

**INTERNATIONAL RAINY LAKE BOARD OF CONTROL**  
**INTERNATIONAL RAINY RIVER WATER POLLUTION BOARD**

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**SPRING 2011 REPORT**

**Submitted to**

**The International Joint Commission**

**March 18, 2011**

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## BOARD MEMBERS AND STAFF

	<b>Canada</b>	<b>USA</b>
<b>IRLBC Members</b>	Gail Faveri, P. Eng Glenn Witherspoon	Michael Price COL Leland Grim
<b>IRRWPB Members</b>	Melanie Neilson Gregory Chapman Kelli Saunders (Alternate)	Jeffrey Stoner PG Nolan Baratono
<b>IRLBC Engineering Advisors</b>	Rick Cousins P. Eng	Edward Eaton PE
<b>Joint Board Secretary</b>	Tana McDaniel	

## **1 INTRODUCTION**

The International Rainy Lake Board of Control (IRLBC) and the International Rainy River Water Pollution Board (IRRWPB) report jointly to the International Joint Commission (IJC) in the spring and fall of each year. Both reports address activities and basin issues of interest occurring since the previous report and may include sections on specific topics under review by the Boards. In addition, the spring reports address regulation of Rainy and Namakan lakes over the past calendar year, while the fall reports address environmental quality and related issues.

Section 2 of this report addresses the regulation of Rainy and Namakan lakes during 2010. Section 3 of this report addresses other activities of the Boards and items of interest in the basin.

## **2 LAKE LEVEL REGULATION**

### **2.1 Overview**

The year overall for the basin was relatively dry with average annual inflow to both lakes at only about 20<sup>th</sup> percentile. It is worth noting that the Lac la Croix basin upstream had an average inflow for the year of only 8<sup>th</sup> percentile. Precipitation for the year was 23<sup>rd</sup> percentile in the Lac la Croix basin while it was 70<sup>th</sup> percentile in the Rainy-Namakan basin. Although dry conditions predominated during the year, inflow was certainly not uniform throughout, leading to regulation challenges during very dry conditions in the spring and heavy rainfall events in July and September. During 2010, Namakan Lake was below its rule curve band for 47 days and above it for nine days. Rainy Lake was below the rule curve band for 59 days but did not exceed the upper rule curve, although levels near the top of the band were experienced in mid-July and again in late September. The 2010 quarter-monthly precipitation for the Lac la Croix and Rainy-Namakan sub-basins is shown in Figure 2. Water levels, net inflows and outflows are shown on Figure 3 for Namakan Lake and Figure 4 for Rainy Lake. Figure 5 provides a legend for these figures.

Winter 2010 regulation proceeded normally from the first of the year through the middle of March, with both Namakan and Rainy Lake levels staying in the middle portion of the IJC rule curve band. Very mild weather led to an unusually early onset to the spring freshet. In mid-March, inflow to Namakan Lake rose to maximum of record for the time of year and inflow to Rainy Lake rose above 95 %ile, although inflows were still relatively low in absolute terms. The Companies responded with outflow increases to control the early rise in levels within the band. By the end of March, inflows were declining, indicating that the snowmelt freshet was over for the year, and outflow reductions were made for both lakes.

Regulation during the second quarter of 2010 was dominated by dry conditions throughout the basin. Following the early spring runoff in March, inflows across the basin declined in April and remained low through the end of June. Although rain fell on about 26 days in June in the Rainy-Namakan basin, sufficient rainfall was not received over a large enough area to significantly improve the low inflow conditions.

Namakan Lake inflow dropped from the highs in March to lower decile by mid-April and the rise in lake level was less than the slope of the lower rule curve, despite outflow reductions by the Companies. By mid-April, outflow was at, or very near, the specified IJC minimum, where it remained through the end of June. Namakan Lake levels fell below the IJC lower rule curve on May 17 and, although rising

steadily, remained below the lower rule curve into early July. The maximum deviation below the lower rule curve was 46 cm (18 in) on June 7.

With very little freshet and declining inflow, Rainy Lake outflow was reduced to the IJC minimum in early April. Even with the outflow reductions, there was very little recovery in lake level and Rainy Lake fell below its IJC lower rule curve on May 10. Inflow remained between lower decile and lower quartile through May and June, allowing some lake level increase, although not enough to see the lake rise into the rule curve band. In the latter half of June, inflow declined again and the lake level began a slow drop. The maximum deviation below the lower rule curve was 25 cm (10 in) on June 3.

The condition of Namakan and Rainy Lakes changed dramatically in July. Rainfall for the month in the Rainy-Namakan basin was the fourth highest in 106 years of record, with much of it coming in the first week of the month. Kettle Falls received 190 mm (almost 8 inches) in the first five days of July.

Namakan Lake rose back into the rule curve band on July 3. Due to the dramatic increase in inflow, the lake rose above its upper rule curve on July 6. Outflow was increased from 49 m<sup>3</sup>/s on July 5 to 310 m<sup>3</sup>/s by July 10. With these outflow increases, the lake was back within its rule curve band on July 15 but heavy rainfall at the end of the third week of July necessitated a doubling of outflow to control the lake level and keep it within the IJC rule curve band.

Rainy Lake levels also rose quickly after the early July rainfall and were back within the rule curve band on July 8. Rainy Lake outflow was increased from the IJC minimum of 100 m<sup>3</sup>/s at the beginning of July to almost 600 m<sup>3</sup>/s before month-end. Lake levels rose to 84% of band late in July before beginning a gradual decline. Inflows rose sharply again in late September, but outflow increases prevented the lake from exceeding the upper rule curve.

Namakan and Rainy Lakes began the last quarter of 2010 high in their respective rule curve bands due to heavy rainfall the last week of September. Outflow increases from both lakes prevented them from exceeding their upper rule curves, and set the trend for generally declining levels through the fall. Average inflows for the fourth quarter for both lakes were somewhat below normal. Namakan and Rainy Lakes ended the year at 84% of band and 29% of band, respectively.

## **2.2 Regulation Concerns and Response**

In April and May, the Boards received several calls regarding the dry conditions in the basin. On April 1 a letter was received from the Kabetogama Lake Association, expressing concerns over low spring lake levels on Kabetogama Lake and possible negative impacts to the local economy with regard to hosting the 2010 Minnesota Governor's Fishing Opener event. The Boards responded on April 8, noting that they and the operators of the dams at Kettle Falls were also concerned about the dry conditions. However, the Boards noted that the 2000 rule curves provide a balance between the risks of both drought and flooding and lake level regulation would follow the rules laid out in the 2000 Order, while being influenced by an awareness that precipitation in the basin over the winter and so far during the year were below normal.

On April 30, Lee Grim, US local member of the IRLBC, visited with residents, resort and houseboats operators of Lake Kabetogama and representatives of the Kabetogama Lake Association who were concerned about the dry conditions and the impact that might have on the Governor's Fishing Opener scheduled for May 13-14. With the steady rise in lake level, reports following the event indicated that lake levels had risen sufficiently to allow for favorable conditions and the event was a successful one.

### **3 BASIN ISSUES AND OTHER BUSINESS**

#### **3.1 Environmental Monitoring for Future Rule Curve Evaluation**

Recent Board reports to the Commission have provided some details of environmental research and monitoring projects being conducted by Voyageurs National Park, including a project that uses five “best bet” ecological indicators (benthic macro-invertebrates, wetland vegetation, fish, common loon and furbearers) to determine effects of implementation of the 2000 Rule Curves. As reported in the Boards' last three reports to the Commission, final reports have been generated and submitted to the Boards for two of the five “best bet” indicators, benthic macro-invertebrates and wetland vegetation. Currently, the peer review process for the fish indicator project is complete and a final report has been accepted, subject to minor revision. The common loon indicator project report is in its final stages and expected to be submitted for publication in a scientific journal, but a submission date has not been established. The furbearer indicator project is in development with no clear timeline.

#### **3.2 IJC International Watersheds Initiative Projects**

The International Watersheds Initiative (IWI) promotes an integrated, ecosystem approach to issues arising in transboundary waters through enhanced local participation and strengthened local capacity. Since the Rainy basin was identified by the IJC as a potential IWI watershed, the Boards have been involved in a number of IWI-related activities. The public can read more about the IWI at:

[http://www.ijc.org/en/activities/bassins\\_watersheds.htm](http://www.ijc.org/en/activities/bassins_watersheds.htm)

##### ***Upper Rainy River Modeling***

In October, the IJC received the final report of a study entitled “Rainy River 2D Hydrodynamic Model Conveyance Study” by the Canadian Hydraulics Centre (CHC). Following IJC approval, it was posted on the IRLBC website. As reported to the Commission at its fall 2010 semi-annual meetings, the CHC had been contracted to develop a computer model to simulate the complex hydraulic conditions of flows in the Upper Rainy River from Rainy Lake to the dam at International Falls/Fort Frances. The two-dimensional model developed simulates the flows under current bathymetry as well as under a state of nature (i.e., before the construction of the bridge and the dam works) based on survey drawings from over a hundred years ago. The model provides information on the hydraulic characteristics of the upper Rainy River, as well as the impact of dam operations on the river.

A follow-up study is underway to use the model to investigate the impact of turbine performance on outflows, to investigate various gate scenarios and graphically animate the water levels, to simulate the 1950 flood and to determine the sensitivity of the water levels to the bathymetry at the Ranier Rapids, the outlet control for Rainy Lake. This study should be complete in the spring of 2011.

##### ***Temperature Monitoring***

As reported last fall, temperature monitoring on the Rainy River was begun in an effort to better understand potential relations to fish spawning events. The USGS, in partnership with IJC-IWI, continues to monitor temperature at the stream gage located on the Rainy River at Manitou Rapids, MN (station 05133500). These data have been collected since spring 2009 and can be viewed via the Internet at: <http://waterdata.usgs.gov/nwis/uv?05133500>

As part of a relocation of its monitoring gage, 05PC021 on the Rainy River at the Town of Rainy River, the Water Survey of Canada installed a water temperature gage. The hourly water temperatures have been available on the web, [http://www.wateroffice.ec.gc.ca/graph/graph\\_e.html?stn=05PC021&prm1=5&prm2=-1&mode=graph&sno=8&sday=8&syrr=2010&emo=9&eday=25&eyr=2010&y1min=&y1max=&y2min=&y2max=](http://www.wateroffice.ec.gc.ca/graph/graph_e.html?stn=05PC021&prm1=5&prm2=-1&mode=graph&sno=8&sday=8&syrr=2010&emo=9&eday=25&eyr=2010&y1min=&y1max=&y2min=&y2max=) since mid-August 2010.

Thirdly, temperature data are gathered upstream and downstream at the International Falls/Fort Frances dam itself on the Rainy River. The interested reader may find the daily temperature data for all Rainy River locations reported on the last page of the Lake of the Woods Control Board 10-day Database Report, at <http://www.lwcb.ca/waterflowdata.html> .

The river water temperature will be correlated with fish spawning habits, to verify the benefits of restricting peaking and ponding at the International/Fort Frances dam during the walleye and sturgeon spawn. A report is expected in winter of 2013 as part of the IWI projects.

As well, the Rainy Boards submitted an IWI proposal for the Seine River First Nations to investigate fish activity in relation to temperature measured below the Crilly dam on the Seine River. The temperature gage will be installed by the Ontario Ministry of Natural Resources. Annual reports are expected from this work with a final report noting any correlation in 2015.

### ***2000 Rule Curve Indicator: Changes in Submerged Aquatic Vegetation***

As reported in the Boards' 2010 fall report, a contract was awarded by the U.S. Section of the Commission to Northland College in Ashland Wisconsin to fund a study to assess changes in near shore submerged aquatic vegetation communities in Rainy Lake and Namakan Reservoir (using Lac la Croix as the reference), and how these changes relate to effects of the 2000 Rule Curves. Under the contract performance period from July 1, 2010 through June 30, 2011, two of the four deliverables, field data collection and submission of a draft dataset and associated letter reports, have been completed and submitted to the IJC to date. The Boards anticipate receiving a draft study report for review in the near-term. This study, being conducted by principal investigators Meeker and Harris, will follow up on similar studies conducted by them in 1987 and from 2002 to 2005, allowing for methodological and taxonomic consistency with the earlier studies.

### ***IWI Modeling Workshop***

A member of the International Rainy River Water Pollution Board and a staff member attended the IWI modeling workshop in Chicago in November, 2010. This was the second of three planned workshops aimed at identifying potential approaches for IJC support of modeling by its various boards. Workshop participants heard presentations and had discussions on hydrologic, hydraulic, and water quality monitoring from various boards as well as state, provincial and federal agencies.

### ***Lake of the Woods Forum***

In November, 2010, the two Rainy Boards jointly submitted an IWI proposal to the IJC to request funding in support of the International Lake of the Woods Water Quality Forum (the "Forum"). In order to help ensure continuation and encourage expansion of the Forum, a grant of \$10,000 (\$2,000 for each of the next five years) was requested, as this Forum provides an annual binational summit for researchers, resource managers and agencies to gather and learn about new and developing water

management research, plan for future activities and to network in an informal setting. It also provides the Rainy Boards an annual assembly of professionals from throughout the basin as well as a forum for outreach, keeps the Boards up to date on research and activities affecting the basin, allows members of the Boards to network with researchers and resource managers in an informal setting and serves as a focal point for water management professionals working within the Rainy River Basin. The commission has given conditional approval for this IWI proposal although approval for funding may be decided on a year by year basis.

### **3.3 Implementation of IJC 2000 Rule Curve Assessment Studies**

As mentioned in the Boards' fall 2010 report, the Commission has undertaken implementation of the studies recommended in the Plan of Study (POS) contained in the June 29, 2009 submission of the IJC's 2000 Rule Curve Assessment Workgroup to the Commission. The Boards have been working closely with IJC staff on prioritization, budgeting, scheduling and management of these studies. It is anticipated that many of these studies will be funded through the IJC's International Watersheds Initiative.

On March 11, 2011 a contract was awarded by the U.S. Section of the Commission to Voyageurs National Park for project manager services, scoping and initial study design for 10 of the POS studies and a subsequent add-on bioindicator synthesis study identified by the Boards. This work will be accomplished in the U.S. and Canadian Fiscal 2012/2013 years.

A listing of these studies includes:

1. Measure changes in benthic-macroinvertebrate communities in relation to the 2000 Rule Curve changes (reservoirs).
2. Determine if northern pike spawning and nursery habitat and reproductive success has changed due to the 2000 Rule Curves.
3. Measure critical fish spawning and nursery habitats and determine how they may be affected by the 2000 Rule Curves (Rainy River).
4. Assess effect of water-level fluctuation on bioindicators using analytical models (synthesis).
5. Develop detailed bathymetric maps of the littoral zone for selected locations to assist other monitoring studies designed to assess the effect of the 2000 Rule Curves on aquatic vegetation, benthos, northern pike, and walleye (reservoirs).
6. Study – Characterize the hydrology of the Rainy River in terms of levels and flows, tributary and local inflow, flow attenuation and alteration from pre-dam and pre-2000 Rule Curve hydrology.
7. Measure critical spawning habitat for walleye on Namakan Reservoir and assess how it has been affected by the rule curve change.
8. Develop reservoir hydrologic model and reservoir PHABSIM or other equivalent habitat model for Rainy Lake and the Namakan Reservoir.
9. Assessment of the impacts of the 2000 Rule Curves on property damages due to flooding and ice.
10. Map and evaluate the distribution of habitats for marsh nesting birds and herptiles.
11. Measure Unionid (mussel) diversity and abundance in the Rainy River to assess effects of 2000 Rule Curves.

### **3.4 Sale of ACH**

In February, AbitibiBowater announced an agreement to sell its share of ACH Ltd. and its associated hydroelectric assets, including the Canadian dam and powerhouse at Fort Frances. The buyer has not

been disclosed, but was described as a major Canadian institutional investor in partnership with a private Canadian renewable energy company. Finalization of the sale is pending completion of regulatory requirements. The Boards were advised by ACH that its current management and operations will remain intact following the sale. Since the announcement, there have been reports in the press of appeals to the provincial government to have a public review of the sale.

### **3.5 Voyageur's Clean Water Project**

The Voyageur's National Park Clean Water Joint Powers Board (VNP CW JPB) was created between St. Louis and Koochiching Counties to help the project partners provide an environmentally sensitive and reasonable solution to the problem of non-compliant and failing septic systems within the Project Area. The Project Area includes the Island View Area of Koochiching County, Kabetogama Township, the unorganized area of Ash River Trail, and the Crane Lake Water and Sewer District in St. Louis County.

Eighty-seven percent (87%) of the sewage generating parcels within the Project Area are served by onsite wastewater systems along with several wastewater generating parcels with no wastewater facilities. The age of the existing on-site systems range from new to 40+ years old. Based on a desktop level review of the information gathered and assumptions listed in the full report, the existing on-site systems within the planning area have a sixty-nine percent (69%) non-compliance rate. Field investigation of the on-site systems would likely determine an even greater percentage of non-compliance.

The JPB recognizes that VNP waters are being negatively affected by human impact such as wastewater from existing developments throughout the region. This water quality degradation threatens the long-term health of the ecosystem and the economic health of the tourism industry upon which the local economy is based.

A member of the International Rainy Lake Board of Control (IRLBC) was invited to their February 10, 2011 board meeting in Cook, Minnesota to inform our boards of their activities in the Rainy Lake and Namakan Basins. Subsequently information they provided about the Voyageur's National Park Clean Water Project, their Public Project Planning Documents and the Project Organizational Chart were distributed to the members of the IRLBC and IRRWPB and discussed on February 24, 2011. That information was also sent to the IJC.

A letter stating that the Boards support projects that improve or protect water quality in the boundary waters between Canada and the United States was written to them. We stated that their project fits within the mission of the IJC's strategic International Watersheds Initiative that emphasizes fostering and enabling local actions to solve local problems in international waters.

### **3.6 Mining**

As the demand, and the associated value, for copper, nickel, silver, gold and a myriad of other metals continue to increase, re-opening formerly closed mines or establishing new mines looks increasingly attractive, and many such ventures are currently underway (or proposed) in the Rainy River Basin. The process of mining creates waste rock piles, tailings and residues that have the potential to contaminate water supplies through seepage of toxic heavy metals into ground water or via runoff into surface waters. Transporting materials required for the mining process (such as hydrochloric acid) to the site, and then transporting materials from the mine, also pose environmental risks. Mining operations also can require large volumes of water and leave a large footprint on the landscape, including the

destruction or displacement of wetlands and wildlife habitat. Understandably, basin residents are concerned about mining development.

PolyMet, Inc. is a Canadian company that is currently undergoing environmental review as it seeks a permit to open the first copper-nickel sulphide mine in the state of Minnesota near Ely, MN. The US Forest Service has initiated an environmental scoping process regarding a land exchange that would allow PolyMet to purchase USFS land for its open pits. The Rainy River Gold Project, a mining project of Rainy River Resources, is an advanced stage gold exploration project situated in the southern half of Richardson Township, approximately fifty kilometres northwest of Fort Frances, ON. The company is currently carrying out an aggressive exploration plan, conducting metallurgical testing and environmental baseline and geotechnical studies. These are just two examples of mining development underway in the Basin. For any of these examples on the U.S. portion of the Rainy Basin, the Minnesota State agencies, Minnesota Pollution Control Agency and Minnesota Department of Natural Resources, have jurisdiction over reviewing environmental impacts and permitting, respectively.

As the Boards learned during their August Basin tour last year, there is also the issue of the Steep Rock iron ore mines near Atikokan, ON, which ceased mining operations in 1979. The open pits began filling in the early 1980's and have resulted in the formation of pit lakes. The two adjacent pits, Hogarth and Caland, are the most substantial, and their water levels continue to rise. The water in the pit lakes is chronically toxic to aquatic life. Current modeling results indicate overflow dates ranging from 2030 to 2070. With no intervention, impaired water overflowing from the pit lakes could adversely affect downstream waters including the Seine River, Rainy Lake, and Rainy River, as well as their associated aquatic communities. Through its Steep Rock Rehabilitation Project, the Ontario Ministry of Natural Resources is developing a long-term management plan for the Steep Rock site that will identify mitigation strategies for downstream waters and public safety, and possible uses of the site. Field work in 2011 includes the identification and delineation of contaminant source areas and further ecological assessment.

### **3.7 Installation of ADCP Flow Gage below Dam**

The US Section of the IJC has committed funding for the U.S. Geological Survey to install and operate a new streamflow gage in a low-gradient reach of the Rainy River below International Falls / Fort Frances using an Acoustic Doppler Velocity Meter. The gage will provide enhanced information on flow through the dam and powerhouses and will be useful for future river hydraulic model input. Gage planning has been by correspondence with people knowledgeable of Rainy River flow issues below International Falls. More site-specific reconnaissance of suitable gage locations, including site-specific instrumentation analysis and ordering, will be completed soon after ice melt. Gage installation is anticipated to be completed in mid-summer 2011.

### **3.8 Meetings**

#### ***International Joint Commission Fall Semi-Annual Meeting***

The Boards met jointly in Ottawa on October 20<sup>th</sup> in advance of their presentation to the IJC at the fall semi-annual meeting. In addition to preparing for their presentation, the Boards discussed proposed and ongoing IWI initiatives such as the efficacy of temperature monitoring to predict spawning periods on the Seine River, support for the Lake of the Woods Water Quality Forum and establishment of a project manager for the gap studies associated with the 2000 Rule Curve. An update was provided on the two dimensional hydrodynamic model being constructed for the Upper Rainy River by the Canadian

Hydraulic Centre. The Boards also discussed funds for a new gauging station, and updates to their work plan. On the afternoon of the 20<sup>th</sup> the Boards presented a summary of their activities to the IJC, referring to their Fall Semi-annual report and providing updates on activities since the time when it was submitted.

### ***Board Meetings and Conference Calls***

The Boards held a number of conference calls throughout the fall and winter of 2010/2011. On November 8 the Boards held a teleconference to discuss proposals for the upcoming IWI modeling workshop one November 17<sup>th</sup> to 18<sup>th</sup>. The Boards discussed their upcoming needs for hydrographic and hydrologic models in the Rainy River and Rainy Lake. On December 6, 2010, the Rainy Boards held a conference call with the International Lake of the Woods and Rainy River Watershed Task Force to discuss priority issues in the watershed and possible changes to governance mechanisms. On February 24<sup>th</sup> the Boards held a conference call to finalize the terms of agreement between the Voyageurs National Park and the IJC to manage the POS gap studies. They also discussed the request for a letter from the Voyageurs Joint Powers Board, and finalized upcoming IWI proposals.

### ***International Lake of the Woods Water Quality Forum, March 9-10 2011***

The International Lake of the Woods Water Quality Forum, sponsored by the Lake of the Woods Water Sustainability Foundation, was held March 9<sup>th</sup> and 10<sup>th</sup> in International Falls, MN. Forum attendance was fairly strong with approximately 90 participants. The focus of this year's Forum was the State of the Fishery with keynote presentations by Don Pereira, Minnesota Department of Natural Resources and John Gunn, Canada Research Chair in Stressed Aquatic Systems, Laurentian University.

In addition to several other fisheries presentations, other speakers covered results of nutrient and hydrologic modeling for the lake, research on algae and remote sensing and an overview of the status of the Steep Rock Mine pits. The International Lake of the Woods and Rainy River Watershed Task Force held a special interactive workshop entitled "Shared Waters, Shared Management: What is the Best Approach?" in order to gather input from participants on their mandate of reviewing binational water management in the basin.

A Forum working group on development of the historical nutrient reconstruction for Lake of the Woods met on March 9<sup>th</sup> to finalize the work plan for the project tasks in anticipation of funding for the project.

At the Foundation's Reception the evening of March 9<sup>th</sup>, Robert Sandford, Chair of the Canadian Partnership Initiative with the United Nations Water for Life Decade, spoke on global water issues.

The Forum Organizing Committee also provided meeting rooms and refreshments for the International Lake of the Woods Multi-Agency Working Group and its Technical Advisory Committee.

## **3.9 Board Membership**

Gail Faveri, P. Eng. was appointed by the IJC as the Canadian co-chair of the IRLBC, effective February 4, 2011. Gail is the manager of the Boundary Waters Issues Unit in Environment Canada in Burlington, Ontario. Gail has been actively participating on the IRLBC in an advisory role, since 2008. She is also the secretary for the St. Lawrence River Board of Control and participates on the Lake of the Woods Control Board. We would also like to acknowledge Rick Walden for continuing to advise the

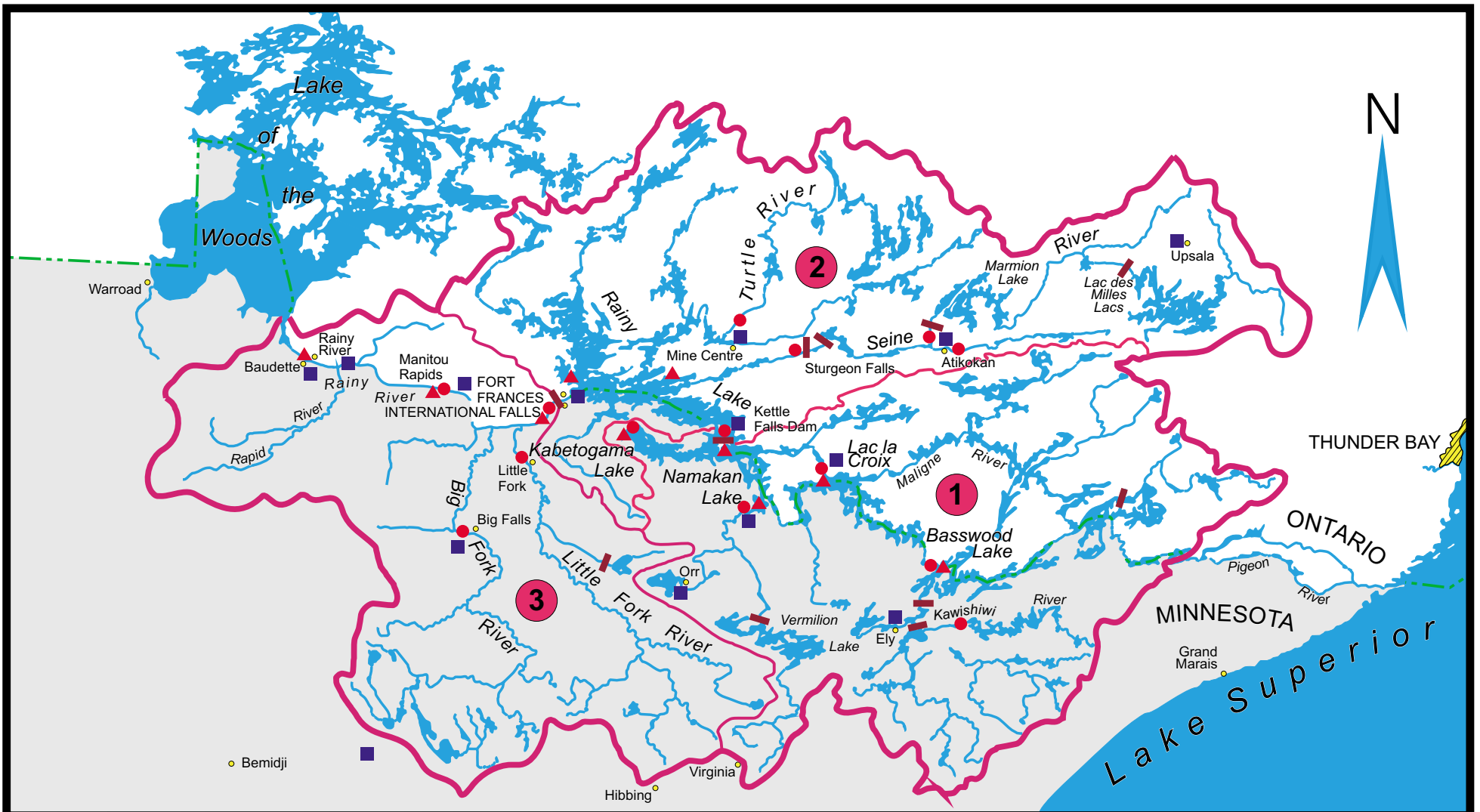
Boards since his retirement in 2010 and for continuing to serve as Interim Canadian Co-Chair of the IRLBC until Gail's appointment.

## APPENDIX

- Figure 1 Rainy River Drainage Basin Map
- Figure 2 Rainy Basin Precipitation
- Figure 3 Namakan Lake Elevation, Net Inflow and Outflow
- Figure 4 Rainy Lake Elevation, Net Inflow and Outflow
- Figure 5 Legend for Lakes and River Graphs

### NOTE

All precipitation, water level and flow data used in the text and figures of this report were taken from the database of the Secretariat of the Lake of the Woods Control Board. At the time of preparation of this report, these data were still provisional and subject to revision.



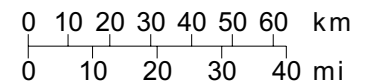
**LEGEND**

- International Boundary - - - - -
- Drainage Basin - - - - -
- Sub-Basins - - - - -
- ① Namakan Lake
- ② Rainy Lake
- ③ Rainy River

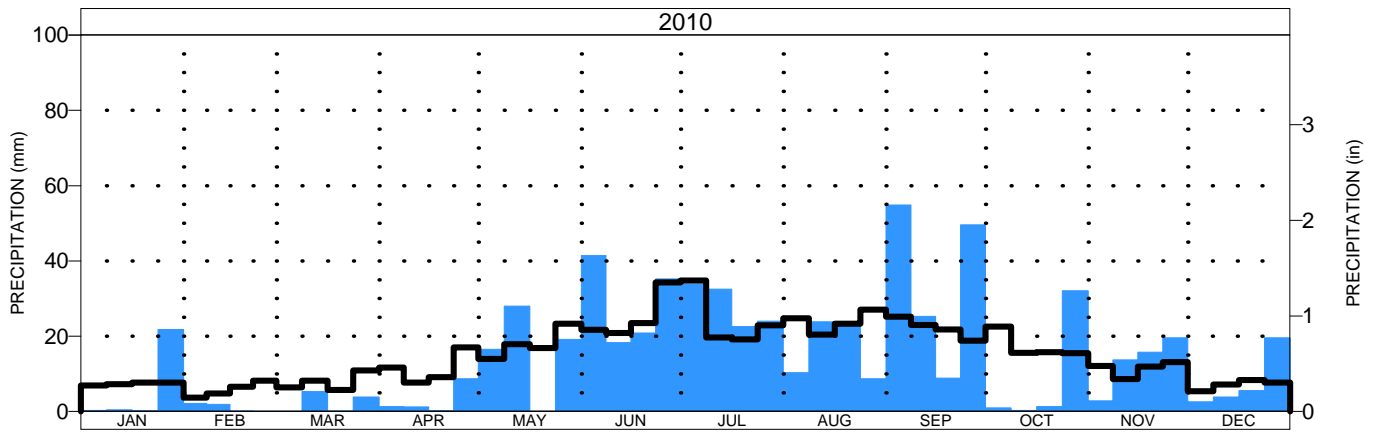
- Control Dams - - - - -
- Data Gauges (Near Real Time)
- Stream Flow - - - - - ●
- Water Level - - - - - ▲
- Precipitation - - - - - ■

**International Rainy Lake Board of Control  
IRLBC**

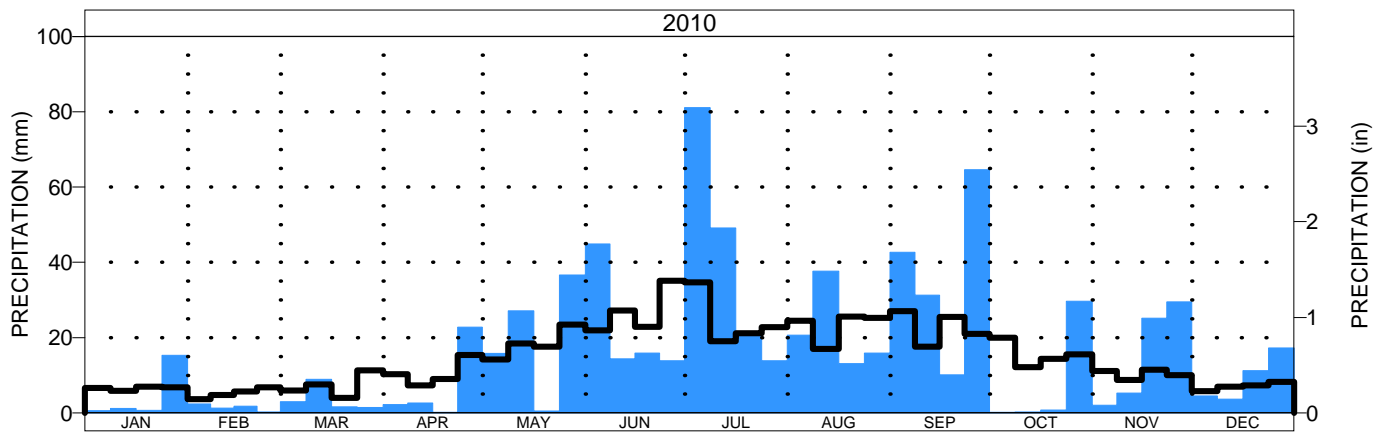
**Rainy River  
Drainage Basin**



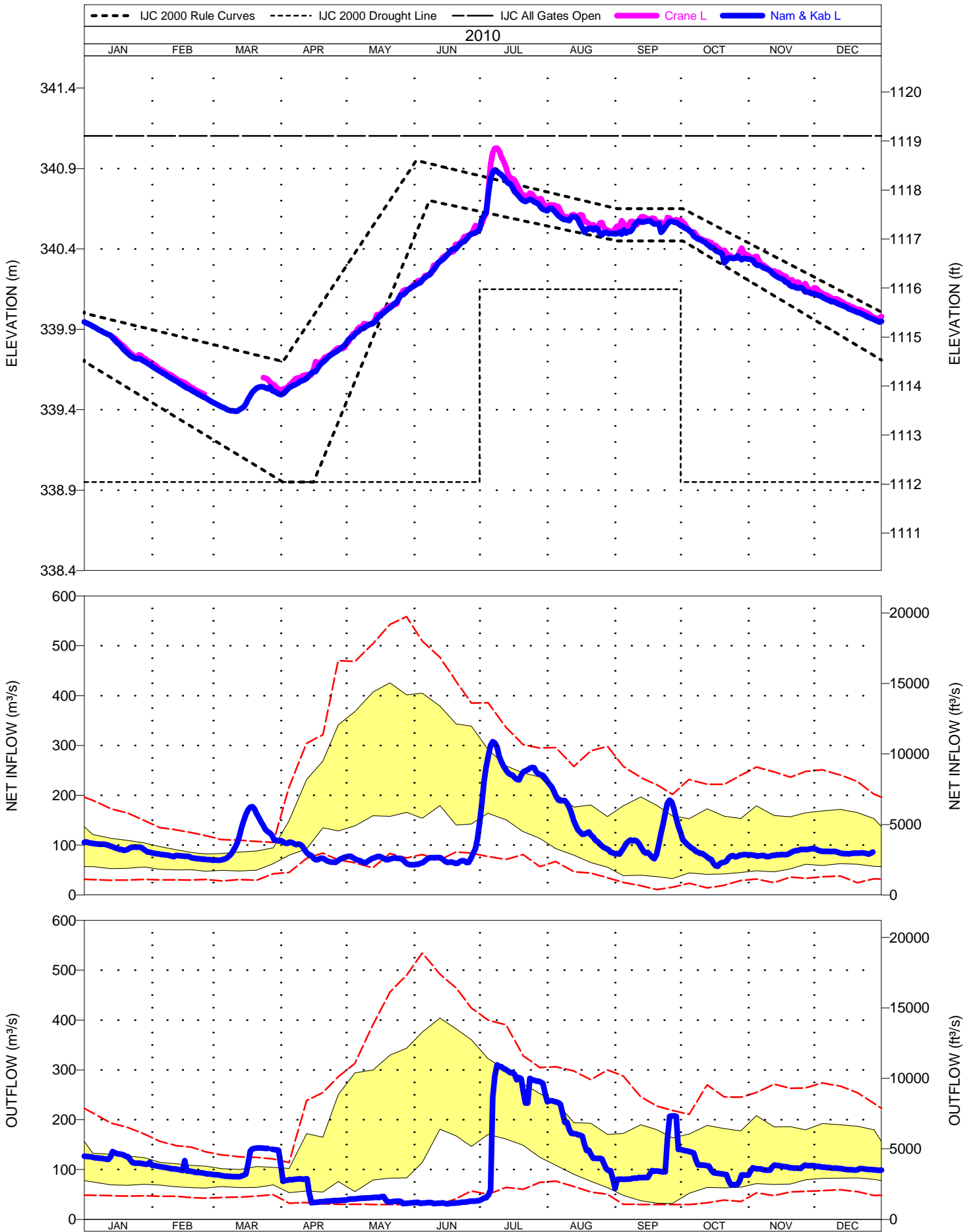
### LAC LA CROIX PRECIPITATION



### RAINY-NAMAKAN PRECIPITATION



# NAMAKAN LAKE



# RAINY LAKE

