

INTERNATIONAL RAINY LAKE BOARD OF CONTROL
IRLBC

EXECUTIVE SUMMARY
OF THE
DRAFT FINAL REPORT

REVIEW OF THE IJC ORDER
FOR
RAINY AND NAMAKAN LAKES

April 28, 1999

Your comments on the Rainy-Namakan rule curve study, as detailed in this Draft Final Report, are welcomed. Watch for announcements for, and plan to attend, the International Joint Commission's Public Hearing, tentatively planned for early July, 1999.

Alternately, send your comments to either of the two Board Members by July 30th:

Col. Kenneth S. Kasprisin
U.S. Army Corps of Engineers
St. Paul District
190 Fifth Street East
St. Paul MN 55105-1638

Mr. Dale R. Kimmett
Environmental Protection Service
Environment Canada
Ottawa ON K1A 0H3

kenneth.s.kasprisin@usace.army.mil

dale.kimmett@ec.gc.ca

EXECUTIVE SUMMARY

The Rainy Lake basin lies within the Canada-United States boundary waters and is therefore subject to the Boundary Waters Treaty of 1909 ratified by the two countries. The basin has long been of interest to the two governments, which issued a Rainy Lake Reference in 1925 requesting the International Joint Commission (IJC) to make recommendations as to the regulation of Rainy Lake and other boundary waters. A Convention in 1940 assigned the IJC the power to determine when emergency conditions existed on Rainy and Namakan lakes and to adopt control measures as necessary. The Commission created the International Rainy Lake Board of Control (IRLBC) in 1941 to examine and report on emergency conditions, and issued its first Order on regulation of the lakes in 1949. In response to extreme inflow conditions, this Order underwent major reviews twice, and was consequently revised by Supplementary Orders issued in 1957 and 1970. The 1970 Order, still in use, specifies an upper and lower rule curve for both Rainy and Namakan lakes, between which the lake levels must be managed under normal conditions. The Order also provides direction on how the lakes are to be managed if the rule curves are violated due to flood or drought events.

Calls for rule curve change have been ongoing virtually since the 1970 Order was implemented, driven by concerns of resort owners over low levels in the Namakan chain of lakes, the creation of Voyageurs National Park in Minnesota which placed a focus on the ecological and environmental values of the water resource, and the concern of natural resource management agencies and others about declining fisheries populations. In 1991 a number of local interests created the Rainy-Namakan Water Level International Steering Committee (SC) as a voluntary group of private citizens and government agencies with a view to recommending changes that would seek a balance among a number of concerns. The work of the International Steering Committee culminated in a *“Final Report and Recommendations”* that was submitted to the IJC in November 1993. A number of local and national groups and individuals expressed support for the SC proposals, but concerns were expressed by some property owners about increased flood risk and by some navigational interests about a shorter boating season. Boise-Cascade, the operator of the control dams, concerned about reduced hydropower production and increased risk of flooding, filed a formal *“Statement in Response of Boise Cascade Corporation and Boise Cascade Canada Limited”* with the IJC in February of 1994.

The International Rainy Lake Board of Control, in presentations to the Commission in 1994, recommended a review of the rule curves and subsequently was asked by the IJC to develop a draft Plan of Study. Following public review and further deliberation the IJC approved a revised Plan of Study dated February 1, 1996. The IRLBC was directed to assess the existing data and information related to the new rule curves proposed by the SC, with the objective of determining what action, if any, the Commission should take regarding the 1970 Supplementary Order. Given the extent of the work already undertaken by the Steering Committee and Boise Cascade Corporation, the Commission sought to restrict the study to an assessment of the proposed rule curves versus those of the existing rule curves rather than a full assessment of all possible regulation alternatives. In addition the Study Plan included the review of two uncontrolled outlets from Namakan Lake and of the minimum outflow requirements for both Rainy and Namakan Lakes. Further, recognizing the several differing water resource management jurisdictions in the basin, the Plan called for the study work conducted by the IRLBC to focus on Rainy and Namakan lakes only, but to provide details of the altered outflow regime to downstream agencies. These agencies, including in particular the Lake of the Woods Control Board with respect to Lake of the Woods and the Winnipeg River, were expected to conduct their own review of the anticipated impacts on the downstream areas and provide feedback which would then be incorporated into the study report by the IRLBC.

Priority was given by the Board to an independent evaluation of the fisheries information and that aspect was completed early in the study. The Plan of Study defined the initial products of the study as being the results of the hydrologic modelling and inflow forecasting efforts, and summaries of all the existing data and information. The Board provided a Status Report dated March 3, 1998 that met that requirement and, because some of the sectoral studies had gone beyond the summary of information stage, was also able to reach a number of preliminary findings as well. The Status Report was circulated to stakeholders, the public and downstream agencies for review and comment, and additional outflow data was provided to the downstream agencies so that they could begin their own assessment. The Board continued with its remaining study components, with filling information gaps, and with encouraging input from others on downstream impacts below Rainy Lake. The IRLBC and the downstream agencies have now completed their work and, based on all available information and feedback, the IRLBC has prepared this draft final report. A summary of the findings in each of the sectoral areas outlined in the Plan of Study are given below. Additional detail is available in the corresponding section of this report, and elaborated in even more detail in the technical reports listed in the bibliography at the end of the report.

Rainy-Namakan Studies

Hydrologic Modelling - Independent hydrologic modelling was conducted to determine the lake levels and outflows likely to result for Rainy and Namakan lakes under different operating rules. The Environment Canada “REGUSE” computer model was used to simulate the regulation of Rainy and Namakan Lakes under four different sets of rule curves: the existing 1970 IJC rule curves, the rule curves proposed by the Steering Committee, alternative C1 (SC curves on Namakan Lake and IJC curves on Rainy Lake), and alternative M1 (a modification of C1 with a wider rising limb in the spring on Namakan Lake, and a blending of the SC and IJC curves on Rainy Lake). The key findings were that the maximum flood level is about 5 cm higher on Namakan Lake and 10 cm higher on Rainy Lake with the SC rule curves than with the IJC curves. The minimum drought level on Namakan Lake is 20 to 100 cm lower with the IJC curves and on Rainy Lake is 7 to 38 cm higher. Based on the number of rule curve violations the SC curves are nominally more viable than the IJC curves on Namakan Lake, but less viable on Rainy Lake. Under the SC curves there is a significant shift in timing of the outflow from both lakes, with less in winter but more in summer, especially June. Average annual energy generation is 6.6% to 7.7% less with the SC curves than with the IJC curves.

In addition, a simple routing model was developed and used to simulate natural lake levels and outflows, the condition before the dams were constructed. The same inflow data set as used for the REGUSE model runs, for years 1958-96, was used. Although there was a wide variation in the timing of natural refill, the earlier refill under the SC curves appears to better fit the natural situation on Namakan Lake while the existing IJC curves appear to better fit the natural situation on Rainy Lake. In both cases the natural variability in spring refill timing was significantly greater than under rule curve regulation.

Inflow Forecasting - The purpose here was to determine the potential to mitigate flood risk through improved inflow forecasting. The Steering Committee had acknowledged that their proposed rule curves would potentially increase flood risk, but felt that the increased risk could be offset through improved forecasting. To test this, a routing model was developed and used to progressively determine the operational potential to reduce high lake levels and outflows for increasing periods of “perfect forecasts”. The results indicated that the number of violations of the upper rule curves are only reduced by 0.8% at best with a perfect 7-day forecast and by 1.6% at best with a perfect 28 day forecast. In essence, an inflow forecast cannot be used to significantly reduce flood peaks because of the hydrologic characteristics of the basin and the limited outflow capacity of the dams.

Flood Risk Assessment - This work was conducted to assess the relative change in risk of high water levels on Rainy and Namakan lakes, if any, under the proposed SC rule curves, as well as under alternatives C1 and M1, compared to the existing IJC rule curves. Assessments were made of the relative change in frequency and duration of Rainy and Namakan levels exceeding the established upper IJC emergency condition levels of 337.75 m on Rainy and 340.95 m on Namakan. The relative change in magnitude and frequency of Rainy Lake outflow was also determined to assess the potential for increased downstream flooding on Rainy River. Compared to the existing curves, all of the alternatives generally produce a small increase in flood levels on Rainy and Namakan for all event frequencies, with the SC curves producing the greatest increase and C1 and M1 producing lower and similar increases. For the 100-yr event on Rainy Lake the increase is 14 cm for the SC curves and 9 cm for C1 and M1. For the 100-yr event on Namakan all of the alternatives produce an increase of 10 cm. The discharge-frequency analysis for Rainy Lake outflow shows that all of the alternatives produce slightly higher discharges for the 5-yr through 100-yr events, compared to the existing condition. The SC curves produces the greatest increase, while M1 produces the least. For the 100-yr event the increase is 50 m³/s for SC, 40 m³/s for C1 and 30 m³/s for M1. The duration of flood levels above the upper IJC emergency level on Rainy Lake increased by about 0.9% for SC, 0.4% for C1 and 0.3% for M1. On Namakan Lake the duration of levels exceeding the upper IJC emergency level increased by about 0.4% for SC, C1 and M1. Overall among the alternatives, increases in Rainy-Namakan flood levels and in Rainy River discharges are relatively small, when compared to the existing condition, and do not appear to very significantly increase flood risk.

Fisheries - The fishery, and the associated tourism, form an important economic resource base for the region. The purpose of this study sector was to determine the impact on the fishery of the present mode of operation, and to determine if the changes proposed by the SC might be effective in aiding the fishery. Two independent fisheries experts, one from Canada and one from the United States, were retained by the Board to evaluate all fisheries studies on Rainy and Namakan lakes and relevant fisheries information from other comparable lakes. The experts, in their initial evaluation, concluded that over-exploitation had played a major role in the decline of fish stocks and that water level regulation has contributed to the decline. The importance of follow-up studies to any management actions was also highlighted. They endorsed the proposed SC rule curve changes as being more representative of natural conditions, and supported continuing efforts to reduce and constrain exploitation pressure. After the natural condition (before dams) simulation results became available a supplemental evaluation was carried out, primarily in light of the new findings regarding the timing of the spring rise on the lakes. In their supplemental evaluation the fisheries consultants recommended that an experimental management approach be adopted that would implement the SC curves on Namakan Lake and leave the existing IJC curves in place on Rainy Lake.

Environmental Data Summary - The environmental review was conducted to determine whether the existing or the proposed regulation would best provide the most benefits for the environmental resource ecosystem components. The initial environmental findings concluded that perceived problems with the existing IJC rule curves were valid. The SC curves would trigger positive responses in the aquatic plant and associated wildlife in Namakan Lake, and minor habitat improvements for the aquatic plant community with consequent benefits to wildlife in Rainy Lake. The report also pointed out the benefits of infrequent high and low water extremes in regulated aquatic system management. Based on a re-evaluation of the findings, following the completion of the natural condition simulation, the reviewers concluded that many of the ecosystem resources would benefit from an earlier spring rise as proposed by the SC on both Namakan and Rainy Lakes. However, regarding Rainy Lake, they acknowledged that if the intent was to obtain more natural conditions, then the later rise provided by the IJC rule curves might be more appropriate. Also in the interest of more natural conditions on Rainy, they encouraged a wider summer band with more “run of the river” operation in order to increase inter-annual variability.

Economic/Social/Recreational Factors - This evaluation was to establish current economic, social and recreational values in a number of impact categories and estimate the incremental changes that would result, if alternate rule curves were adopted. Quantitative analysis was performed to the extent possible, but qualitative where necessary, to determine the effects of the proposed changes.

Hydropower is generated by Boise Cascade on the US side, and by Abitibi-Consolidated on the Canadian side, at the outlet of Rainy Lake. The demand for electricity at the company mills exceeds their power generating capability at all times. The value of the power produced is approximately US\$5.1 million per annum. When compared to the existing rule curves, all of the alternatives result in a decrease in hydropower energy production, particularly in the winter months when it is most costly to replace. The additional yearly average cost of replacing this power ranges from US\$376,000 with the Steering Committee proposal to US\$114,000 under Alternative C1.

All of the alternatives evaluated resulted in increased flood damages when compared to the existing condition. The average annual flood damages were estimated at US\$15,000 for the existing rule curves, US\$23,000 for the Steering Committee proposal, and about US\$21,000 for the two alternatives tested. For the flood of record, 1950, flood damages increased by about US\$2.4 million under the two alternatives and by about US\$2.8 million under the SC proposal when compared to the existing rule curves. Overall, there are small differences in flood damage potential among the alternatives, except for extreme events where the differences are large.

In 1990 the fishery and associated tourism generated approximately US\$8.7 million in gross revenues in the Rainy-Namakan basin, with 98% of this contributed by the sports fishery. (For comparison, the equivalent value on Lake of the Woods is US\$46.2 million.). The recreation-tourism benefits of the alternatives evaluated could not be quantified, but were assessed qualitatively. The SC curves on Rainy Lake and particularly the SC, C1 and M1 curves on Namakan Lake should provide positive benefits to recreation and tourism due to the early spring refill and associated improvements in the fishery and navigation access. SC, C1 and M1 curves should provide significant positive benefit to Namakan Lake due to their decreased winter drawdown. However, the SC and M1 curves on Rainy Lake and SC, M1 and C1 on Namakan Lake, which feature slowly declining summer levels, may negatively impact recreation and tourism due to potential problems with navigation access in the late summer.

The study looked at the effects of rule curve change on water supply intakes, on the commercial fishery and on shore erosion, but found either no impacts or minimal impacts in these areas.

Native Peoples, tourism businesses, and recreationists use tributaries to the Namakan Chain of Lakes for navigation for personal, business, and recreation purposes. This should improve with any of the alternatives for Namakan Lake, based on expected increases in spring water levels.

While the wild rice harvest on Rainy Lake is small, it has cultural significance to the Native Peoples. Compared to the existing rule curves, the Steering Committee proposal could provide positive benefits, while the two alternatives maintain the status quo.

Downstream Impacts

Changes to the rule curves on Rainy and Namakan lakes changes the timing and magnitude of outflows from Rainy Lake, which in turn changes the levels and flows down the Rainy River and has the potential to change levels and flows on Lake of the Woods and the Winnipeg River. Implementation of the SC rule curves would result in changes throughout the year, but the most significant would occur from spring to early summer. With the earlier rise of Rainy and Namakan

levels under SC rule curve operations, there is less outflow in the spring as water is held back to fill the upper lakes, and then more outflow in the early summer, once the upper lakes are filled. As a result, the changes made to benefit a particular interest on the upper lakes can have the opposite effect on the same interest downstream. The earlier refill of Rainy and Namakan lakes to better ensure good spawning conditions there result in less water being available for the same purpose downstream.

Rainy River - If the SC rule curves were adopted in place of the existing IJC curves, river levels would be lower in the late winter to early spring, and higher in the late spring to early summer. The extent of change diminishes as one moves downstream. Just below the Fort Frances - International Falls dam, the mean level would be 0.6 m lower in late March and 0.4 m higher in late June, whereas at Manitou Rapids the equivalent values would be 0.5 m lower and 0.3 m higher, and at the Town of Rainy River the changes would be within +/- 0.1 m. For other months the differences in level would not be as significant. The Ontario Ministry of Natural Resources (OMNR) believes that the SC curves may enhance the spring spawn on the Rainy River as levels tend to be increasing during the spawning period, but notes that this would be dependent on there being adequate spawning area at the lower initial water levels, which could only be determined through field investigation. Others with an interest in the river believe that there is not yet enough information available regarding impacts on the river and have requested that no changes be made to rule curves until further study has been conducted.

Lake of the Woods - The Lake of the Woods Control Board (LWCB) took a keen interest in how a changed outflow regime from Rainy Lake might affect the waters it regulates. Once the modelled Rainy Lake outflows were available, the LWCB conducted its own extensive modelling to determine the impacts on the levels of Lake of the Woods and the levels and flows on the Winnipeg River. These results were detailed in the report "*Lake of the Woods Modelling - Impacts of Rainy-Namakan Rule Curve Change*" dated June 5, 1998. The LWCB then turned over its results to the public and in particular to the various interest groups active on its waters, seeking their comment. Based on its own work and on the feedback received, the LWCB provided the IRLBC with a summary of the anticipated impacts and a statement of its position on the issue. For Lake of the Woods it was determined that the maximum flood level would be about 5 cm higher with the SC rule curves as opposed to the existing IJC curves, and that the amount of time the lake was above the normal operating range would double, although this still occurs relatively infrequently. It was noted that the proposed SC changes would make the regulation objectives for Lake of the Woods and the Winnipeg River more difficult to achieve, and that the current frequency of success in reaching spring spawning target levels on Lake of the Woods could only be maintained by producing wider variations in flow and less achievement of target levels on the Winnipeg River. All input received by the LWCB from the public and interest groups regarding the impacts was negative. In particular, hydropower interests on the Winnipeg River computed generation losses, and OMNR resource managers cited threats to the downstream fishery and shore nesting birds. The LWCB concluded that there are no benefits, and in some years significant disbenefits, for its downstream areas if the SC rule curve proposals were implemented. Nevertheless, the LWCB offered to consider some disbenefits downstream in order to achieve some benefits upstream, provided that there is a net gain for the basin overall. It is not prepared to accept changes that result in unmanageable impacts downstream, or greater disbenefits downstream than those achieved upstream. Given the available information, the LWCB felt that a reasonable compromise between upstream and downstream interests would be the C1 alternative, provided that it was implemented on a trial basis.

Conclusions and Recommendations

The IRLBC has assembled and evaluated a wide array of existing information in all of the areas defined in the Plan of Study. While some data gaps still exist in relation to the possible impacts of changes to the rule curves on fisheries and on the aquatic environment downstream of Rainy Lake, the Board believes enough information is available to derive and justify its recommendations.

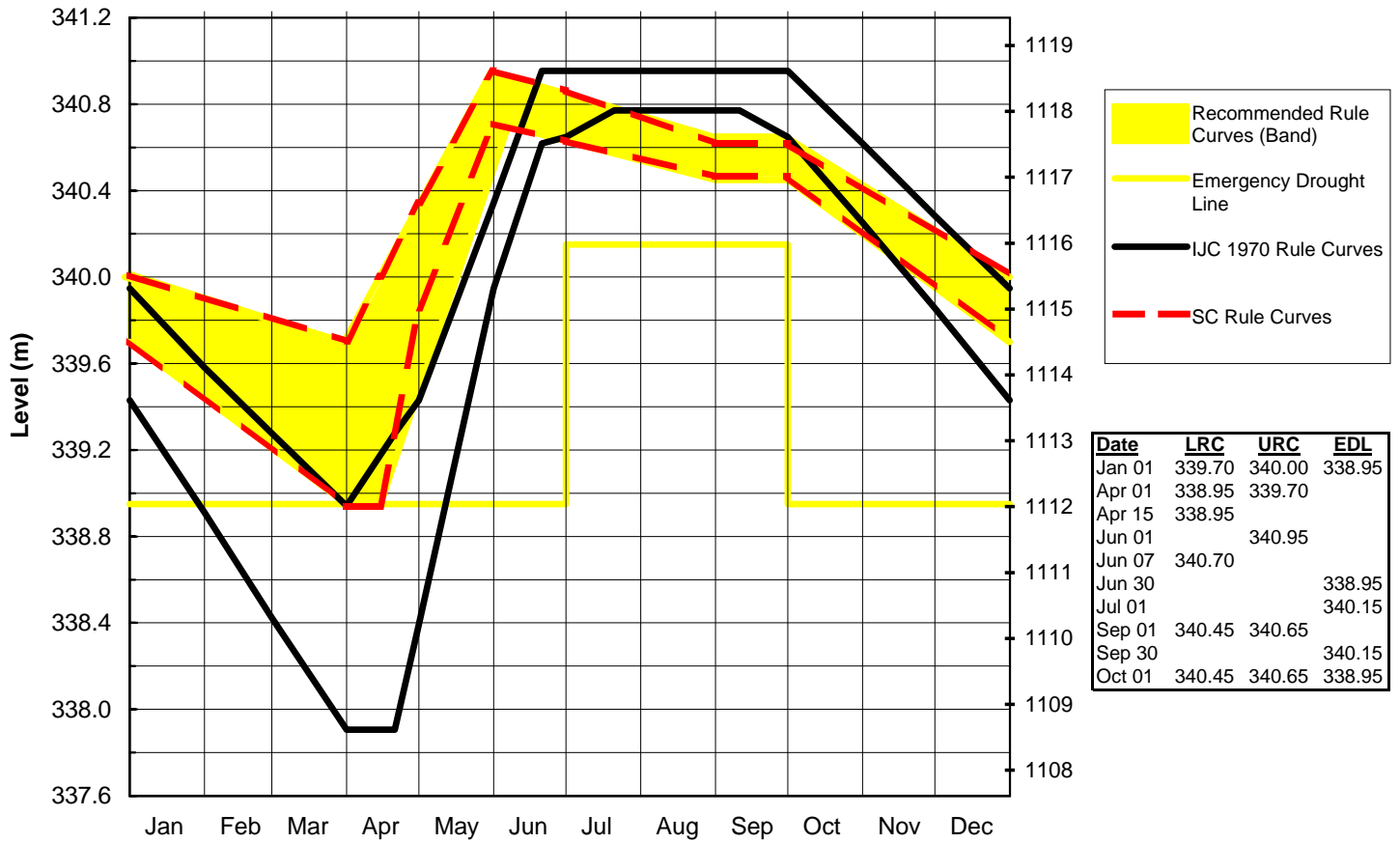
Overall, the Board recommends the rule curves shown on Figure 1, which are defined in metric units and are similar to the alternative M1 rule curves for Namakan Lake (same as the SC proposal except for a wider rising limb in the spring) and the existing IJC rule curves for Rainy Lake. These curves as a set will have less impact, both positive and negative, than the SC proposal for both lakes and should provide a better balance for the basin as a whole than either the existing IJC rule curves or the proposed SC rule curves. The recommended curves should balance not only the upstream versus downstream environmental benefits, but also the tradeoff on the upper lakes between fishery and environmental resources versus hydropower and flood risk.

The recommendations of the Board regarding Rainy and Namakan lakes are given below. The justification is provided in the Conclusions and Recommendations section of the report.

- 1. The recommended rule curves shown on Figure 1 should be adopted. These are essentially a minor modification of the proposed International Steering Committee rule curves on Namakan Lake and the existing IJC rule curves on Rainy Lake.*
- 2. The minimum outflow criteria for Namakan Lake should be expressed in terms of the total Namakan Chain of Lakes outflow rather than in terms of the Kettle Falls outflow, so that the overflows from Gold and Bear Portage are accounted for.*
- 3. The minimum outflow criteria should be revised as follows for both lakes. On Namakan Lake, the outflow should be reduced to 30 m³/s instantaneous whenever the lake level is below the Lower Rule Curve, and should be further reducible, at the discretion of the IRLBC but no lower than 15 m³/s, whenever the lake level is below the Emergency Drought Line (EDL) shown on Figure 1. On Rainy Lake, the outflow should be reduced to 100 m³/s instantaneous whenever the lake level is below the LRC, and should be further reducible, at the discretion of the IRLBC but no lower than 65 m³/s, whenever the lake level is below the EDL shown on Figure 1. (The current seasonal and diurnal criteria would be eliminated.)*
- 4. Any new rule curves adopted should be implemented on a trial basis. The length of the trial could be for a defined period, or linked to certain hydrological extremes occurring during the trial period, but in any case should not be shorter than 10 years so that a range of events can be experienced and adaptations of the biological community can begin to be identified.*
- 5. Monitoring programs should be implemented by the resource management agencies in accordance with the recommendations of the fisheries and environmental resources experts to enable the impacts of new rule curves on the biological and aquatic communities to be identified, and to provide an adequate source of information for future reviews.*
- 6. The Order should state that, within the rule curve operating bands, regulation operations are to be solely at the discretion of the dam owners in accordance with basin conditions. The flexibility intended to be offered by these bands for responding to current basin conditions and local needs should not be constrained by any additional rules.*

The Board has set aside a three month period (to July 30, 1999) for stakeholder and public review of the draft final report. Comments and feedback will be taken into consideration, along with other information that becomes available, when the Board finalizes this report.

Namakan Lake Recommended Rule Curves



Rainy Lake Recommended Rule Curves

