

INTERNATIONAL RAINY LAKE BOARD OF CONTROL

IRLBC

PLAN OF STUDY

for

**REVIEW OF THE IJC ORDER
FOR RAINY AND NAMAKAN LAKES**

February 1, 1996

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INTRODUCTION

Following its April 1995 semi-annual meeting, the International Joint Commission (IJC) requested its International Rainy Lake Board of Control (IRLBC) to prepare a plan of study to review its 1970 Order for the regulation of Rainy Lake and the Namakan Chain of Lakes. Over the past few years, several organizations within the basin had in succession questioned the current rule curves on the lakes. They believed that changes in the way the lakes are regulated could provide certain benefits; for example, to the fishery and to navigation. This culminated in a specific proposal for new rule curves, submitted to the Commission by the Rainy Lake and Namakan Reservoir Water Level International Steering Committee in their "Final Report and Recommendations," dated November, 1993. An opposing viewpoint was submitted to the Commission by Boise Cascade Corporation in a report dated February 10, 1994. At the IJC semi-annual meetings in the spring and fall of 1994, the IRLBC made presentations to the Commission summarizing the issues and recommending that the Order be reviewed. As a first step, the Commission held a public hearing on November 10, 1994 in International Falls, Minnesota to seek public views on the adequacy of its existing Order.

SCOPE AND OBJECTIVE

Specifically, the Commission asked the Board to prepare a plan of study to assess the existing data and information related to the proposed new rule curves, with the objective of determining what action, if any, it should take regarding its Order. Given the extent of work already conducted by the Steering Committee and Boise Cascade Corporation, the IJC has sought to restrict this study to an assessment of the merits of the proposed rule curves versus those of the existing rule curves, rather than a full evaluation of all possible regulation alternatives. Similarly, the Board proposes limiting the study to a reconnaissance level to the extent possible, focussing on review and analysis of the work already done. However, the issue is complicated by the fact that not all of the work to date in certain areas, such as the fishery, is in agreement regarding the benefits of the proposed new curves. Further, since the proposed curves potentially increase flood risk on the lakes, this impact must clearly be examined very carefully. In addition, the Commission has agreed that certain other issues not addressed in the proposal, such as the impact of the two uncontrolled overflows from Namakan into Rainy, and the appropriateness of the current minimum outflow requirements for both lakes, should be reviewed at the same time.

The main objective of the work proposed herein is to provide the Commission with an evaluation of the incremental effects of the proposed rule curves versus the existing rule curves in the areas of flood and drought management, environmental impacts, economics, social factors and recreation. This will lead to an overall assessment of the two sets of curves which, given the diverse nature of the interests involved, will be subjective but will be based on present day social and economic values. Possible outcomes of the study are the recommendation of one set of rule curves over the other (the existing or the proposed), the conclusion that more information or analysis is required before a choice can be made, or the conclusion that neither of the two methods of regulation appears suitable and that an alternate method should be found. If either of these last two conclusions is reached, the further work that would have to be done as a second phase would be defined. However, if it appears that either of the two sets of curves might be rendered acceptable through minor changes, a limited attempt to define these would be included in the present study.

STUDY PROCESS

To meet its objective within the context of the Commission's existing regulation

mandate, the study must address a number of questions. Some of the key questions are:

- Are the level and flow modelling results for the existing rules and the proposed rules as presented to date by Boise and the Steering Committee valid? If not, what are the levels and flows that result from these two methods of regulation?
- How significant is the increased flood risk that is purported to result from the proposed curves?
- Can this flood risk be mitigated to any degree, and if so how much, by improved forecasting and operating as suggested by the Steering Committee?
- What are the benefits/disbenefits associated with both sets of rule curves, from various points of view? How are these benefits/disbenefits affected by incremental changes in these rule curves?
- What impacts does the present mode of regulation have on the fishery? Is the condition of the fishery dominated by other factors, such as overfishing? Would the changes being proposed be effective in aiding the fishery? Are all of the proposed changes required to effect a benefit?
- considering the various interests, and the views of society today, and subject to the Commission's regulation mandate with respect to "emergency conditions", is there a different balance point between the interests that would be a better compromise than the one arrived at in the 1970 Order?

To obtain the required answers, the study will proceed by:

- Reviewing, summarizing and evaluating existing work. As stated previously, numerous biologic, aquatic, hydrologic modelling and other studies have already been conducted by various state and federal agencies and by public and private researchers. While much of this portion of the study should be straight forward, clearly certain key areas, such as the fishery, will require evaluation by independent experts. In addition, it will be necessary to document areas of insufficient or inconclusive information.
- Performing additional work where necessary. Hydrologic modelling will be conducted to provide an independent assessment of the model results achieved to date, which are of critical importance as they are the basis of all conclusions regarding the benefits of the proposed new curves. The ability to mitigate, through improved inflow forecasting and reservoir operations, the increased flood risk deemed to be associated with the proposed new rule curves will be assessed. Also, detailed analysis of flood frequency, flood risk and flood damages will be conducted.
- Soliciting and evaluating input from others. While direct study activities will be restricted to the geographic area covered by the 1938 Rainy Lake Convention, it is recognized that the proposed new rule curves may have impacts on areas downstream of Rainy Lake. This aspect will be addressed by providing the results of the hydrologic modelling to the responsible downstream agencies and to interested groups, in whatever form they require, and requesting that they perform their own assessment and advise the study team of their conclusions. All input received will be evaluated and the need for any further work will be assessed.

The initial products from the study will be the results of the hydrologic modelling and inflow forecasting efforts and the summaries of all of the existing data and information. These will be submitted to the Commission in the form of a Status Report. Work will then proceed on the evaluation of the information available in all technical areas, leading to an assessment of the impacts of the proposed changes. At

this stage it will be necessary to factor in any differences in the expected lake level and outflow results revealed by the hydrologic modelling, and any benefits that might accrue from the inflow forecasting work. Coordination of effort among the technical areas will be important. Some further modelling work and some re-assessment of certain factors may be expected if the results raise more questions or suggest minor variations in regulation. This stage will result in a draft report to the Commission, with recommendations and conclusions. Since the evaluation process leading to these recommendations and conclusions must necessarily be a subjective one, which will consider both social and economic values, and attempt to balance both quantifiable and intangible benefits, the rationale used will be fully explained in the report.

A summary of the study process is presented in Figure 1. Specific details of the study methodology are provided in the last section.

INVOLVEMENT OF THE PUBLIC AND OTHER AGENCIES

Involvement of the public as the work progresses is intended to be a significant component of the study. By periodically providing information and seeking input, and by involving all the players and affected parties, it is hoped that a consensus can be reached that is widely acceptable to stakeholders. Further, if changes to the existing rule curves are recommended, it is expected that they would initially be implemented on a trial basis, allowing for further public involvement.

As a first step in involving the public and other agencies, this study plan was distributed in draft form to allow for input on the study process, and was revised based on the comments received. Next, as shown in Figure 1, a status report, summarizing the existing work and the results of hydrologic modelling and inflow forecasting, will also be made available for review and comment. This in particular will provide an opportunity, for those who have already provided input, to confirm or revise their position. At this time the detailed model output will also be made available to those Rainy-Namakan groups who have already conducted their own studies, to allow them to re-assess (if necessary) the impacts from their own perspective. Finally, the study report, with conclusions and recommendations, will be made available in draft form, providing an opportunity to respond. Since this report will include a full explanation of the rationale used in arriving at the recommendations and conclusions, the public will be able to provide input not only on the study results but also on the assessment process and decision criteria. Comments received at this stage will be incorporated into the final report and, should any significant shortcomings in the methodology be revealed, the results themselves will be re-assessed. In between these primary contact points, the study team will maintain contact with affected agencies and with members of the public requesting more involvement.

In addition to the above, the involvement of certain agencies will be sought in specific areas. The dam owners and operators (*When the Steering Committee proposal was submitted, the United States portions of the rainy and Namakan outlet works were owned by the Boise Cascade Corporation and the Canadian portions were owned by its subsidiary, Boise Cascade Canada, Limited, which managed the lake levels. Since that time the Canadian firm has gone through several changes. It is now part of Stone-Consolidated and is no longer controlled by Boise Cascade.*) will be consulted during the early stages of the hydrologic modelling work concerning their lake management experience. The Steering Committee and the Minnesota Department of Natural Resources, who as proponents of the proposed new rule curves have suggested that improved inflow forecasting could mitigate increased flood risk, will be asked to play a significant role as part of a team in assessing this potential and developing this capability if possible. The Minnesota Department of Natural Resources and the Ontario Ministry of Natural Resources will be asked to provide input on the impacts of the proposed changes on the Rainy River. Similarly, the International Rainy River Pollution Board will be asked to provide input on impacts on the Rainy River in general and to advise on minimum Rainy Lake outflow criteria

in particular. Regarding Lake of the Woods and areas further downstream, the altered outflow record from Rainy Lake will be provided to the Lake of the Woods Control Board (*This Board, whose legislated mandate to regulate Lake of the Woods and the Winnipeg River is broader than that currently assigned to the IJC with respect to Rainy and Namakan lakes, is the logical agency to lead a review of the impacts of the rule curve change on the waters it controls.*) and also to any other agency or group that requests it, and they will be asked to conduct their own assessment and to advise the study team accordingly.

ORGANIZATIONAL STRUCTURE AND RESOURCE REQUIREMENTS

The study will be led and coordinated by the Co-Chairs of the International Rainy Lake Board of Control. On behalf of the Commission, they will be responsible for the direction of all work, the provision of guidance as required, the approval of all communications and reports, the assessment of all results, the weighing of the alternatives, the preparation of the final report with conclusions and recommendations, and its submission to the IJC. It will of course be up to the Commission to decide on what action, if any, to take; in the meantime, the existing rule curves will remain in effect.

The Co-Chairs will each use Project Managers to supervise the study activities on a day-to-day basis. Significant portions of the study work will be done by the Co-Chairs' own and other governmental agencies, but some tasks will be contracted out and, as already noted, some work and participation will be solicited from other agencies or groups. For example, the evaluation of the fisheries issue will be contracted jointly to two fisheries experts, one Canadian and one American. The assessment of inflow forecasting will be by a small working group assembled by the Co-Chairs, in which the agencies supporting rule curve change will be asked to play a significant role to ensure that their thoughts on the matter are fully explored, and also the dam owners to ensure that their experience in actual operations is available. Regardless of how the various components of the study are carried out, all review and evaluation of existing work, and all final assessment of new work, will be conducted by independent, impartial persons with the appropriate skills and knowledge.

Final estimates of resource requirements will not be available until the study team is assembled and has planned in detail how the study will be conducted. However, at this stage it is recognized that significant personnel resources will be needed, and it is estimated that the likely cost will be about \$200,000 US (proposed to be shared equally between the two countries). The governments that normally would support this work are currently operating under restraint programs or even downsizing programs. Thus the ability to proceed with the study is dependent on adequate support being approved and made available.

STUDY METHODOLOGY

The following sections are intended to provide some further detail on how the study will be conducted in key areas. However, it must be recognized that the study itself will require a broader and more specialized expertise in a number of areas than was available to the Control Board in preparing this Plan. Consequently, this should be regarded as proposed methodology only, which will be revised as necessary in the early stages of the study. Once the study team is assembled and the appropriate experts to conduct the various components are identified, they will be asked to finalize the task lists and methodology and to establish their specific assessment criteria. Presently it should be assumed that any topic identified as relevant by these experts will be reviewed; no inferences should be drawn from topics either presently included in or excluded from the following sections. Nevertheless, the following is believed to be a good indication of the scope of the study, and it can be assumed that the methodology and the assessment criteria applied in each area of the study will conform with the generally accepted practice in each field.

I. Hydrologic Factors

A. Evaluation Process

Both the Steering Committee and Boise Cascade used hydrologic models to assess the lake levels and river flows that could be expected to result from regulating Rainy and Namakan lakes in accordance with both the existing and the proposed rule curves. The studies done by the Steering Committee to determine the environmental and socio-economic benefits of their proposed rule curves, and the studies done by Boise to determine the disbenefits of the new curves to hydropower and flood management, are based on the results of these models. Thus the validity of the hydrologic modelling results have a direct bearing on the validity of many of the conclusions and recommendations of these studies. The evaluation process outlined herein calls for independent hydrologic modelling to determine the resultant levels and flows from different methods of regulation (at a minimum, the existing curves, the proposed curves, and perhaps one other option). This is essential either to confirm the reported results tabled by others, or to determine more realistic outcomes based on more appropriate modelling assumptions. In particular, this modelling will determine if the water levels needed to realize specific benefits can actually be achieved at certain times of the year, and will provide a basis for flood risk assessment by determining the likely frequency and extent of flooding.

The proposed rule curves potentially increase the risk of flooding, a fact acknowledged by the proponents of the plan. The Steering Committee and the Minnesota Department of Natural Resources have suggested that improved reservoir inflow forecasting could offset this increased risk. To assess whether this is actually the case, it will be necessary to try to develop a suitable inflow forecasting capability and then see if it can be used effectively to improve operations. Given the Commission's regulatory mandate with respect to the avoidance of "emergency conditions", and since the rising limbs of the proposed rule curves closely approximate earlier IJC curves that were revised specifically to reduce flooding, it is clear that flood risk will need to be assessed very carefully. This must be done for both the proposed and the existing rule curves, and both with and without the benefit of any inflow forecasting capability that may be developed.

Further, with the existing Order under review, it is logical to address several other hydrologic issues not directly related to the new rule curve proposal. These would include the question of whether rule curves are still the best means of regulating these lakes, whether some form of balancing of water between the lakes should be provided for, how the uncontrolled overflows from Namakan to Rainy should be accounted for, and whether the same minimum outflows from the lakes are still appropriate.

B. Tasks

1. Hydrologic Modelling

The initial steps will be to review and critique the several modelling exercises conducted to date, and to consult with the dam owners and operators regarding their lake management experience. The outcome of these steps will be a summary of the model results, the pros and cons of each approach, a linkage between the pros and cons and the results (to explain identified biases in the results, etc.), and a compilation of modelling criteria to be employed in the followup modelling (criteria needed to correct any shortcomings of the modelling to date, or to address additional issues that were not initially perceived as important). A suitable model will then be adopted, adapted or developed, new results will be produced for both the existing and proposed rule curves, and these results will be compared with the results obtained in the earlier studies by others. The new model results will of course be supplied to these other study groups or to agencies directly involved with Rainy and Namakan lakes, to enable them to evaluate the impacts of the different operating modes on the environmental, fisheries and socio-economic aspects. The

results will also be made available to downstream interests and agencies, and their feedback on downstream impacts will be sought. (Specifically, input will be sought from the International Rainy River Pollution Board; from the Minnesota and Ontario Natural Resource departments; and from the Lake of the Woods Control Board.) The public will also be advised as to the relative impacts or consequences of the two modes of operation. Any new approaches to regulation or proposed variations on the two sets of rule curves that arise either from the modelling work or feedback to it will be documented, and minimal modelling work may be done to evaluate one additional alternative.

2. Inflow Forecasting

The initial step will be to determine the potential to mitigate flood risk through improved inflow forecasting. This will be done with the hydrologic model by seeing if reservoir operations can be significantly improved with perfect foreknowledge of inflow events and, if so, the extent of foreknowledge required. If the extent of foreknowledge required might realistically be achieved through an actual forecast, the investigation will proceed to the next stage of seeing if such a forecast can be developed. This stage will include a review of the forecasting methods developed for the basin to date, an assessment of other potential methodology, an assessment of any additional basin monitoring that would be required and the cost of its implementation and operation, and then the development, calibration and testing of the adopted approach. The final stage will be to assess the extent of flood mitigation likely to be achieved, and other operational benefits or disbenefits, by running the hydrologic model both with and without the inflow forecast. If overall improvement is achieved, then this benefit will be reflected in the hydrologic model results that are subsequently used as the basis for assessing flood risk and damage under the two sets of rule curves, and the damage benefits will be compared with the cost of operating the forecasting system.

3. Flood Risk Assessment

Based on hydrologic modelling results for both the existing and proposed rule curves, and both with and without the benefit of any inflow forecasting capability that may be developed, elevation-frequency and elevation-duration curves will be produced. These results will be provided to the economics reviewer to develop average annual damages and incremental damages comparisons for each method of regulation tested.

4. Other Hydrologic Issues

Regarding the minimum outflow criteria for Rainy and Namakan lakes, the appropriate Minnesota and Ontario departments/ministries, and the International Rainy River Pollution Board (with respect to Rainy Lake outflows) will be asked to assess the situation and make recommendations. This will be done early in the hydrologic modelling exercise so that any revised criteria will be reflected in the model results. Regarding the Bear Portage and Gold Portage overflows from the Namakan Chain into Rainy Lake, the impacts of these flows on lake levels at critical periods (such as low inflow periods under summer water level conditions) will be assessed and recommendations made to the Commission. The overflows are not accounted for in the current Order, and, in conjunction with the minimum outflow specified at Kettle Falls, can make it difficult to maintain the level of Namakan Lake. As well, the discharge capacity of Gold Portage has increased since the current Order was developed.

Regarding the question of whether rule curves are the best approach and the question of balancing of water between lakes (between Rainy and Namakan or between these lakes and further downstream), specific tasks are not yet readily definable. The effort and direction taken will be somewhat dependent on how the rest of the work evolves and on the feedback received. The issue of rule curves versus an alternate approach is important in light of the growing recognition of the environmental

benefits of not having very similar levels every year. The issue of balancing is important in the context of considering the river system as a whole, not just separate portions of it. Preliminary comments on both issues will be prepared for the Commission but if, for example, the best solution for Rainy-Namakan was found to result in significant negative impacts downstream, the issue of water balancing would require more attention.

II. Environmental Resource Factors

A. Evaluation Process

The process for the evaluation of ecosystem concerns will include a review of all concerns identified in the existing studies to date, as well as any additional concerns that may be identified by the expert reviewers once the study commences. The ecosystem concerns described herein have been identified for initial emphasis in the review. This plan of study recognizes that a large volume of data and analyses has already been completed. The review effort conducted under this plan may reveal that insufficient information exists for an ecosystem component for the purposes of deciding between the two rule curves. Any deficiencies or uncertainties will be noted and described, including suggested methods for correcting them. Also, the hydrologic modelling review may invalidate some of the conclusions reached in prior environmental studies under review. These impacts will need to be considered. Further, the review should concentrate on the proposed changes in the rule curves. Separating the rule curves by seasons and lakes will assist decision-makers in deciding which portions, if any, of the proposed changes in rule curves have merits.

The environmental review should be conducted from the perspective of determining whether the existing or the proposed regulation would best provide the most benefits for the environmental resource ecosystem components. The survey of existing information conducted for preparing this plan of study has resulted in the identification of the following ecosystem components that should receive initial emphasis in the review and evaluation process: a) Restricted annual variability (band type curves); b) Decline in and/or less than optimum walleye, northern pike, whitefish, and cisco populations and habitat quality; c) Less diversity and density of aquatic plants than natural systems; d) Concern with low densities and reproductive success of grebe, loon, and marsh nesting birds; e) Lower densities and diversity in benthic (bottom-dwelling) organisms in the littoral zone of the lakes; f) Winter mortality of amphibians and reptiles; g) Erosion and loss of important cultural resources sites; h) Downstream impacts on Rainy River. Other ecosystem concerns identified during the review process will receive consideration as well.

B. Tasks

1. Critique, Summarize and Evaluate Existing Data and Information

The existing data and information will be critiqued and summarized for the identified environmental resource ecosystem components. These components will be evaluated under the existing and proposed methods of regulation, with initial emphasis placed on the following concerns and potential causal factors:

- Restricted annual variability (band type curves) The proposed rule curves would not change this over existing conditions. However, this may impact some of the ecosystem components identified and needs to be considered in the evaluation under other causal factors. In addition, any opportunities to improve fish and wildlife conditions under the existing and proposed rule curves should be identified. Natural systems depend on infrequently occurring events (drought and floods) to refresh the system. There may be opportunities that nature presents to simulate these infrequently occurring events, while not appreciably affecting the existing economics.
- Decline in and/or less than optimum walleye, northern pike, whitefish, and

cisco populations and habitat.

- Effects of delayed high water until early summer on the availability and quality of walleye and northern pike spawning habitat.
 - Effects of high, stable summer and fall water levels on the quality of available walleye spawning habitat.
 - Effects of winter drawdown on the fall spawning whitefish and cisco
 - Effects of winter drawdown on availability and quality of overwintering habitat
 - Over-exploitation
 - Abiotic factors affecting spawning success
 - Competition with non-native species (black crappie)
 - Less diversity and density of aquatic plants compared to natural systems
 - Effects of high, stable summer and fall water levels on aquatic plants
 - Effects of winter drawdown on drying and freezing of aquatic plants
 - Effects of restricted year-to-year variability in water levels
 - Effects of water clarity (tea colored water)
 - Concern with low densities and reproductive success of grebe, loon, and marsh nesting birds
 - effects of delayed high water until early summer on nesting success
 - effects of a less diverse and abundant aquatic plant community on marsh nesting bird reproductive success
 - disturbance from human activities
 - Lower densities and diversity in benthic (bottom-dwelling) organisms in the littoral zone of the lakes
 - Effects of winter drawdowns on benthic productivity and diversity in the littoral zone of the lakes
 - Effects of a less diverse and abundant aquatic plant community on benthic productivity and diversity
 - Winter mortality of amphibians and reptiles
 - Effects of winter drawdowns on the survival of wintering amphibians
 - Erosion and loss of important cultural resources sites.
 - High summer and fall water levels, in combination with intense wave action causes bank undercutting and slumping.
 - Downstream impacts on the Rainy River
 - The Rainy River extends from the dam at Rainy Lake about 80 miles before entering Lake of the Woods. Water levels and current patterns in most of this length are influenced primarily by releases from the Rainy Lake dam. Instream flow needs for the Rainy River were only briefly discussed, and no analysis was completed to evaluate the existing versus proposed discharge curves.
2. Assess Significance of Incremental Changes and Draw Conclusions A comparison of conditions under the proposed rule curves versus the existing rule curves will be prepared, in quantitative terms to the extent possible but also qualitatively. Conclusions will be drawn from the evaluation, reflecting the significance of the incremental changes in impacts on the environmental resource ecosystem components. By attempting to define benefits/disbenefits incrementally for a range of water levels between the existing and proposed curves, it will be possible to consider variants that may still deliver some of the desired benefits while avoiding unacceptable disbenefits.
3. Focus the Review With Specific Questions

The review will be focussed by addressing specific questions, which will be

finalized by the study team based on the following examples. A number of these examples deal with the fishery since its condition is a key area of concern and one of the prime reasons for considering rule curve change, but similar questions would be posed as well for other environmental topics. Example questions are: a) Are the concerns/perceived problems valid? b) Would the proposed rule curve changes contribute, and by what magnitude, to meeting the objectives established for the proposed resolution to address the concerns/perceived problems? c) Would other causal factors (either outside of the IJC's control or not addressed by the proposal, such as restricted year-to-year variability or competition from other species) mask any effects of the proposed rule changes? d) How significant a factor is over-exploitation of the fishery compared to other causal factors in the reported decline of the fishery? e) Will the proposed method of regulation make a difference in improving the fishery or are causal factors outside the method of regulation predominant? f) Are all of the proposed changes required to effect a benefit to the fishery or is there room for compromise? g) Would other types of changes be more effective than changing the method of regulation? h) Is there sufficient information to address the preceding questions for each ecosystem component? I) If the answer is "no" to the preceding question, what additional studies would be warranted?

III. Economic/Social/Recreational Factors

A. Evaluation Process The evaluation process requires two steps: a) establish a baseline of current economic, social and recreational values in a number of categories for the existing rule curves, and b) estimate the incremental changes in values that would result in the same categories with the adoption of the proposed new rule curves. The evaluation will be in quantitative terms to the extent possible, primarily in dollars, but will be qualitative where necessary.

The survey of existing information conducted in the development of this plan of study has resulted in the identification of the following economic, social and recreational impact categories that should initially be considered as a part of the review and evaluation process: a) domestic water supply, b) navigation, c) hydropower, d) flood damages, e) tourism, f) recreation, g) commercial fishing, h) erosion, and I) transportation needs of native peoples. This study will review and evaluate these impact categories for Rainy and Namakan lakes only. As stated previously, the study team will count on the responsible agencies and interested groups in the downstream areas to perform similar assessments and advise the study team of their results. These results will be evaluated and the need for further work will be determined.

Existing information and data are to be utilized in conducting this review and evaluation process. The hydrologic modelling review may invalidate some of the conclusions reached in prior economic/social/recreation studies under review. These impacts will need to be considered. If existing information and data do not allow reasonable quantitative estimates of incremental changes in economic, social, and recreational impacts to be developed, then a qualitative evaluation in each case will be provided. Data deficiencies in such cases will be noted and, where warranted, a description of the data and methods by which they can be remedied will be provided.

B. Tasks

1. Critique, Summarize and Evaluate Existing Data and Information

For each of the nine impact categories previously identified in the evaluation process, existing data and information will be critiqued and summarized. These categories will then be evaluated for conditions under the existing rule curves to establish a baseline for later comparisons. Impact categories will be

evaluated quantitatively where possible. Any exceptions, whether due to lack of data or the superiority of an alternative measurement approach, will be discussed.

2. Make Comparisons of Incremental Changes in Impacts

With the baseline established, this step will estimate the incremental changes in values that could be anticipated under conditions with the proposed rule curves in place. These should stem directly from changes in water levels and flows that result from the proposed rule curves. Some indicators of measurable changes in impacts for each category are suggested below to serve as a starting point for comparisons:

- Domestic water supply: incremental costs, if any, associated with access to adequate water supplies as a result of the proposed rule curves
- Navigation: incremental change in public and private revenues on an average annual basis associated with lake navigability, examining the change in usage for the following activities: dock and launch access for power boats; adequate depths for sailboating; lake access from river tributaries and bays by houseboat businesses and individual boaters; and boating safety/harbor of refuge/dredging issues as costs avoided.
- Hydropower: incremental change in hydroelectric output and the dollar value of change in output, on an average annual basis
- Flood damages: incremental change in exposure to flood damages on an average annual basis, taking into account such factors as the number of potentially vulnerable structures, their location and elevation, and their estimated value
- Tourism: incremental change in tourism and resort revenues that can be estimated on an average annual basis. Emphasis should be placed on the incremental change to Voyageurs National Park as a major tourism draw in the region.
- Recreation benefits: incremental change in value of recreation benefits, on an average annual basis, examining the change in usage for beach use and recreational fishing. These activities should be examined from both public use and private riparian landowner use perspectives.
- Commercial fishing: incremental change in the average annual value of commercial fishing harvest associated with the proposed rule curve
- Erosion damages: the incremental change in exposure to erosion damages on an average annual basis, taking into account the value of land and facilities subject to loss.
- Transportation needs of native peoples: the incremental change in costs necessary to provide alternative transportation arrangements, comparing conditions under the existing rule curves versus the proposed rule curves

Other indicators of measurable changes in impacts for each category that are identified during the review will be evaluated in addition to the aforementioned indicators initially identified for study.

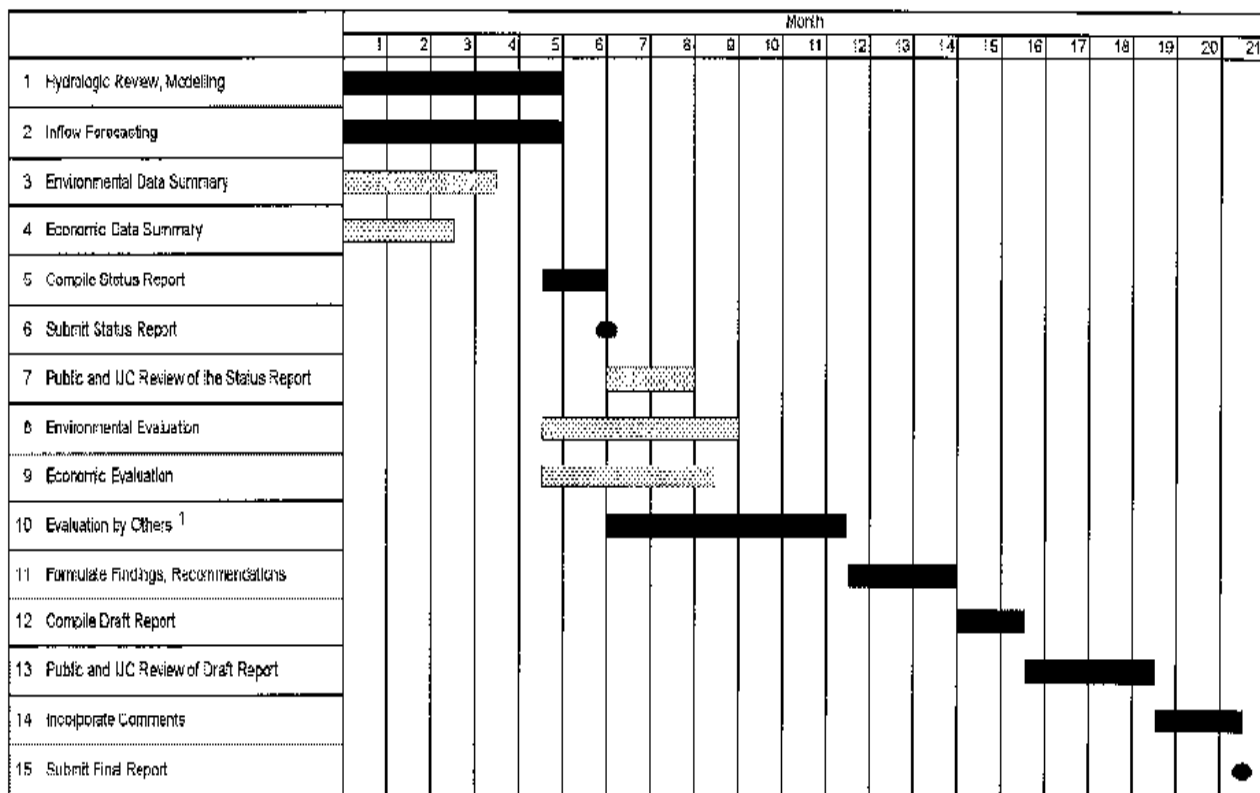
3. Assess Significance of Incremental Changes and Draw Conclusions

A comparison of conditions under the proposed rule curves versus the existing rule curves will be prepared for the identified economic, social, and recreational impact categories. This comparison will focus on the incremental changes in impacts between the two rule curves rather than on the absolute

magnitude of impacts. Conclusions from the evaluation reflecting the significance of the incremental changes in values will be developed.

Figure 1

REVIEW OF THE 1970 IJC ORDER FOR RAINY AND NAMAKAN LAKES



¹ Includes evaluation by upstream and downstream interests as well as by Rainy and Namakan interests.

LEGEND Critical [Solid Black Box]
 Non-critical [Dotted Box]
 Report [Dot]