 50% local, public members on each watershed board, while striving for a diversity of disciplinary perspectives, gender parity, and inclusion of non-governmental organizations. The IRLWWB has come closest to achieving these goals.

The IJC has created other mechanisms to promote participation by community members. Recently, the IJC has encouraged boards to consider creating Community Advisory Groups, an action already taken by the IRLWWB. To the extent practicable, boards will seek to build on existing local groups and basin commissions in forming these outreach groups.

The evolution of two watershed boards and one pilot watershed board illustrates the organic nature of board development based on local involvement, the diversity of stakeholders and interests, basin characteristics and circumstances.

International St. Croix River Watershed Board

In April 2007, the Canadian and U.S. governments and Commission agreed to designate the ISCRWB the first official watershed board. The new board was comprised of 10 members. There previously had been two international boards in the St. Croix River watershed, one concerned with water levels and flows and another concerned with water quality. The International St. Croix River Board of Control was established by the governments in 1915 to monitor compliance with the requirements of the order of approval issued by the IJC for the dams on the St. Croix at Forest City, Vanceboro, Grand Falls and Milltown. The International Advisory Board on Pollution Control-St. Croix River was established in 1962 to report on compliance with water quality objectives approved by both governments and on pollution abatement efforts of industries and municipalities along the river.

The IJC formally combined the boards in September 2000 and established the International St. Croix River Board. Since the two boards had already worked together for some time on a range of issues and had regularly

held joint annual public meetings, their amalgamation in 2000 and designation as an international watershed board in 2007 was a natural progression.

The ISCRWB uses mechanisms that already exist in the basin to incorporate specific community perspectives. The Passamaquoddy Intertribal Council, consisting of American Tribes and First Nations, and the International St. Croix Waterways Commission send observers to the board's meetings. Public perspectives also are incorporated through an annual public meeting and other special events, such as science forums.

International Rainy-Lake of the Woods Watershed Board

The second watershed board has a distinctly different history and board structure. In the summer of 2012, the governments wrote to the Commission to express their support for forming a watershed board in the basin. Formed in April 2013, the 20-member IRLWWB also merges the former levels control board and water pollution board (Figure 1).

The International Rainy Lake Board of Control was established in 1941 to assist the IJC in emergency regulation of the level of Rainy

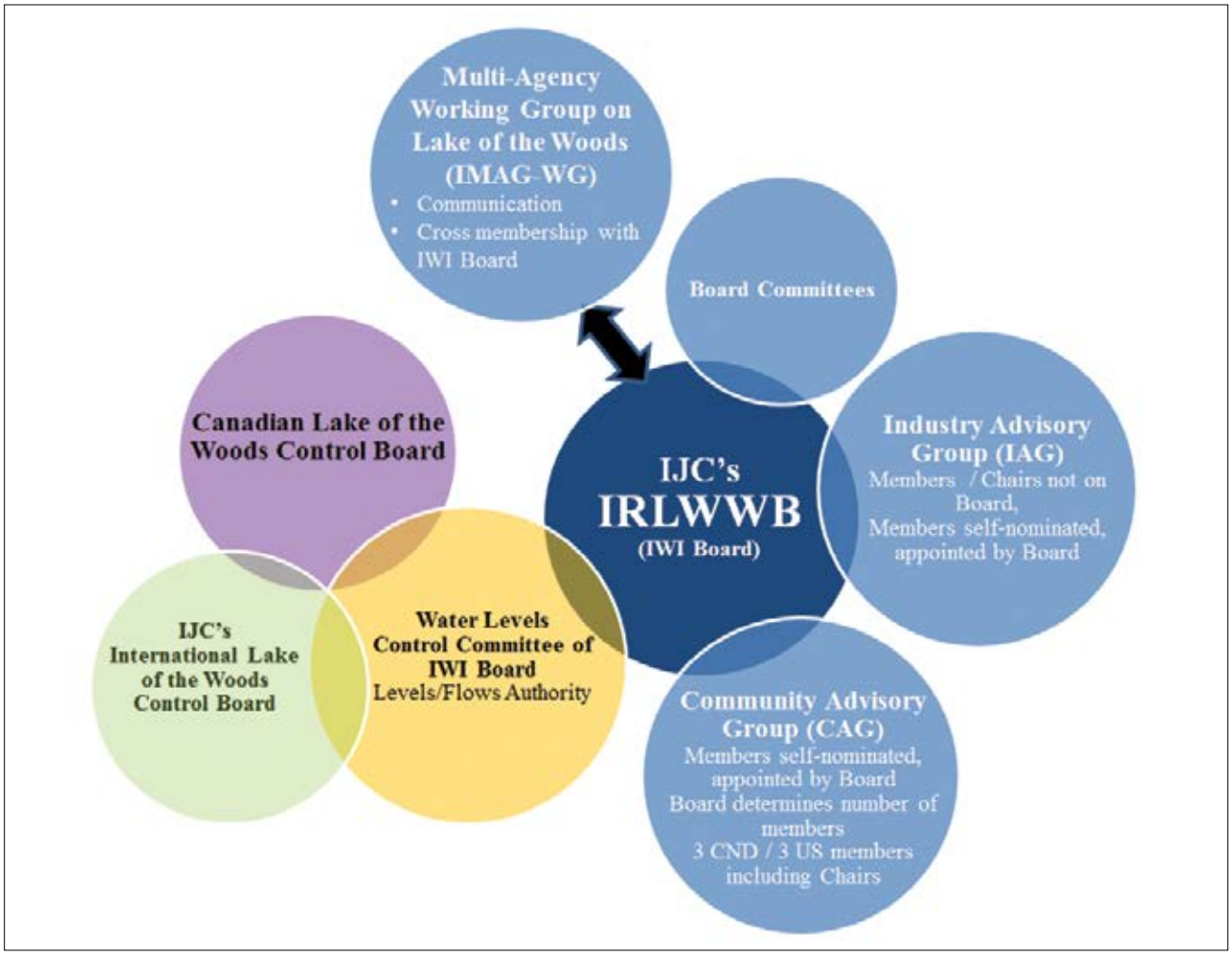

Figure 1: Rainy-Lake of the Woods Watershed Board Structure

Lake and other boundary waters in the Rainy Lake Watershed. Pursuant to a reference from the U.S. and Canadian governments, the IJC established the International River Water Pollution Board in 1966 to assist it in reporting on progress toward pollution abatement in the Rainy River. The impetus for the merger of these two boards and designation as a watershed board came from the local community.

> "The International Rainy-Lake of the Woods Watershed Board was created in 2013 and continues to grow into its new mandate. Already however it has demonstrated the benefits of bringing together local citizenry, with in-depth knowledge of the watershed and diversity of backgrounds and perspectives, along with water management experts, to identify and understand the complex interrelationships of issues affecting water quantity and water quality and the challenges associated with addressing these issues."
>
> *- Michael Goffin, Canadian Chair, IRLWWB.*

The large size of the IRLWWB is the result of several factors. The watershed itself is larger than the St. Croix watershed at 69,750 km2 (27,114 miles2) compared to 4,230 km2 (1,630 miles2). As well, more than half of the board members are watershed residents, including several governmental members who live within the basin. First Nations, Métis and American Tribes all have members on the board.

The IRLWWB is informed by a Community Advisory Group, consisting of a broad range of binational watershed stakeholders, and by an Industry Advisory Group, a forum to provide perspectives of local industries on both sides of the border on the board's activities related to water management and water quality. Membership of the Industry Advisory Group is open to water-related industries operating in the watershed. The IRLWWB is currently developing a public engagement plan, a key component of which is consultation with First Nations, Métis and American Tribes. The board uses additional methods to hear from the public, including open houses, public meetings and web surveys.

The advisory groups have contributed significantly to the board's work. For example, Community Advisory Group members have provided water quality data that the board did not know existed, and the data proved useful in the development of the IJC's water quality plan of study for the basin. As well, both advisory

groups have contributed to the dissemination of information on the board's actions, water level forecasts, and warnings, including those issued during the major flooding in 2014.

To address industry concerns, a water levels committee of the IRLWWB was created. The committee retains authority to oversee lake level regulation, while keeping the full board informed.

Finally, it is important to note that the early success of the IRLWWB is in no small measure due to the support it receives from a Lake of the Woods International Watershed Coordinator. This position is supported with funding from state and provincial agencies and the IJC, and has been an essential management tool for achieving progress with a large and diverse board in a sprawling, complex and dynamic basin. During the flood of 2014, the value of the networks built by the IRLWWB, with the support of its coordinator, was apparent to agencies, elected officials and much of the general public. Additionally, the IWI-supported data harmonization project enhanced the capacity of the operators to manage water flows.

International Red River Board

The experience of the International Red River Board (IRRB), a pilot watershed board, further demonstrates the unique ways in which each board functions. The Red River basin covers an area of 116,500 km^2 (45,000 miles^2), excluding the Assiniboine River basin.

Under a 1948 reference from the governments, the IJC established the International Souris-Red Rivers Engineering Board to investigate water use and apportionment in the Souris and Red basins. Pursuant to a 1964 reference from the governments, the IJC created the International Red River Pollution Board to address water pollution crossing the boundary.

In 2001 these boards were merged with respect to the Red River (while a separate International Souris Board was created) and given a directive to assist the Commission in preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem health of the Red River and its tributaries and aquifers.

In compliance with the board's mandate to involve the public in its work, facilitate provision of information within the basin, and conduct an annual public meeting in the basin, the membership on the board was expanded to include two representatives from the Red River Basin Commission among its 18 board members. The Red River Basin Commission is a broadly representative stakeholder organization that has considerable knowledge of the basin and credibility with the basin's residents.

As watershed boards are formed in other basins, broad local support from diverse constituencies, leading to inclusive board membership, will be an essential ingredient.

4. INTERNATIONAL WATERSHED BOARD STRUCTURE

5. CURRENT STRATEGIC PRIORITIES

5. CURRENT STRATEGIC PRIORITIES

This section presents an overview of progress on the IWI's two current strategic priorities and an outline of how the work in these areas is being applied to important transboundary water management challenges.

A. TRANSBOUNDARY HYDROGRAPHIC DATA HARMONIZATION

Sound transboundary watershed management is built on seamless and comprehensive hydrographic data (*i.e.,* stream network, basin delineation, elevation datum, physical features) for the geography within the basin. Canada and the U.S. developed their own data sets using different methodologies and interpretations and data formatting and naming conventions. Data sets were truncated (or ended) at the international border. This made it nearly impossible to conduct a comprehensive basin-wide hydrological or hydraulic analysis for shared basins. Reconciling these data sets to produce one seamless data set for a transboundary basin is an arduous and time-consuming effort involving multiple jurisdictions. The Commission decided to take on this challenge as one of its first strategic IWI priorities.

In 2004, the IJC initiated a pilot study in the St. Croix basin to assess the proposed methodology and determine the level of effort that would be required to produce a seamless hydrographic data set for this transboundary basin. In 2006, following the pilot study, the Commission undertook a scoping and costing exercise to determine the effort needed to complete this work for all transboundary basins. Recognizing that it would have to take on a leadership role if this work was to succeed, the Commission established a binational task force to undertake the project, which it supported with substantial IWI funds.

In 2007, the Commission formed a binational Transboundary Hydrographic Data Harmonization Task Force to move forward using IWI funds and leveraging in-kind resources from the key national agencies. The task force consisted of representatives of the United States Geological Survey (USGS), the United States Environmental Protection Agency, Environment Canada, Natural Resources Canada, and Agriculture and Agri-Food Canada. The task force reported to the Commission.

Essential data for these basins or regions have been collected and stored by a variety of different federal, state and provincial agencies in each country. The IWI helped bring together representatives of these agencies to create a complete data inventory, to identify the steward of the data, and to document how it was stored and formatted. Then the careful work began of reconciling the data and structuring them into an agreed-upon format that best served the needs of all interests.

Over the next five years, the task force proceeded to delineate and approve the transboundary basins and the nested sub-basin delineations (Figure 2). The task force also developed a system to link locations where names were not consistent for a feature or stream. All streamflow segments were linked so that there was a continuous flow path (Figure 2). The final product was a fully harmonized data set for the basin (Figure 3). These data are formatted for use in a geographical information system (GIS) and thereby readily useable by users in both countries.

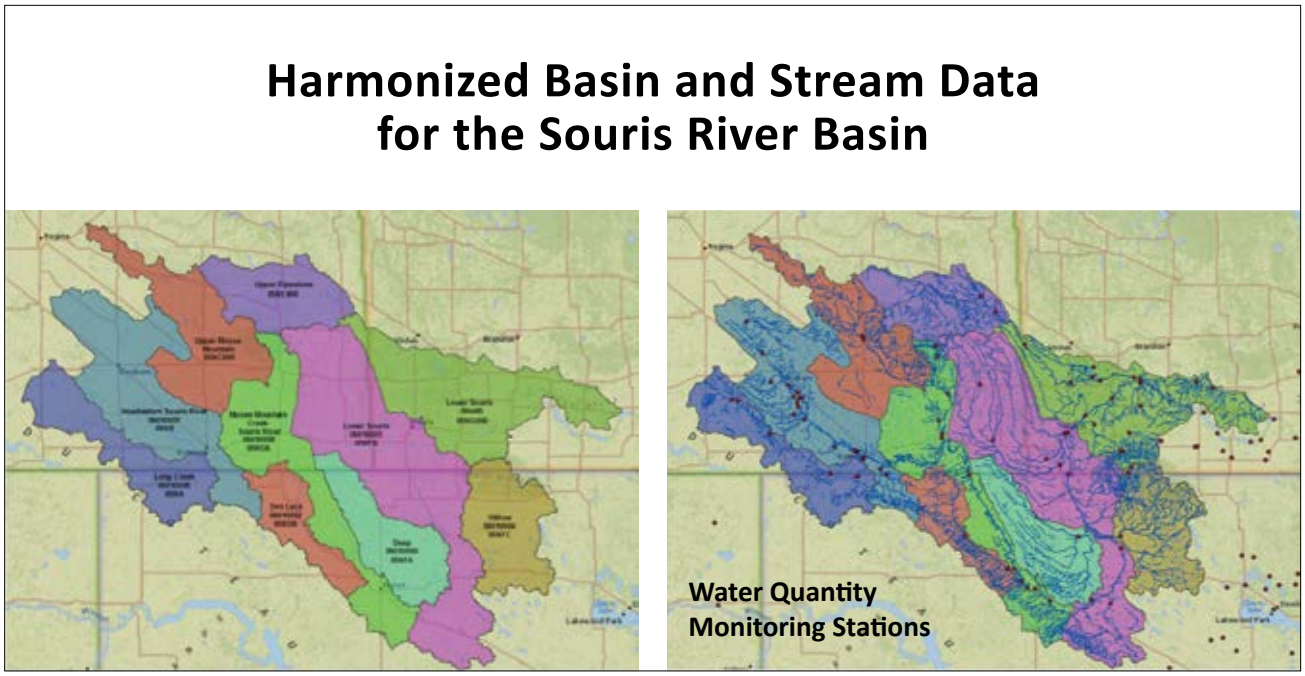

Figure 2: Harmonized Basin and Stream Data for the Souris River Basin

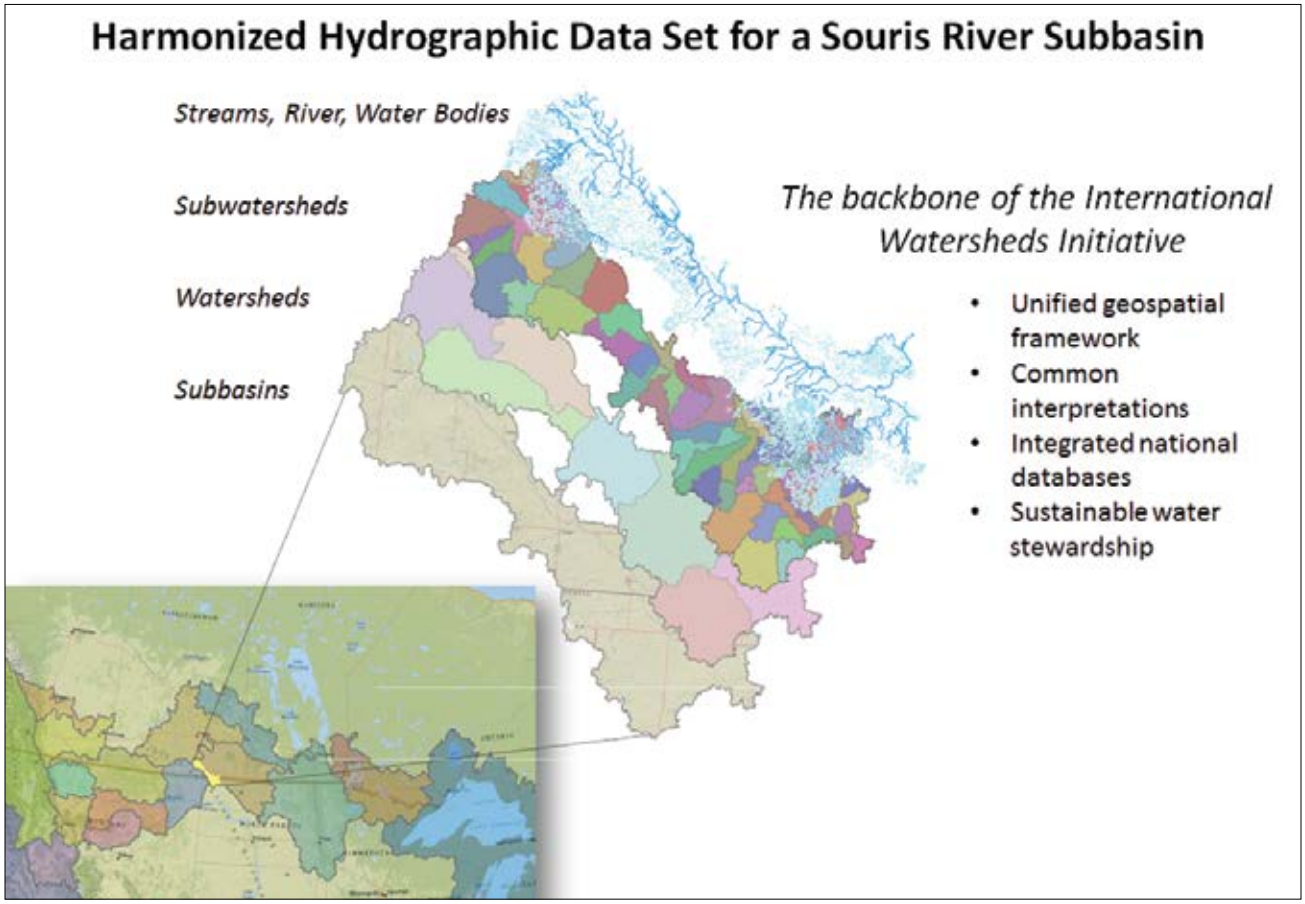

Figure 3: Harmonized Hydrographic Data Set for Souris River Subbasin

In 2013, in partnership with federal, provincial and state agencies in Canada and the U.S., the task force completed a seamless geospatial data set for each transboundary basin to provide a consistent view of drainage basins along the international border. These uninterrupted data have already begun to make it easier for agencies in the two countries to solve complex water issues that require a thorough understanding of hydrography on both sides of the international border.

This transboundary geospatial data set is being stored by a national agency in each country. In the U.S., the data are stored as part of the National Hydrography Dataset and Watersheds Boundary Dataset that are managed by the USGS (www.waterdata.usgs/gov). In Canada, the data are housed by Natural Resources Canada as part of the National Hydro Network and accessible through the Geogratis website (www.geogratis.gc.ca/geogratis).

This harmonization work received considerable external recognition in 2013. Awards to the task force from Esri International and Esri Canada, companies that develop a GIS and the Geospatial World Forum attest to the value and importance of this effort. The work was recognized for showing how two countries can collaborate and share data to address transboundary water-related issues. It is considered a model for other countries that have shared basins and incongruent hydrographic data sets.

These seamless geospatial data will serve a myriad of applications. They will be used to underpin hydraulic, hydrological and water quality models to address a broad range of environmental issues, including, for example, water regulation, water apportionment, flood prediction and delineation, determination of in-stream flow requirements for aquatic life, and nutrient loading.

The harmonization work is a vivid demonstration of how the IWI provides essential data and information that agencies require in order to better fulfill their missions. Moving forward, the Commission is fostering the stewardship of this valuable data set. This task is fundamental to the IJC's vision that essential water data are harmonized and available in the transboundary basins. The goal is to establish and maintain an ongoing operational system in which updated data collected and provided by one agency are immediately available to all partners (federal, provincial, state and local) on both sides of the boundary. Current efforts are also focusing on providing a higher spatial resolution, which is important for more detailed analyses and applications.

B. BINATIONAL WATER QUALITY MODELLING USING SPARROW

One challenging environmental issue found in most of the transboundary basins is excessive nutrient loading. Human land use practices (*e.g.,* agriculture) and activities (*e.g.,* wastewater discharge) are compounding the amounts of nitrogen and phosphorus entering the boundary waters. These nutrients are transported and eventually deposited in receiving lakes or reservoirs. This excess nutrient loading produces harmful and nuisance algal blooms that are detrimental to aquatic ecosystems, negatively impact those who depend on the lake for their livelihood and in some cases even affect human health. Examples of lakes that have become eutrophic because of excess binational nutrient loading include: Lake Champlain-Missisquoi Bay (IJC, 2012a), Lake Erie (IJC, 2014a), Lake of the Woods (Clarke and Sellers, 2014) and Lake Winnipeg (Environment Canada and Manitoba Water Stewardship, 2011).

At the request of the International Souris River and Red River Boards, the Commission undertook the development and binational application of a numerical water quality model for the Red-Assiniboine basin nutrient loading estimation. With IWI funding, the IJC was able to assemble and support a strong scientific team to undertake the project. In partnership with the USGS and the National Research Council of Canada (NRCC), and with active participation from several federal, states and provincial agencies, the work began in 2011.

After considering many existing water quality models, the IJC decided to use the SPARROW model, which had been developed by the USGS. This model was selected because it had already undergone extensive peer review, was appropriate for the scale (*i.e.,* a large basin) and purpose of the application (*i.e.,* estimating regional nutrient loading and quantifying sources). The fact that much effort had already gone into the application of SPARROW in the U.S. portion of the Red-Assiniboine basin also made it an attractive option.

It is important to note that this model uses the harmonized hydrographic transboundary data set facilitated by the Commission and its successful application would not have been possible without this important contribution.

The model now has been calibrated and has been consistently applied to the full Red-Assiniboine basin after three years of intensive work that was supported by government partner agencies in both Canada and the U.S. (Jenkinson and Benoy, 2015). This model enables all jurisdictions to better understand water quality dynamics and nutrient loading in this important transboundary basin.

Figure 4 shows those areas in the basin that have the highest phosphorus yields and therefore where reduction efforts could be effectively focussed. Based on the model, it is estimated that about two-thirds of the phosphorus loading that comes from the Red River into Lake Winnipeg originates in the U.S. portion of the basin. It is becoming increasingly clear that a binational solution is required to address this environmental issue.

The Red-Assiniboine basin SPARROW model will undergo peer review once all the documentation for the model has been completed. Given the importance of the model outputs and the need for analytical tools that facilitate ease of interpretation, the IJC is collaborating with the USGS on developing an online mapping and decision support system to make the results

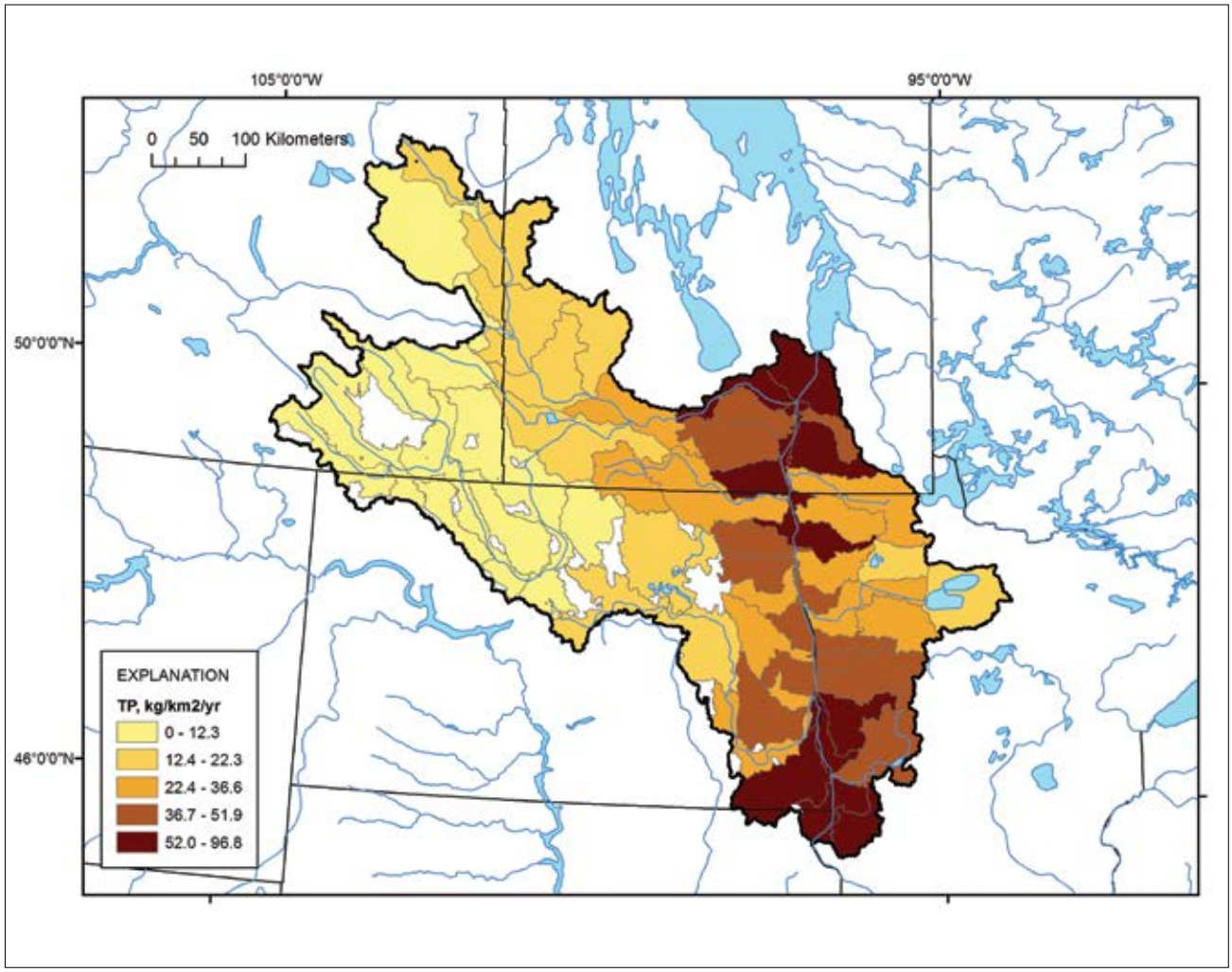

Figure 4: Sample Output from the Red-Assiniboine River SPARROW Model Showing Total Phosphorus Yields (kg/km2/yr) by Sub-watershed Across the Basin.

more readily available to interested agencies and the public.

The IRRB is planning to use the results from the model in support of its basin-wide nutrient management strategy to encourage all impacted jurisdictions to use this information in working towards solutions to help reduce nutrient loading. This modelling work is unique, as it marks the first time that there has been full binational collaboration in the development and application of a common regional water quality model to a transboundary basin in North America.

Building on this success, the IJC is now focussing its effort on the development of a SPARROW model that will cover the Rainy-Lake of the Woods and Great Lakes basins supported by IWI funding. The goal is to have this new model completed by the end of 2015 (NRCC, 2014).

6. IWI ACCOMPLISHMENTS

6. IWI ACCOMPLISHMENTS

This section highlights the key recent accomplishments of the IWI, under each of the international watershed boards and in several other transboundary basins.

A. INTERNATIONAL ST. CROIX RIVER WATERSHED BOARD

Sound fisheries management in the St. Croix basin is a longstanding challenge. In 1995, the State of Maine blocked the passage of alewife fish, which are indigenous to the basin, at the Woodland Dam, restricting the species to less than 0.2% of its historical St. Croix spawning habitat. This action was undertaken over unsubstantiated concerns that the resurgence of alewives in the river - from 169,000 to more than 2.6 million between 1981 and 1987 - had reduced the smallmouth bass population in Spednic Lake and impacted the recreational fishery.

For more than 12 years following the closure of the fishways, the IJC and the St. Croix Board met with parties involved in the issue to assist in developing a consensus to reopen the river to alewives. In addition, the board issued two scientific reports on the issue, outlining the scientific case for reopening the river.

After discussion about next steps with the Commission in 2009, the board asked expert members of the binational, interagency St. Croix Fisheries Steering Committee to develop an adaptive management plan for alewife restoration in the watershed. The plan proposed to reopen the river to the alewife while monitoring the basin's smallmouth bass and alewife populations (Figure 5).

Figure 5: Public Meeting in Princeton, Maine (August, 2010) on the Proposed Adaptive Management Plan for Alewives

IWI funds were used for:

- developing the adaptive management plan;
- collecting bathymetric data in Spednic Lake that were used to develop a digital terrain model to assess the smallmouth bass habitat (Dudley et al., 2011);
- collecting water temperature data during bass spawning; and,
- supporting the river herring (alewives and blueback herring) count over the past four years (Figure 6).

These IWI-supported efforts have further contributed to making a scientifically credible case for the restoration of the alewives in the St. Croix basin.

In April 2013, the Maine Legislature and Senate overwhelmingly approved a bill to reopen the remaining areas of the eastern branch of the St. Croix (above Grand Falls and Vanceboro) to alewife passage. This action restored 16,724 hectares (41,325 acres) of spawning habitat for river herring restoration. In April 2015, a legislative attempt to reverse this decision and close the fishway passages was overwhelmingly defeated.

Average annual returns of river herring appear to be slowly increasing, but it is still early in the restoration process. Population counts are also highly variable but it is clear that restoration of the alewife population in the St. Croix basin will take time (Table 2).

An IWI-sponsored study is underway to develop a model of the food webs within the St. Croix basin. The study, led by the USGS - Maine Cooperative Fish and Wildlife Research Unit at the University of Maine, is entitled, Trophic and Marine Interactions in the St. Croix River, Maine; Statues of Diadromous Fishes, Connectivity, Water Quality and Food Webs.

The St. Croix basin also served as a pilot for data harmonization, an effort described earlier in section 5. Pulling together existing hydrographic data from the Maine and New Brunswick sides of the St. Croix basin into a single, seamless, harmonized GIS data product resulted in the first unified maps and data set covering the rivers, lakes, reservoirs, streams and drainage areas at a scale of 1:24,000-1:50,000.

IWI funding has also been used by the board to better understand water quality in the watershed through additional water quality sampling and an assessment of human health issues related to water quality (Oblak, 2011) and contributing to the organization of the State of the Science Conference held in November 2014.

Figure 6: St. Croix River, Annual Alewife/Fish Count at the Milltown Fishway Trap.

"IWI support to researchers in the watershed provided scientific fisheries and monitoring studies that helped to inform Maine's deliberations to re-open the fishway at Grand Falls dams in 2013 to alewife passage."

- Bill Appleby, Canadian Chair and Christopher Barrron, U.S. Chair, ISCRWB.

Table 2: River Herring (Alewives and Blueback Herring) Annual Count

Year	River Herring Count
2014	27,312
2013	16,677
2012	36,168
2011	25,142
2010	58,776
LONG-TERM AVERAGE (2004-2013)	**18,553**

B. INTERNATIONAL RAINY-LAKE OF THE WOODS WATERSHED BOARD

The IJC has been particularly active in the Rainy-Lake of the Woods basin. IWI funding has supported a wide range of work that has greatly contributed to a better understanding of the basin's water issues and to improved water management. To add to the challenge, the Rainy River flows in and out of two large lakes (Figure 7) fed by a number of tributary lakes and rivers, some of which form the border between the two countries.

Issues in the basin range from flooding, water quality (contaminant and nutrient loading), invasive species, bank erosion and sedimentation and climate change, to the impacts of water level regulation on fisheries, waterfowl and wild rice production. More details on these issues can be found in the *Rainy-Lake of the Woods State of the Basin Report* (Clark and Sellers, 2014), which was partially funded by the IWI.

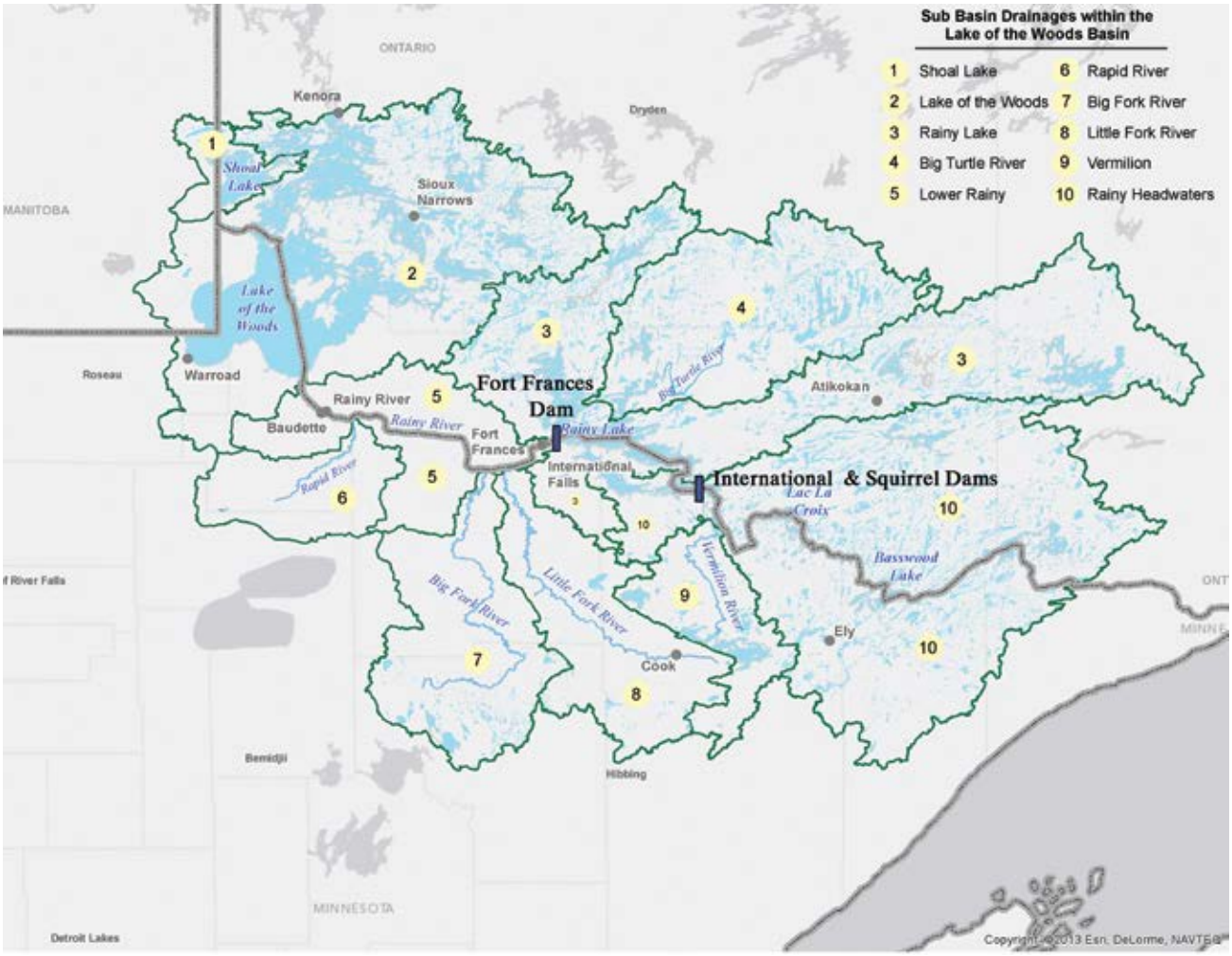

Figure 7: Rainy River - Lake of the Woods Basin Map

Flooding is a major concern in the watershed and can have severe impacts, as evidenced by the 2014 flooding on Rainy Lake, which was the second highest flood level on record after the 1950 flood. Considerable IWI funding has been invested over the years to better understand the hydraulics, model flows and water levels in this complex system of rivers and lakes.

Figure 8 shows the Fort Frances/International Falls dam. Some members of the public were under the impression that flooding of Rainy Lake was exacerbated by dam operations at the lake outflow, particularly because not all the gates were opened during the 2008 freshet. To address the flooding concerns, a conveyance study of the Rainy River (NRCC, 2010a) was completed using a two-dimensional hydro-dynamic model (Telemac). Figure 9 illustrates the Rainy River hydraulic model domain. The model identified three areas where the flow was being constricted in the upper Rainy River and showed that under certain flow conditions, the hydraulic performance of the system could not be improved through opening all the dam gates because of these upstream hydraulic controls.

A second phase of this work resulted in further refinements to the model and provided more engineering guidance to dam operators on the structure's hydraulic performance (NRCC, 2011a). An interactive animation module was developed

Figure 8: Fort Frances/International Falls Dam

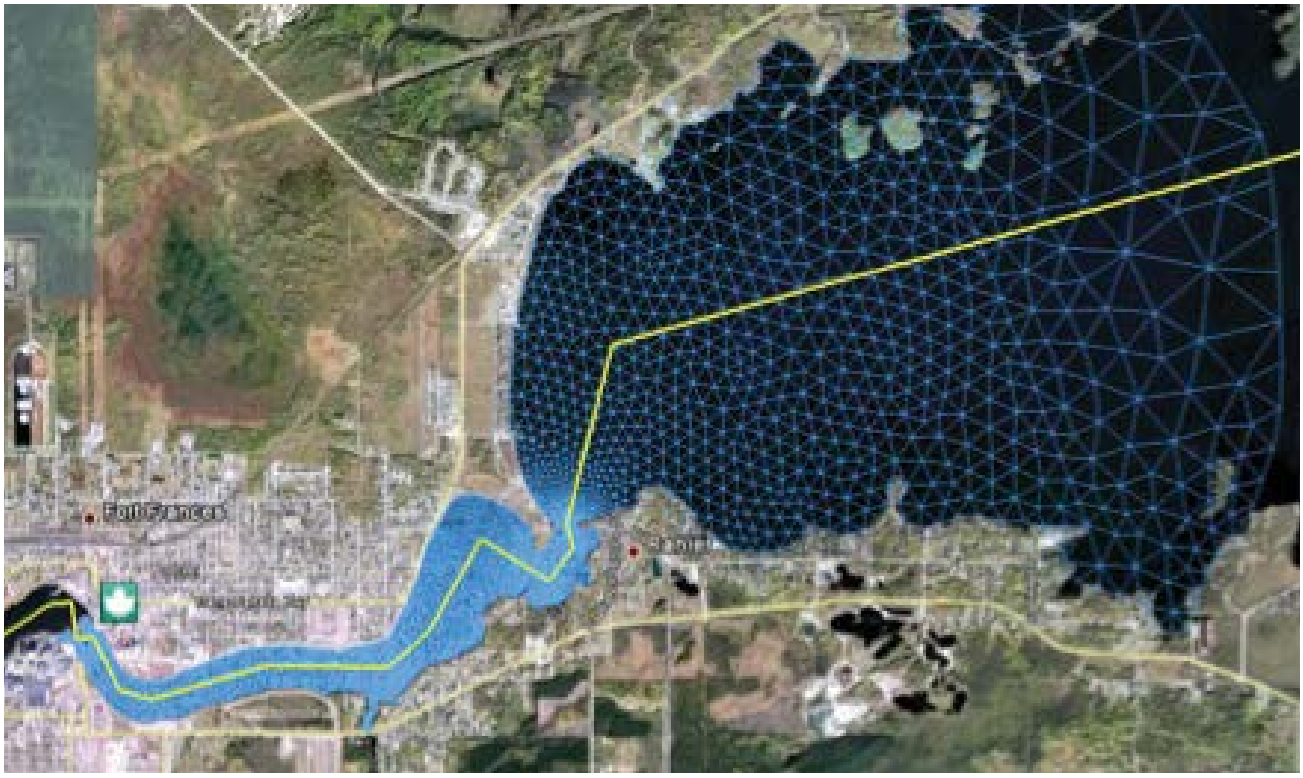

Figure 9: Upper Rainy River Hydraulic Model Domain

to help make this scientific explanation more understandable to non-technical audiences.

Other IWI-funded work focussed on surveying of four channel constrictions in the Namakan Reservoir System. Hydrographic and cross-sectional river velocity data were collected by the USGS and used in the development of an one-dimensional hydrodynamic model (HEC-RAS) to show the impact on flows and water levels due to these constrictions (Environment Canada, 2013). This work provided some useful insights. To optimize future modelling work, vertical digital elevation problems (*i.e.,* datum issues) in the basin were addressed through additional work undertaken in October 2014.

The IWI has been instrumental in providing the funding to collect critical field data in the studies described above and for the funding the installation of four new permanent hydrometric (water quantity) monitoring stations needed to supplement the current basin network.

Water quality is also a basin priority that has benefitted from IWI support in both funding and staff resources. Over the years, IWI funding has gone into supporting the annual International Lake of the Woods Water Quality Forum that brings experts together to discuss the basin's water quality issues. Early work supported by the IWI focussed on providing a preliminary assessment of potential water-related health issues in the Lake of the Woods and Rainy River (Oblak, 2009). More recently, the IWI focus has been on the development of a comprehensive water quality plan of study for the Rainy-Lake of the Woods basin to present to the Canadian and U.S. governments in 2015 (IJC, 2015). As noted in section 5, the IWI is funding development of a water quality (SPARROW) model

> "I view the establishment of the IWI as one of the best decisions governments and the IJC have made since the establishment of the Boundary Waters Treaty. The IWI promotes holistic management of transboundary water-related issues in entire watersheds instead of disparate portions of them. In particular, the International Rainy-Lake of the Woods Watershed Board has worked closely with the Seine River First Nation through IWI projects that enabled them to initiate studies that assess the adverse impacts of water level changes on their wild rice, walleye and lake sturgeon food supplies."
>
> *- Leland (Lee) Grim, former U.S. board member, IRLWWB.*

that will cover the Great Lakes basin and will include the Rainy-Lake of the Woods basin.

The impact of water level regulation on fisheries in the basin is another important priority. The IWI funded a five-year temperature, water level and fish monitoring project on the Rainy River at the dam. This study focussed on providing recommendations on flow regulation, in particular the peaking of flows, so as limit the impacts on fish spawning (Northern Bioscience Ecological Consulting, 2015). Another similar IWI-supported study was conducted on the Seine River that involved collaboration with the Seine River First Nation, the Shooniyaa WaBiitong of Fort Frances, Ontario Ministry of Natural Resources and Forestry, and support from the Canadian government's Aboriginal Funding for Species at Risk. The five-year project, which started in 2011, will determine if peaking and ponding affects sturgeon spawning, and how the timing of the spawn may be determined by temperature and other surrogate indigenous knowledge parameters.

Impacts of water level regulation on wild rice harvesting are of particular interest to First Nations, Métis and American Tribes (Figure 10). Figure 11 illustrates how wild rice is being impacted by cattail invasion. A pair of two-year projects was approved for IWI funding at the end of March 2014. The project *Effect of Water Management Regime on Wild Rice Production* will provide a better understanding of how water management practices affect the various stages of wild rice development. Another project, *Effect of Water Management Regime on Cattail Invasion into Wild Rice Stands*, will provide a better understanding of how cattail invasions affect wild rice stands and possibly fish spawning and its relationship to the entire ecosystem in general. Both projects will end in April 2016. The Seine River First Nation is involved in both projects.

Figure 10: U.S. Commissioner Rich Moy (left), Chief Jim Leonard (middle) and Canadian Chair Gordon Walker (right) Meeting (August, 2014) to Discuss First Nation Issues

Figure 11: Wild Rice (light green) Encroached by Invasive Cattails (dark green) in Rat River Bay

Building on the transboundary hydrographic data harmonization work, this basin is being used to pilot the application of StreamStats with IWI funding. The USGS-led StreamStats project will allow web users to select any point in the Rainy River system and obtain a flow estimate based on multiple regression analyses. Prior to this, users could get flow data only at locations where there was an existing hydrometric station.

In 2012, the Commission submitted its report to the Canadian and U.S. governments requesting that the existing boards be merged and designated as a watershed board (IJC, 2012b), and the governments concurred. In January 2013, the IRLWWB was established with the amalgamation of the International Rainy Lake Control Board and the International Rainy River Pollution Board, with water quality responsibilities in Lake of the Woods.

"As the recently appointed U.S. Chair to this new watershed board I see a lot of excitement and energy from all the members. The board is very dynamic and fully engaged in tackling the challenging water-related issues in the basin."

- Colonel Daniel Koprowski, U.S. Chair, IRLWWB.

C. INTERNATIONAL RED RIVER BOARD

The IRRB, a pilot watershed board for the past 15 years, recently asked the Commission to approach the governments in regard to being designated a watershed board. The board's primary focus has been on addressing a number of long-term, sensitive water issues in the basin. Funding from the IWI has been instrumental in shedding light on a number of binational issues in the Red River basin through the collection of critical data, development of credible models, and the application of sound science.

One notable example was a comprehensive three-year fish pathogens and parasites sampling program conducted from 2006-2008 in the Red River basin with a particular focus on Devils Lake in North Dakota. Concerns had been raised that direct discharging of water from Devils Lake could introduce new pathogens and parasites into the Red River system that could adversely affect downstream fish populations.

Devils Lake is a closed lake system and has only overflowed once in the last 2000 years. However, rising lake levels over the last 75 years have put it on a course to overflow and discharge into the Red River (Figure 12). The IJC, through its IRRB, took up the question as to what actions, if any, were needed to protect the Red River aquatic ecosystem based on the apparent inevitability of waters from both basins being mixed.

The analyses of the aquatic field surveys concluded that three bacteria, one parasite and several lesions were identified on fish from Devils Lake that had not been identified elsewhere in the basin. In 2011, the Commission assembled a group of experts from Canada and the U.S. to consider the implications and potential risk to the Red River ecosystem associated with these findings.

These experts determined that the fish parasites and pathogens in Devils Lake could be transferred from the lake through the gravel and rock filter currently in place by birds (often the intermediate or final parasite host) and by unintentional and intentional transfer by people (or their boats). They also noted that the parasites and bacteria found in Devils Lake were widely distributed throughout much of North America's waterways. They observed that these particular pathogens could adversely affect fish health, but only if fish health already were compromised due to other reasons. Based on these facts, the experts concluded that the risk to downstream fisheries was low from the

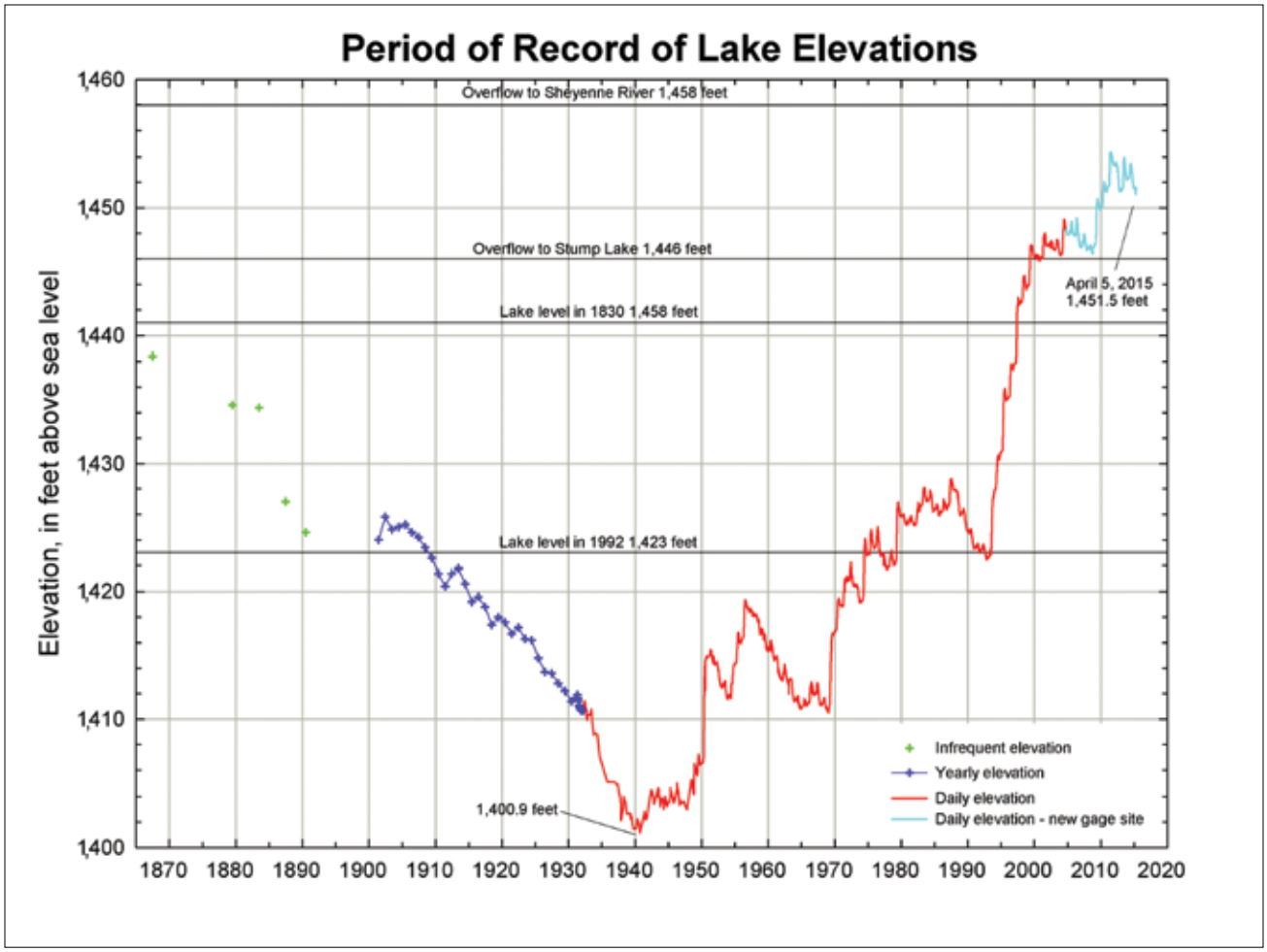

Figure 12: Devils Lake, North Dakota Annual Peak Lake Water Levels

parasites and pathogens found in Devils Lake, and the potential for causing disease was negligible. The fish experts provided a number of recommendations to reduce the risk of certain pathogens and invasive species entering the Red River basin (IJC, 2011).

Through the IWI, the Commission is helping local communities resolve issues by developing credible models to help them make informed decisions. For example, flooding in the Pembina River basin has been a long-standing concern. Modification of drainage patterns through human actions such as construction of the elevated Road Dike that runs along the Canada-U.S. border has complicated the issue (Figure 13).

Understanding and modelling flows in prairie streams that have a very low slope is extremely challenging. Considerable efforts and IWI funding were used to develop and calibrate a two-dimensional hydrodynamic model for the system (NRCC, 2010b; 2011b; 2012a). The model and its results were shared with all the jurisdictions. Several public meetings also were held and further feedback was provided on the model's flooding predictions. There was considerable support for the model and the credibility of the model projections.

The IRRB established the Lower Pembina River Flooding Task Team in 2008, when this work was initiated, to exercise oversight over the modelling effort. In 2012, the task team

report, *An Exploratory Analysis of Mitigation Measures for the Lower Pembina River Basin*, was provided to the Commission based on the model results (IJC, 2012c).

The IJC transmitted this report to the Canadian and U.S. governments in December 2012 and encouraged them to establish a task team comprising the decision makers and to work towards finding a binational solution that would help manage the long-standing flooding issue in the Pembina basin. Based on this recommendation, the Governor of North Dakota and the Premier of Manitoba established the Pembina River Task Team to work on narrowing the options for an agreed-upon binational solution. The team consists of five members each from North Dakota and Manitoba, as well as the co-chairs of the IRBB.

Nutrient loading is a significant water quality issue in the Red River basin. To address this binational issue, the IRRB has formulated a basin-wide nutrient management strategy as described in its recent progress report to the Commission (IJC, 2014b). Much has been accomplished with IWI funding support. After a comprehensive assessment of different approaches to determining recommended nutrient targets (RESPEC Consulting and Services, 2013) the IRRB selected the stress-or-response modelling approach. IWI funding has been recently allocated to the development of the Red River stressor-response model and the compilation of the essential data required for input into the model.

The SPARROW model, discussed in section 5, will provide the IRRB with the information

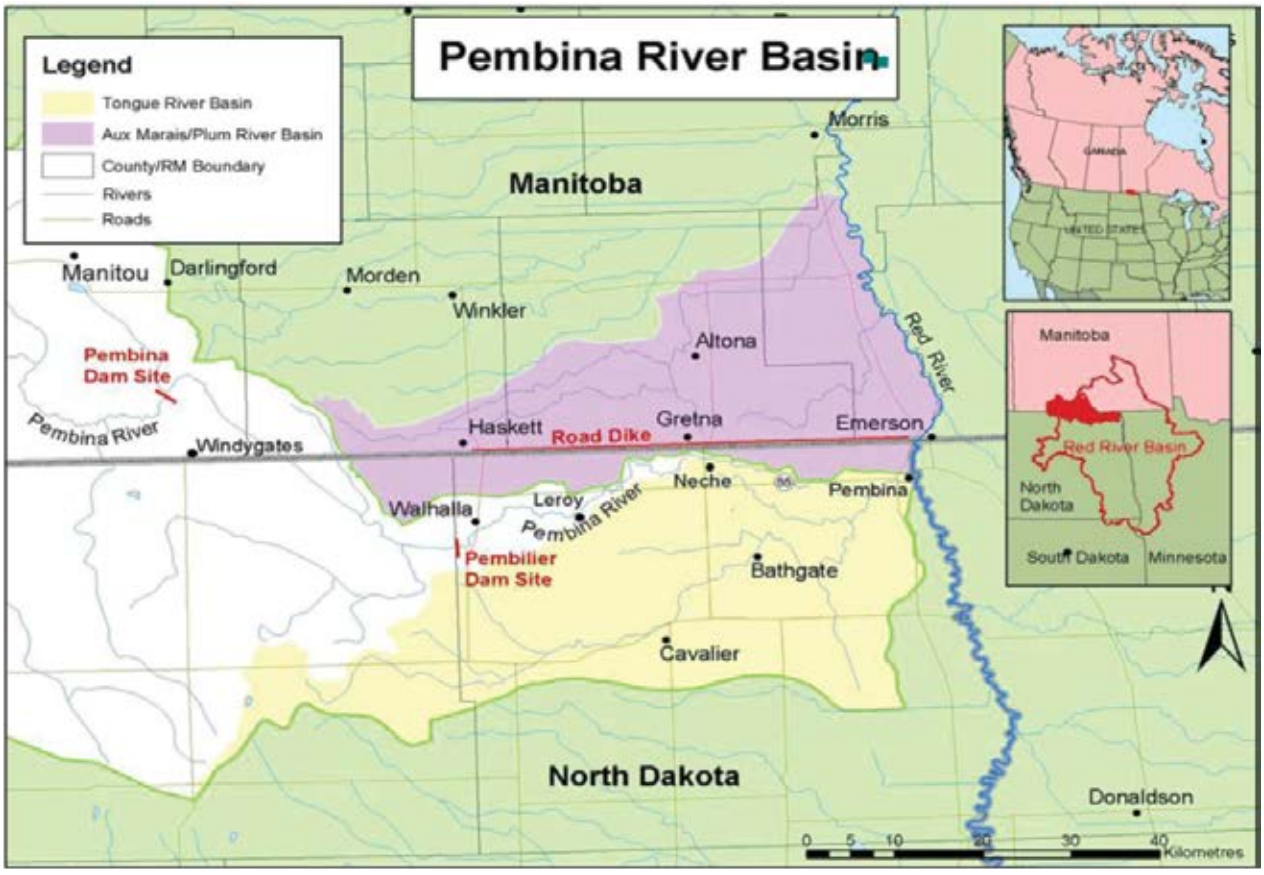

Figure 13: Road Dike along the International Boundary

"Flooding in the lower Pembina River basin has been a long-standing issue for governments and citizens of Manitoba and North Dakota. The IWI funding support for the two-dimensional modelling of the lower Pembina River provides both governments with the scientific understanding to move forward on resolving the impacts from both natural and infrastructure-induced flooding."

- Steve Topping, Canadian board member and Randy Gjestvang, U.S. board member, IRRB.

and knowledge it needs about phosphorus and nitrogen loading throughout the basin and assist the board in understanding point- and non-point source contributions of these nutrients and the delivery mechanisms. This knowledge will form the basis of advice that the IJC can provide to the federal, state and provincial governments for better protection of the transboundary waters.

Through the IWI, the IRRB has been able to explore and evaluate emerging water issues such as potential water apportionment of the Red River flow. Reports have been prepared on water governance options (de Loë, 2009), methods for determining natural flow in the basin (R. Halliday & Associates, 2010), and assessing instream flow requirements for aquatic life (Laughing Water Arts & Science Inc., 2011). This work is contributing to a better

"The assistance we have received from IWI, both financial and technical, has been instrumental in allowing us to move forward with our nutrient management strategy. The stressor-response model we are developing with IWI's assistance is a critical element for the strategy; without it we would not be able to obtain the level of detail needed to develop adequate targets for nutrient reduction."

- Jim Ziegler, U.S. board member, IRRB.

> "The IWI-funded SPARROW model for the international Red River basin provides critical information on nutrient export and is an important component of the International Red River Board's work to develop a nutrient management strategy. The nutrient management strategy includes development of nutrient targets for the Red River that will help to improve water quality in the watershed and downstream in Lake Winnipeg."
>
> *- Nicole Armstrong, Canadian board member, IRRB.*

understanding of the implications of potential water apportionment in the Red River basin.

Other IWI projects include an assessment (R. Halliday & Associates, 2009) of what has been accomplished with respect to reducing the impacts of flooding in the Red River basin and follow up to the IJC's report, *Living with the Red* (IJC, 2000b). An interactive map gallery for the Red River basin was produced to assist with the IRRB's outreach efforts.

D. INTERNATIONAL SOURIS RIVER BOARD

The International Souris River Board (ISRB), a pilot watershed board, has recently focussed on documenting the historic 2011 flood and assessing whether modifications are needed to improve the existing operation plan under the *1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin*.

The 2011 flood event was more than twice as large as the previous record flood, which occurred in 1976 (Table 3). The 2011 spring peak at Sherwood would have been in the order of 600 m^3/s (21,200 ft^3/s); however, the flow was reduced to 100 m^3/s (3,530 ft^3/s) by flood control storage in the Canadian reservoirs. In2011 a high flow of 800 m^3/s (28,500 ft^3/s) persisted into the summer, which was approximately16 times larger than the maximum summer peak experienced in recorded history.

Table 3: Souris River near Sherwood (at the International Border), Highest Ten Recorded Peak Mean Daily Flows

Year	Peak Flow (ft^3/s)	Peak Flow (m^3/s)
2011	28,500	800
1976	13,800	390
1979	8,470	240
1948	7,380	210
1975	6,740	190
1974	6,280	180
1943	5,330	150
1955	5,010	140
1982	3,850	110
1956	3,530	100

IWI funding was used to determine the scope of work required to undertake a comprehensive review of the current operation plan based on the 2011 flood. In 2012, the binational Souris River Basin Task Force was formed to develop the plan of study. Its report, *Plan of Study: For the Review of the Operating Plan Contained in Annex A of the 1989 International Agreement between the Government of Canada and the Government of the United States of America* was completed and submitted to the Commission in 2013 (IJC, 2013b).

"The International Watersheds Initiative funding was pivotal for the International Souris River Board to be able to develop a comprehensive plan of study for reviewing the existing operation plan, based on knowledge gained from the historic 2011 flood. This work has been well received by the public and all the water agencies in the basin."

– Todd Sando, U.S. Chair, ISRB.

The report was forwarded to Canadian and U.S. governments in 2013 with the recommendation that they support the proposed optimal option. This option was based on a three-year time frame, at a cost of $2.1M and dealt with the flooding impacts in the most comprehensive manner. Discussions on this proposal are ongoing with the two governments.

The ISRB has also accessed additional IWI funds to evaluate the water quality sampling network in the basin as it relates to addressing the board's water quality mandate. It is also using the Red-Assiniboine SPARROW modelling results for its portion of the basin in discussions regarding nutrient loading.

"The International Watersheds Initiative, through its support for the implementation of the SPARROW model as well as the data harmonization project, has laid a solid science foundation for the International Souris River Board. This foundation is essential for the board to address emerging water availability and water quality concerns in the Souris basin."

- Russell Boals, Canadian Chair, ISRB.

E. APPLICATION OF IWI PRINCIPLES IN OTHER TRANSBOUNDARY BASINS

Richelieu River-Lake Champlain

In April 2011, a combination of record spring precipitation and the third highest cumulative annual snowfall on record resulted in major flooding in the Richelieu River basin in Canada and Lake Champlain in the United States. A new record water level for the lake was set in a region that has been plagued by major flood events over the last hundred years. In the spring flood of 2011, the flood stage was exceeded on April 13 and persisted until June 19, a total of 67 days. Nearly 4,000 homes were damaged in both countries, resulting in tens of millions of dollars in damage. About 80% of the total damages occurred in Canada.

In response to the devastating flood, the governments of Canada and the U. S. requested that the IJC review the issue and make recommendations regarding a comprehensive study of measures to mitigate flooding and its impacts on Lake Champlain and the Richelieu River basin. The Commission established the International Lake Champlain-Richelieu River Work Group in May 2012 to address this reference.

The work group undertook its evaluation in part with IWI funding support. Its report, *Plan of Study for the Identification of Measures to Mitigate Flooding and the Impacts of Flooding of Lake Champlain and Richelieu River* was completed in 2013 (IJC, 2013c). The Commission forwarded the report to governments with recommendations on funding of $14M over five years, establishing a study board, restricting further development in the flood plain and strengthening coordination mechanisms for flood preparedness and flood forecasting.

The governments of Canada and the U.S. responded in 2014 with a limited study request asking the Commission to collect and harmonize data on the topography, bathymetry, aquatic vegetation, soil texture and other features for the watershed. In addition, the governments requested that the IJC create static flood-inundation maps showing the areas, where data are available, that would be affected at different water levels on Lake Champlain and the Richelieu River. To carry out these specific tasks, the Commission established the International Lake Champlain-Richelieu River Technical Working Group in the fall of 2014.

Great Lakes-St. Lawrence Basin

IWI funding has helped move the concept of adaptive management forward and supported some of the important related work in the Great Lakes-St Lawrence River basin. This work is beneficial to all three boards of control in this basin: Lake Superior; Niagara; and St. Lawrence.

One of the key recommendations of the International Upper Great Lakes Study (IJC, 2012d) was for the Commission to develop and implement an adaptive management strategy to better manage and regulate water levels in the Great Lakes-St. Lawrence system. The IJC followed up on this recommendation by establishing the International Great Lakes-St. Lawrence River Task Force. In May 2013, the task team submitted its report, *Building Collaboration across the Great Lakes - St. Lawrence River System: An Adaptive Management Plan* (IJC, 2013a). The report was forwarded to the governments with the Commission's recommendation that the proposed adaptive management plan be implemented.

In 2014, funding was provided through the IWI to undertake a number of key binational projects that will greatly improve understanding of the

Figure 14. Meeting (July 2014) of the Commission with the St. Mary-Milk Accredited Officers and Agency Staff to Discuss Water Issues in the Basin

basin's hydrology and its impacts on water levels. This work will also underpin the Commission's adaptive management approach to water regulation. The work includes a binational comparison of runoff into Lake Ontario, and development of a state-space model for Lake Ontario water balance calculations.

Other projects are focussing on the impacts of water regulation, including a survey of shoreline

"IWI funding has allowed us to develop a new natural flow model for the Milk River which has improved the timeliness and precision of the apportionment of the water in the Milk River watershed. In addition, IWI funding has allowed us to properly archive the important apportionment data developed by the Accredited Officers over the past 90 years and make these data more available to stakeholders."

- Max Ethridge, U.S. Accredited Officer and Al Pietroniro, Canadian Accredited Officer.

protection structures in the St. Lawrence-Lake Ontario corridor, and establishment of compensating works movement limits to prevent fish stranding in the St. Marys rapids.

In an effort to make water regulation concepts more understandable to the public, funding from the IWI was used to develop a series of animations. This product can be accessed on the IJC's International St. Lawrence Board of Control webpage (http://ijc.org/en_/islrbc). Based on public feedback, these animations are useful and other boards are looking at this approach to improve their outreach efforts.

St. Mary-Milk Basin

Under the 1921 IJC order of approval, the Commission administers apportionment of flows in the St. Mary and Milk Rivers, which are in a semi-arid region along the Alberta-Montana border where water availability is limited. In accordance with the order, the two countries share and verify each other's records to ensure the annual allocation of water is delivered as per the terms and conditions of the order (Figure 14). The Commission has been working closely with the Accredited Officers of the St. Mary-Milk Rivers in modernizing the apportionment process to account for changes in water monitoring technologies and techniques. IWI funds were essential for updating the approach for computing natural flow and apportionment.

Funding has now been allocated to implement the St. Mary-Milk Rivers natural flow data warehouse, which will greatly improve the efficiency and effectiveness of apportioning the waters. There are plans to allocate additional funding to undertake a comprehensive consumptive uses study for the Milk River basin. The last such study was completed in 1986. Since then, the amount of irrigated land has increased significantly through the use of modern irrigation practices, and there has been considerable land development.

Osoyoos and Okanagan Basins

In January 2013, a new supplementary order of approval came into effect for Osoyoos Lake. It is administered by the IJC's International Osoyoos Lake Board of Control (IOLBC). The new order was based on the knowledge gained from studies completed over a five-year period. The 2011 Osoyoos Lake Science Forum, which received IWI funding, as well as subsequent IJC public hearings in the communities of Osoyoos, BC, and Oroville, WA, set forth numerous recommendations directly related to regulating Osoyoos Lake outflows and revising the order (Alexander and Garcia, 2011). The Forum and public hearings generated a useful dialogue and list of actions that could be taken to help avoid future conflicts. All recommendations were given consideration and some resulted in changes to the revised order.

A recurring theme from the Forum and public meetings is that the IOLBC's limited mandate leaves a number of important aspects of the health of Osoyoos Lake unresolved. There also was support to expand the board to include First Nation, American Tribal and local representation or to devise more formal links to external committees and advisory bodies in the basin. The Commission is giving these findings serious consideration.

The Commission is focussing on improving the public's level of understanding of the role of the IJC and water management in the Okanagan (Okanogan) basin and increasing the level of local involvement in the work of the IOLBC. The IWI is funding a short video that will highlight the water issues and water regulation challenges in this important transboundary basin.

6. IWI ACCOMPLISHMENTS

7. CHALLENGES AND OPPORTUNITIES

7. CHALLENGES AND OPPORTUNITIES

Since the governments' approval of IWI in 1998, the initiative has realized many successes but has also faced important challenges. The challenges fall under four broad headings: IWI scope and mandate; outreach and communications; watershed board structure and membership; and, IWI administration.

IWI Scope and Mandate

The IWI changed the way transboundary work on water is conducted in key watersheds by applying an integrated ecosystem approach that engaged a wide array of interests with a particular focus on local expertise. Securing acceptance and participation by some provinces, states and stakeholders in IWI efforts has taken time. The IJC has been working deliberately with and listening to concerns of these jurisdictions and stakeholders on both sides of the border as requested by the Canadian and U.S. governments. Over time, the Commission has been able to demonstrate that watershed boards serve to supplement and support, rather than supplant, the authorities and perspectives of all relevant governmental jurisdictions, and that IJC is committed to the inclusion of all stakeholders in the IWI process.

The Commission has concentrated its efforts on transboundary basins where it has an existing water quantity and quality reporting mandate. Amalgamating its pollution and control boards into a single watershed board is a natural evolution of their roles. Jurisdictions and stakeholders in four transboundary basins have embraced the development of a watershed board. The St. Croix and the Rainy-Lake of the Woods watershed boards are leading this evolution, with the Red and Souris River Boards focussing on applying the IWI principles.

A related challenge is educating stakeholders and the public that the Commission's mandate is limited to reporting on water quantity and quality at the boundary. But the watershed approach allows the Commission to look at issues in a holistic manner, while adhering to the Commission's specific responsibilities under the *Boundary Waters Treaty*.

Outreach and Communications

Communications and outreach have been an integral part of IWI since its inception. As noted in this report, the Commission and its boards have developed a number of short animations to help the public better understand a number of complex issues. Communication products, such as an IWI brochure (Figure 15), have proven to be effective in reaching the broader public (IJC, 2013d). Considerable effort has gone into upgrading the Commission's website and making IWI information and GIS-based maps and products more accessible to the public.

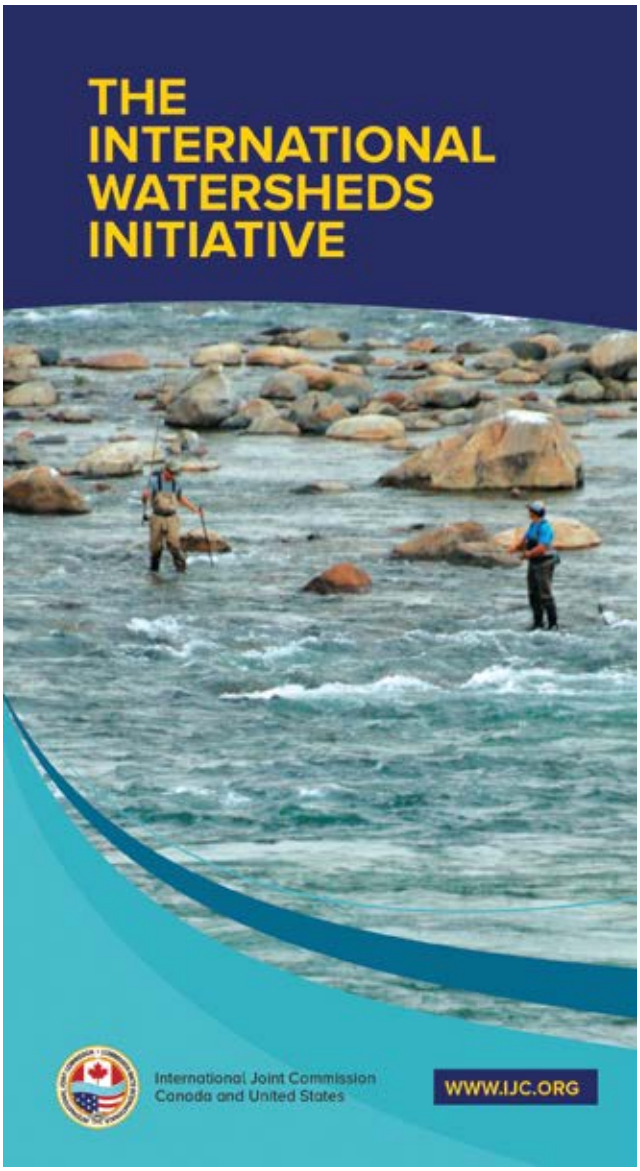

Figure 15: International Watersheds Initiative Brochure Cover

The Commission has been working closely with its boards to reach the general public through webinars, newsletters, broader media exposure, science forums and more effectively organized public meetings.

The Commission also will work more closely with the boards to ensure the effective communication of the accomplishments and value of the IWI. More effort will be put into exploring and using current technologies to reach out and engage the wide range of interests in the basin.

IJC boards in other transboundary basins are also engaged, as much of the work of the IWI is of interest and could benefit their operations that are currently limited to water regulation. Knowledge transfer and lessons learned are important components of the IWI. The Commission will employ effective mechanisms, such as webinars, to promote knowledge transfer to all the boards.

The Commission takes advantage of opportunities to discuss the IWI and the watershed board model with jurisdictions and stakeholders in these other transboundary basins. The Commission believes that this ongoing dialogue may lead to further support for the IWI in these transboundary basins over time. Designation of additional watershed boards, of course, will ultimately be a decision undertaken by the two federal governments.

Watershed Board Structure and Membership

Each transboundary basin is unique and comprises a range of jurisdictions and stakeholders. The Commission has learned that each watershed board needs to be tailored to

the dynamics and interests in that particular basin. The Commission's goal of ensuring inclusiveness and diversity on these watershed boards also can present challenges.

Public involvement varies from watershed board to board and can comprise two or more members on the board to larger participation through a Citizens or Industry Advisory Group. The Commission has the challenge of selecting a limited number of representatives from the larger public to provide constructive input on a broad range of issues.

First Nations, Métis and American Tribes have requested greater involvement on Commission boards. The governments have requested the Commission ensure that they be represented on the watershed boards. The presence of numerous and distinct bands and tribes in each transboundary basin creates a challenge for the Commission to select appropriate representation. Dialogue and trust-building have been important components of the Commission's strategy for successful aboriginal engagement.

The St. Croix and the Rainy-Lake of the Woods watershed boards have been enriched through the involvement of these groups and the sharing of their traditional knowledge.

IWI Administration

Differing fiscal years and financial regulations for the two countries can make it challenging at times to undertake truly collaborative work on a transboundary issue. As described in this report, however, the Commission has succeeded in fostering increased collaboration in spite of this administrative issue.

The boards are well engaged in IWI and the project evaluation process. Efforts are underway to ensure a timelier turnaround with regard to board input at various steps of the project. The Commission is working with the boards to further improve the project management system.

8. FUTURE STRATEGIC PRIORITIES FOR THE IWI

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Previous strategic priorities (*i.e.,* data harmonization and water quality modelling) have focussed on the development of tools and techniques the boards needed to address transboundary issues. The Commission is now considering a new set of priorities that will increase board and public understanding of changes to ecosystems due to natural or anthropogenic influences. This improved understanding will, in turn, strengthen the Commission's ability to advise governments on priority issues in the international watersheds.

After a series of meetings on the development of a new set of strategic priorities and based on the feedback received from the IJC boards, the following three overarching issues have been identified as new strategic priorities for the IWI:

1. Impacts on water quantity and quality in transboundary basins from climate change.
2. Impacts on water quality in transboundary basins from nutrient loading and eutrophication/harmful algae blooms.
3. Impacts on the quality of transboundary waters from heavy metal and associated contaminants.

For each of these broad issues, the IJC is considering activities it can undertake that are consistent with its mandate.

First, strengthening understanding of the impacts of climate change on water resources is critical for good water stewardship in these transboundary basins. Water policies and infrastructure are put in place that have timelines reaching out 30 to 50 years or more, so climate change must be factored into these long-term decisions. The Commission has been incorporating the most current climate science and climate scenarios from advanced regional climate models into its recent water regulation plan reviews (*e.g.,* Osoyoos Lake, Lake Superior, Lake Ontario-St Lawrence River) to ensure the robustness of the revised plans to address a changing climate. The Commission will continue this practice as it proceeds to update the orders of approval for all the remaining water control structures (*i.e.,* dams) under its jurisdiction.

In addition, the Commission will collaborate with key federal agencies and research institutions in the application of advanced regional climate models to transboundary basins to support its boards in understanding climate change impacts on key issues such as water apportionment, nutrient loading and aquatic ecosystem health.

Second, the IJC's binational modelling of nutrient loading has been well received in transboundary basins where it is being applied. This modelling provides a consistent assessment of nutrient loading to boundary waters in each basin. The considerable knowledge gained through this work will be useful in other transboundary basins.

Through this innovative work, the IJC plans to complete a broader assessment of this important binational issue and highlight creative approaches and best practices that are being undertaken by various jurisdictions to address the nutrient issue.

Finally, the Commission recognizes that degradation of the water quality in transboundary basins is an important issue that has received only limited attention to date. The IJC has received numerous water quality references

from the governments over the past 50 years. Some of these have resulted in specific international water quality objectives being established and monitored at the international border in some of the transboundary basins. As a first step, the Commission plans to review all these water quality references and assess the relevancy and adequacy of the existing water quality objectives. Many of the water quality objectives were established in the 1960s and 1970s. Science and technology have made considerable advances since that period. The Commission will report back to governments on adequacy of these international water quality objectives and put forth recommendations.

8. FUTURE STRATEGIC PRIORITIES FOR THE IWI

9. MOVING FORWARD

9. MOVING FORWARD

Consistent with its mandate, the IJC will be planning and implementing actions to address these new strategic priorities as part of current and future IWI program activities. To assist transboundary water stewardship and support the interests of the governments, the Commission will conduct the following actions:

1. Continue to consult with boards and governments to further refine the strategic priorities.
2. Communicate these actions to all the boards.
3. Convene workshops and webinars to improve board understanding of priorities.
4. Develop an implementation plan and work with boards to increase their IWI project activities that align with the three new strategic priorities.

Furthermore, to address the challenges and opportunities identified in this report, the Commission has identified a number of specific actions for outreach and communication, and for improving IWI program efficiency and effectiveness.

Outreach and Communications

In working to improve IWI outreach and communications, the IJC will:

- Pursue greater local public involvement through more diverse board membership, Community Advisory Groups and enhanced public engagement efforts;
- Involve First Nations, Métis and American Tribes to ensure that their perspectives are included in shaping the path forward;
- Reach out to provincial, state, local communities and basin organizations to promote and inform them of the importance of the IWI;
- Develop general outreach products to increase the visibility and promote the relevance of the IWI;
- Work with the boards to improve communications, outreach and availability of IWI information on their websites;
- Provide updates on IWI activities in the IJC's annual activity report; and,
- Convene workshops and webinars to improve the boards' understanding and awareness of key environmental issues and advancements in science and technology.

Program Efficiency and Effectiveness

In working to strengthen IWI program efficiency and effectiveness, the IJC will:

- Work closely with governments in the development of IWI concepts and the designation of watershed boards;
- Provide watershed boards with renewed directives on a more regular basis;
- Work with the boards to develop scientific guidelines, such as the *International Joint Commission Model Selection and Implementation Guidelines* (NRCC, 2012b), to improve the quality of the Commission's scientific efforts;
- Implement improvements to the IWI project management system and assign dedicated personnel support;
- Promote collaboration among its transboundary boards and its advisory boards, such as the Health Professionals Advisory Board, to address pertinent human health issues identified by a transboundary board; and,
- Pursue opportunities to leverage additional local resources to help deliver on the IWI mandate, reduce duplication of effort and ensure prudent expenditure of IWI funds.

10. CONCLUSION

10. CONCLUSION

Over the past decade, the IWI has matured and is recognized today as an essential approach for the Commission and governments to effectively address transboundary issues.

In the third IWI report to governments in 2009, the Commission's three recommendations to governments focussed on funding support, designations of international watershed boards and federal participation on boards. All three issues have been, and continue to be, addressed:

- The Commission is pleased that the Canadian and U.S. governments have provided ongoing annual funding for the IWI. The support of the governments during this period has enabled the Commission to undertake the breadth and depth of IWI collaborative work highlighted in this report.
- Important progress has been made on the designation of international watershed boards. The IRLWWB was officially designated as the second international watershed board and other boards are embracing the IWI principles.
- The need for active federal participation on the boards also has been addressed. Vacancies on the boards have been filled with high calibre, dynamic and dedicated individuals and there has been considerable collaboration with federal agencies on both sides of the border.

As outlined in this report, the support of the governments for the IWI has been instrumental in addressing a number of binational water-related challenges. The work of the IWI is providing a scientific foundation for addressing current and emerging environmental issues and establishing a more inclusive board structure for these important basins. The two countries and several of their jurisdictions have greatly benefited from this investment and IWI successes, particularly the data harmonization work and binational water quality modelling.

The IJC has provided valuable advice to the governments of Canada and the U.S. for more than a century. During this period, water resources management has evolved in response to population shifts, industry and agriculture developments, public health concerns, climate change, progress in science and technology, invasive species and other factors. Through concerted actions, the IJC and the governments have been able to adjust to an evolving environment in their efforts to anticipate, avoid and resolve transboundary water conflicts.

The IWI's ecosystem-based, locally-focussed, basin-wide collaborative approach has gained attention and has been adopted to varying degrees by agencies and jurisdictions on both sides of the border in other transboundary basins. Through the IWI, a dialogue has been initiated, trust built, data shared and collaborations developed along the extent of the Canada-U.S. border. These efforts have contributed to the health and sustainability of the transboundary waters and hold promise for binational water stewardship in the future.

In a very tangible sense, the IWI has moved from a promising concept to a cornerstone of how the IJC carries out its mandate for the governments.

The Commission will be addressing the list of actions identified in this report and will continue to work closely with governments, boards, and all transboundary basin interests in implementing IWI principles in these shared basins. The Commission looks forward to reporting back to governments on IWI's achievements in 2020.

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