

July 31, 2009

Re: Peer Review of the Study Board Document, *Socio-Economic Sector Evaluations of Lake Superior Regulation Plans for the International Upper Great Lakes Levels Study* (IUGLS)

The Review Team convened by the Independent Review Group (IRG) has assessed the *Socio-Economic Sector Evaluations of Lake Superior Regulation Plans for the International Upper Great Lakes Levels Study* methodology proposal developed by the Lake Superior Study Group of the IUGLS. The Review Team has participated in a thorough discussion with the PEG, the IUGLS Study Managers, and the International Joint Commission's (IJC) Engineering Advisors concerning the proposal.

The Study Managers has been asked to respond to the IJC's Directive to "review the operation of structures controlling Lake Superior outflow in relation to impacts of such operations on water levels and flows, and consequently affected interests assess the need for changes in the Orders or regulation plan to meet the contemporary and emerging needs, interests, and preferences for managing the system in a sustainable manner, including climate change scenarios; and evaluate any options identified to improve the operating rules and criteria governing Lake Superior Outflow regulation". In particular this Review Team was tasked with reviewing the methodology pertaining to socio-economic evaluation of the Lake Superior regulation plans.

For the most part, the Review Team finds the methods to be appropriate and sufficient to inform water resources decision makers with a few exceptions noted below. The Review Team has also developed suggestions to improve the evaluation strategy. Based on the review of the proposal and the technical discussion, following are Review Team comments on the proposed methodology. These comments should be considered along with the IRG's previous report in May 2009 concerning Lake Superior regulation plans.

A. Study Objective and Focus

The study objectives can be summarized under the following statements:

(a) At the outset, the strategy document states that "The key goal of the International Upper Great Lakes Study is to formulate and evaluate options to improve the rules for regulating levels on Lake Superior." (page iii).

(b) The document then expands the description of the goals by re-stating the IJC Directive to the Study Board (page xi) to: "examine physical processes and possible ongoing St. Clair River changes and its impacts on levels of Lakes Michigan and Huron; review the operation of structures controlling Lake Superior outflow in relation to impacts of such operations on water levels and flows, and consequently affected interests; assess the need for changes in the Orders or regulation plan to meet the contemporary and emerging needs, interests, and preferences for managing the system in a sustainable

manner, including climate change scenarios, and evaluate any options identified to improve the operating rules and criteria governing Lake Superior Outflow regulation”.

(c) The IJC Directive then concludes (page xii) that “In carrying out this mandate, the Study Board is encouraged to integrate as many relevant considerations and perspectives into its work as possible, including those that have not been incorporated to date in assessments of The Upper Great Lakes System regulation, to assure that all significant issues are adequately addressed.”

(d) Further, after revisiting the IJC Directive, the strategy document states that (page xii), “So, the fundamental purpose of the study is to develop and evaluate a set of alternative regulation plans that improves the current regulation plan 77-A”. And on page 1, “This strategy paper deals with only the rules for regulating Lake Superior releases.”

The strategy document then discusses some biophysical facts that begin to question the efficacy of studies with objectives (a) to (d). Starting on page 5 and continuing on to page 6, and particularly the figures on page 6, it is noted that “...regulation has a very modest, if not negligible effects on the extremes of the water levels spectrum.” (page 5). And on page 3, “any new regulation plan is expected to have a relatively small impact on water levels ... making it difficult to quantitatively differentiate the impacts of the new plan from the existing one”.

The Review Team is concerned that, in framing rather sweeping objectives in response to the IJC Directive, the Study Team may be raising public expectations as to the degree to which the regulation of Lake Superior may be modified to meet the competing needs of water users and shoreline interests around Lake Superior and the downstream lakes of the upper Great Lakes. A realistic account of the possible changes in water level regulation is particularly important given the shared vision planning approach identified in the methodology. The ultimate resolution may well be based on “informed consent” under which is understood that adaptation, not absolute control, is a key element of the regulation strategy. Studies that specifically identify the relevance of Lake Superior regulation to levels regimes of downstream lakes, given the historical record, are important to considering public expectations. This will provide context for any proposed improvements to Lake Superior outflow regulation.

The IJC specifically directed the study to examine climate change issues. Feasible climate change scenarios could radically change the inflows to Lake Superior. Detailed site investigations and study of water uses are important to determine the range of lake levels, including those outside the historical range, which pose problems.

The final step would be to integrate the economic and ecosystem stresses as a function of lake level, with the climate change scenarios, and changed physical characteristics and outflow management to determine optimum plans in the interests of uses and the ecosystem.

The Study Group should ensure that the stated objectives of the study in response to the IJC’s Directive do not raise unwarranted expectations by the public.

B. Integration across use studies and the ecological studies, including study criteria

There appears to no systematic integration of methods and criteria among the studies. For example, does the methodology allow us to say that a “navigation dollar” is equivalent to a “hydropower dollar”? One integration gap appears to be the development of climate change scenarios, and the implications of climate change. Each of the study areas and disciplines needs to be involved in the development of the parameters for the climate change studies since the uses and disciplines are best placed to understand the potential stresses.

There does not appear to be a consensus on the study time period. The most common reference within the methodology document is to a 100-year planning horizon, but this should be stated clearly for each study component.

There is no reference to the sequencing of studies in terms of time lines. For example the use and ecological studies should do a preliminary overview of existing knowledge of stresses posed by lake level regimes. The study teams should also recommend a research strategy to address key gaps by an early date such that the all study teams and Study Group have an opportunity to appreciate the big picture, and can discuss priority data gaps that may be critical to the overall study.

The Study Group should ensure that there is a high degree of consistency and integration across the various study sectors of this proposal.

C. Climate Change Stress Testing

The Review team agrees that climate change poses a particular challenge to developing an adaptive management framework for Lake Superior regulation. Probabilities associate with any particular climate change scenario cannot be calculated. An alternative is to develop scientifically-justified runoff scenarios that can have destructive consequences considering climate change. That is, what are the water level ranges outside the historical record where the society, economy, and environment within the upper Great Lakes basin are stressed? What are the effects and can they be mitigated?

A study and response strategy could look like the following. It would not utilize probabilities as such, but would use a reactive strategy based upon knowledge about damages. The current study at this stage would accomplish steps (a) to (c), with (d) and (e) as responses to future, uncertain events.

- (a) Determine Ecosystem and Economic System Stresses at the historic range and say +20% and -20% change above and below that range



(b) Develop scientifically-sound climate change scenarios that meet this criterion



(c) Apply early warning indicators from part (a), identifying potential damages.



(d) Conduct research on management and remediation strategies as conditions evolve.



(e) Evaluate benefits and costs of management and remediation strategies relative to the benefits and costs of waiting for more information, and conducting further research.

While the Review Team considers that climate change stress testing is an important component of this study, the approach identified in the previous discussion should not be taken as prescriptive.

D. Irrigation Water Use

Irrigation water use is given the same priority as hydropower use in the *Boundary Waters Treaty* yet it receives no explicit discussion in the study proposal. It is the Review Team's understanding that current withdrawals for irrigation in the upper Great Lakes are similar to those for municipal purposes. Yet irrigation use is largely consumptive while municipal use is largely non-consumptive. Even so, it is likely that current irrigation water use is not particularly relevant to the regulation of Lake superior.

However, under a climate change scenario, with irrigation water use increasing, this situation may not continue, as irrigation may become both a large withdrawal use and consumer of water. Increased irrigation may also lead to nutrient and contaminant laden return flows that may have localized ecological effects.

The Study Group should be directed to review the current level of irrigation water use and place that use in the context of current water demands in the basin. If present water use or projected water use under climate change is significant, the socio-economic effects of irrigation water use should be explicitly considered in the Lake Superior regulation plan.

E. Hedonic Price Model.

The hedonic price index model proposed (page 48) will likely not work to estimate potential damages over the range of extreme events. The model can be used in episodic cases of one particular event, and then with time series data evaluate the damage with and without the event. The model also is very data and time intensive. As an alternative, we suggest a focus on the top five percent of communities having the highest sensitivity to low/high water impacts with the objective of starting to build a repository of actionable data.

F. Secondary Benefits and Regional Expenditures

The methodology proposal (page 80) does not provide specific guidance for the study groups to address secondary benefits and regional expenditure. This is a significant omission. Secondary (negative) impacts on regional economies may be severe if lake level regimes shut down shoreline activities. This is important to shoreline communities that are heavily dependent upon shoreline developments for a large share of community income. As lake level regimes foreclose these economic opportunities, other opportunities are not possible due to geographic isolation or workforce skill sets, and infrastructure that cannot easily be adapted to new economic uses. Second, aboriginal groups, and other low-income households may also be disproportionately affected by lake level regimes. It is recommended that an overview of potentially sensitive communities and disadvantaged groups that could be affected be undertaken. This could be accomplished with the use of census data, which could be overlaid on a site map of affected activities that the study groups could prepare. The Study Group should be directed to prepare or become aware of plans and scenarios that affect regional economies, disadvantaged groups, and low-income households.

G. Detailed Comments Based on Study Proposal

The following detailed comments on the study proposal are editorial in nature. They are provided for the information of the Study Team.

Page xi. What were the drive or energy, the public issues and the political circumstances that led to the IJC Directive to the Study Board? Has this political/social climate changed since the Directive was issued? Can this be made explicit such that the study is continuously aligned to meet the expectations and deal with the perceptions of the evolving political/social climate? There do not appear to be separate studies related to the institutional framework that would assist this process. What is the nature of study results that would be difficult to explain, or have the greatest acceptance for implementation?

Page 13. “The Upper Great Lakes region includes U.S. counties with unemployment rates of over 20 percent, and the future of the U.S. and Canadian auto industry appears tenuous.” Statements such as this refer to current conditions which may be short term and immediate trends which could be irrelevant in the context of the long-term implications of proposed regulation plan. We suggest developing a report section on economic context and policy to frame the analysis assumptions.

Page 17. The third and fourth paragraphs appear to be at odds. The third paragraph states the economic conditions will stay at current levels for the 100-year planning horizon. The fourth paragraph states that the contextual narrative will provide the Board information on trends. So there will be a “business as usual” forecast in some way, but the third paragraph states no, for example the amount of water withdrawn for cooling will be at today’s levels. What is the answer?

We suggest that the study would get useful information for evaluation purposes with access to trends forecast, and another higher growth scenario. Comparisons among the three in plan formulation may show that economic growth forecasts may or may not affect decision- making. This is a useful result.

As such, we propose the evaluating the following economic scenarios.

- (a) The current economy going forward for 100 years, with and without climate change (no economic trends)
- (b) The current economy going forward for 100 years, utilizing current economic trends, with and without climate change.
- (c) A high economic growth scenario going forward for 100 years, with and without climate change.

Scenario (c) could incorporate expert opinion on the upside to growth of the Midwest economy. One positive sign for growth is the growing importance of ocean shipping, containerization, rail and containerization trends. The Midwest, and Chicago in particular, are poised for major expansion within a world-wide system of growing trade, given its strategic hub location between rail and water transport, mid continent joining all three coasts. There are other upside potentials for the Midwest that need to be investigated, including the role of carbon credits and sequestration. This will be driven by international protocols and carbon trading. Given the biophysical and climatic advantages for the region, growth in agriculture could result. This is an example. Not much is known about this yet but it needs investigation. There may be other upside opportunities as well.

Page 18. “The Board’s recommendation for a new regulation plan or order is unlikely to have much effect on hydropower production at the stations in the St. Marys River, and most likely no measurable effects at downstream hydropower stations on Lake Michigan, the Niagara River, and on or near the Welland Canal.”

If this is the case, why do the hydropower analysis at all? That said, there may be major implications from climate change scenarios that require new release works at the St. Mary’s River.

Page 24. Electricity price forecasts. The price of electricity could increase in an economic growth scenario in which carbon credits, sequestration requirements become important. Also the profitability of hydroelectric power could increase since it would not likely require carbon credit offsets. As the quantity of water in the St Marys River is

insufficient to operate the installed hydro capacity continuously, one could also contemplate complementary operation of hydro and wind power in such a way as to provide higher valued hydropower for peaking.

Page 27. “The primary performance indicator for commercial navigation will be changes in the cost of shipping.” This is reasonable, but may not capture the total cost of losses to commercial transportation due to low water levels. If there is a shift to less economic and environmentally desirable modes, such as rail and especially trucking, the increased costs may occur outside commercial navigation. The environmental consequences of increased greenhouse gas emissions would also need to be noted. Also diversion to trucking causes additional wear and tear to roadways that could be overlooked. (This point is covered to some degree in the last paragraph of section 4.2.3 on page 28).

Page 29. How will the study team capture information on commodity changes using one year of data?

Page 29. “Quantification of M&I impacts is hampered because of the lack of definitive information on intake pipe location and vulnerability to low water levels, and the expense of obtaining comprehensive data.” Information on intake pipe and outfall pipe location and vulnerability is absolutely essential to undertake the study, to determine lake level impacts on these facilities. Study resources to undertake such surveys are essential. On pages 33 to 36, there appear to be comprehensive surveys of intakes and outfalls. So there is confusion between the meaning of the discussion between page 29, and pages 33 to 35. Exactly what is the problem with current data?

Page 30. “...the effect of M&I use is barely noticeable in comparison to the renewable flows in Great Lakes” “Most of the water that is withdrawn is returned to the basin.” It would be potentially useful to disaggregate the municipal and industrial uses. One can reasonably assume that most water withdrawn for municipal purposes will return to the basin. One can also assume, that with reasonable water conservation measures – Denver, for example – water demands for municipal purposes will not increase even with significant population increases. The same assumptions may not apply to industrial water use, but knowledge of existing industrial uses can be used to make an informed projection of future use.

Page 35. A more convincing argument should be made for considering only intakes and low levels, to the exclusion of outfalls and high levels

Page 37. Water use demand is described, forecasting demand to the year 2040. Why wasn't the forecast period 100 years, the same as most of the other studies in the program?

Page 39. The sample sites miss two very important boating sites: Michigan City, IN/New Buffalo, MI, and Traverse City, MI. The study should state the criteria used to select sites. Should the criteria be based on the local importance of tourism and recreation?

Page 41. Last sentence is mis-worded. However, the IRG feels that the estimated economic value of these economic sectors (tourism, recreational boating, cruise ship) should be presented in order to put the importance of these issues into context.

Page 43 – Page 47. Coastal Zone Processes- low and high water damages, and erosion damages to riparian property. It is not clear from the methodology document what the performance indicator for this use. “At this time, with the exception of low water impacts, the Coastal Zone TWG is not planning to use dollar values (for example average annual damage due to flooding) as part of the Stage 2 Pls. It is hard to imagine not having dollar estimates of damages a performance indicator. Without it, the Board would have perhaps information on the number of riparian properties affected. The severity of the damage needs to be known for levels regulation purposes, and floodplain management to prevent damages from getting worse.

Also, could the historical experience of 1978-87 and 1999-2006 be used to estimate actual economic impacts of high/low levels?

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