

DATE: June 24, 2011

## MEMORANDUM

FROM: Todd Redder, Joe DePinto, Scudder  
Mackey

PROJECT: IERM3

TO: Tony Eberhardt, IUGLS U.S. Manager  
Syed Moin, IUGLS Canadian Manager

CC:

SUBJECT: Response to Peer Review Comments for "Documentation of the Integrated Ecological Response Model (IERM2) for the International Upper Great Lakes Water Levels Study"

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### Introduction

This memorandum documents our responses to Independent Peer Review (IPR) comments received on April 26, 2011 for the IERM2 documentation report submitted on March 4, 2011 to the International Upper Great Lakes Study (IUGLS). The key concerns identified in the IPR comment documents are summarized along with our specific response to those concerns. A number of the comments were addressed in a final revision of the IERM2 documentation report, while other comments have been addressed with the responses provided in this memorandum. Specific revisions made to the IERM2 documentation report are noted within the responses to the individual comments.

### Responses to Peer Review Comments

Specific peer review comments and our responses are organized below for each of the two IPR reviewers.

#### Comments Submitted by Reviewer #1 (Dr. Chambers)

- 1. The reviewer commented that "Considerable attention ... is paid to identifying relationships between ecological indicators (listed in Table 2-3) and water quantity regime (magnitude, timing and duration of water level or flow). Yet even where such relationships are quantified, they are rarely used to identify thresholds (i.e., boundaries associated with ecological impairment)." A closely related comment was as follows: "The approach for setting thresholds needs to be clearly documented so that others can use this approach and verify it."*

Although the Fact Sheets in Appendix A summarize the approach for setting thresholds in a number of cases, we agree that this information needs to be featured prominently (yet concisely) in the main body of the report. To address this need, the IERM2 documentation report was revised to include a new section and a table (Table 3-2) in Chapter 3 that provides the following information for each of the Coping Zone (CZ) criteria:

- Rationale (i.e., approach and justification for developing the criterion from performance indicator results and expert judgment);
- Uncertainty & Limitations; and
- Sensitivity (i.e., to hydrologic/hydraulic scenarios).

**2. *The reviewer stated: “Ideally, criteria should be defined using statistical approaches to identify thresholds (e.g., regression tree analysis) or, for indicators where recommended ecological limits are available (e.g., wetland habitat required to support waterfowl populations), predicting the water quantity regime that sustains the desired ecological endpoint based on regression relationships between the indicator and water quantity.”***

Although we agree that a statistically-based approach (such as regression tree analysis) for identifying the CZ criteria would be preferred, there are insufficient data available to support such an analysis for any of the performance indicators included in the IERM2 model. Due to the limited timeframe and resources available for model development and application, the development of the CZ criteria has necessarily relied heavily on site-specific experience, expert judgment, and ecological theory to provide context and interpretation for limited available supporting datasets. The IUGLS Managers are well aware of these constraints and recognize that the uncertainty associated with the CZ criteria can only be adequately addressed through adaptive management.

**3. *The reviewer stated “the IERM2 includes a large number of indicators, making it difficult for managers and informed public to absorb and weigh in decision making.” It was suggested that the number of indicators be reduced by 1) omitting consumer (e.g., macroinvertebrate, fish, bird) indicators that were derived from plant indicators, and 2) combining wetland vegetation indicators.***

Although a relatively large number of criteria are being evaluated, it is important to note that the CZ criteria, and not the raw performance indicators (PIs), are the focal point of the decision analysis. Grouping of performance indicators (PIs) has already occurred as part of the CZ criteria development process. For example, the range compression criteria for Lake Michigan Huron (i.e., LMH-01 and LMH-02) integrate multiple vegetation indicators for wetlands in Saginaw Bay, Arcadia Lake, and other sites. We believe that it is important to maintain the full suite of CZ criteria, as there is little or no redundancy across the individual criteria. Finally, as suggested by the preliminary IERM2 application presented in Chapter 4, it is worth noting that only a limited number of CZ criteria have demonstrated sensitivity with respect to “Zone C” occurrences for the historical net basin supply (NBS) and alternative NBS scenarios (as indicated in Table 3-2 in the revised report). Although the Coping Zone Calculator generates results for each of the thirty-three CZ criteria for a given hydrologic/hydraulic scenario, logic in the Shared Vision Model only summarizes results for those criteria that have “Zone C” conditions reported (again, for a particular scenario). Because the Shared Vision Model filters the results, managers and other stakeholders are provided with only the pertinent information regarding CZ criteria responses.

**4. The reviewer commented “you discuss the need for vegetation to support consumer communities. What about vegetation preferences? Are some vegetation types or species better habitat than others?”**

A common theme that is embodied in many of the performance indicators, and discussed throughout the report and the individual Fact Sheets (Appendix A), is the need to maintain diversity in wetland vegetation to support a diversity of consumer species. For example, the importance of maintaining vegetation diversity to support abundant and diverse macroinvertebrate and wetland fish populations is addressed in Fact Sheets 03, 04, 13, and 14.

**5. The reviewer commented that it is “not clear what a P release indicator tells [us]. What if released P is rapidly taken up by growing vegetation? How does a change in P release rate inform regulation plans?”**

We recognize that the nutrient release indicator has significant limitations and is not sufficiently developed or supported at this point to be used to inform selection of regulation plans. Due to these significant limitations, this performance indicator was not used directly to develop any CZ criteria; rather, it is cited as providing additional support for CZ criterion “LMH-03”, which seeks to avoid monotonic increasing or decreasing water levels over decadal timescales. The limitations and uncertainty associated with the nutrient release indicator are noted at the end of Section 2.2.1.c in the revised report.

**6. The reviewer asked “why are some indicators related to elevation and others to water depth? It would be easier to follow if only a limited number of water quantity metrics [were used].”**

As described for the wetland vegetation rules-based approaches, recent water depth conditions and flooding/dewatering history are key factors affecting the dominant vegetation type at a particular wetland elevation. Therefore, it is necessary to use both water level and computed water depth (i.e., based on a specific wetland elevation) to support the calculation of wetland vegetation performance indicators. Again, it is important to note that the Coping Zone criteria, (and not the “raw” performance indicators) are the focal point of the decision analysis for regulation plans, and only three types of “water quantity metrics” are used for those criteria: 1) monthly water levels, 2) St. Marys River monthly flow rate, and 3) gate openings for the Compensating Works in the St. Marys River.

**7. Other comments and editorial suggestions:**

Other specific comments and minor editorial suggestions were addressed in the appropriate sections in the revised IERM2 documentation report.

### **Comments Submitted by Reviewer #2 (Dr. Bedford)**

**8. The reviewer commented: “The objectives of the work are not stated as such, but as tasks, purposes, questions, and various other wordings that can be interpreted as objectives. No subsection is entitled ‘Objectives’. They appear in various places in the document and are not always entirely consistent with each other.”**

A specific “objectives” section (1.2) was incorporated into the main body of the IERM2 documentation report and reconciled with implied statements concerning objectives throughout the contextual overview document and the main body of the report (e.g., Executive Summary).

**9. The reviewer commented: “While it may be lost on your audience, I do nonetheless think that in the name of scientific integrity you should make clear, more so than you have already done, what those limitations are. I think it especially important that you note the high variability among the individual PIs. Say explicitly where you are more and less uncertain.” A related comment suggests the need for “an entire section devoted to an explicit discussion of the limitations of the overall model and of individual components models”, and a follow-up suggestion is made that this information be summarized in tabular format. (Similar additional comments/suggestions are stated in the “Specific Comments” section.)**

As noted in our response to Comment #1 above, we agree that specific statements regarding uncertainty and limitations for individual PIs and CZ criteria should be incorporated into the main body of the report. To address this need, the IERM2 documentation report was revised to include a new section and a table (Table 3-2) in Chapter 3 that provides the following information for each of the Coping Zone (CZ) criteria:

- Rationale (i.e., approach and justification for developing the criterion from performance indicator results and expert judgment);
- Uncertainty & Limitations; and
- Sensitivity (i.e., to hydrologic/hydraulic scenarios).

**10. The reviewer commented: “Most importantly, if you and the adaptive management group are serious about adaptive management, say where improved data would help reduce uncertainty. Identify specific research needs. ... Pull all recommendations into one prominent place.”**

We agree that there is value in summarizing specific recommendations for informing and supporting adaptive management efforts. Therefore, Chapter 6 was added to the IERM2 documentation report to synthesize specific recommendations for adaptive management of the Upper Great Lakes ecosystem.

**11. The reviewer commented: “I am most concerned about the nutrient flux data. Insofar as this is one key measure of ‘ecosystem function’, which is a threshold variable between ‘coping zones’. I think it incumbent on you to identify the severe limitations embodied in this PI.”**

We recognize that the nutrient release indicator has significant limitations and is not sufficiently developed or supported at this point to be used to inform selection of regulation plans. Due to these significant limitations, this performance indicator was not used directly to develop any CZ criteria; rather, it is cited as providing additional support for CZ criterion “LMH-03”, which seeks to avoid monotonic increasing or decreasing water levels over decadal timescales. The limitations and uncertainty associated with the nutrient release indicator are noted at the end of Section 2.2.1.c in the revised report.

**12. The reviewer commented: “I also take issue with your statement that no historical data exist (p. 4) to guide us as climate changes ... superb paleo-ecological data exist for lakes and wetlands.”**

This statement in the contextual documentation has been modified based on discussions with Doug Wilcox.

**13. The reviewer commented: “In terms of Poff’s and others ‘natural flow regime’, timing is as important as magnitude and duration. You initially mention this fact, but then many of the PIs exclude timing.”**

In our view, timing of flow and water level regimes is considered either explicitly or implicitly for many of the Coping Zone criteria, although the timescales might be different than those typically considered for flow conditions in river systems. For example, the criteria that are based on St. Marys River flow refer to specific time periods (e.g., month of June) for which flow conditions should be evaluated. “Timing” is also important for many of the water level based criteria, although the relevant timescales often involve multiple years or even decades. Finally, there are several criteria for Lake Michigan-Huron that specifically address changes in water level on a seasonal basis (e.g., criteria “LMH-04” and “LMH-09”).

**14. The reviewer commented: “It seems especially important to me that the executive summary be written in plain English, with all acronyms spelled out.”**

Improvements to the Executive Summary were made in the revised version of the IERM2 documentation report to address this comment.

**15. Other comments and editorial suggestions:**

Other specific comments and minor editorial suggestions were addressed in the appropriate sections in the revised IERM2 documentation report.