Manuscript: Detection of Conveyance Changes in St. Clair River
Using Historical Water-Level and Flow Data with
Inverse One-Dimensional Hydrodynamic Modeling

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Name of Reviewer: _Colin Rennie

1. Are the objectives of the work clearly stated? 1 2 3 4 5

2. Are the methods employed valid, appropriate and sufficient to address the questions, hypotheses or the problem? 1 2 3 4 5

3. Are the observations, conclusions and recommendations supported by the material presented in the manuscript (e.g., data, model and analyses)? 1 2 3 4 5

4. Are the assumptions used valid and are the mathematics presented correct? 1 2 3 4 5

5. Is the manuscript well organized, material precise and to the point, and clearly written using correct grammar and syntax? 1 2 3 4 5

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Recommendation (please circle your response)

A - acceptable
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Comments (limit responses to one paragraph for each question; reference pages, charts, and data. Please distinguish if responses are of major or minor concerns.)

Please see detailed analysis below

A. What is the best/most unique part of the analysis?
- Modelling of all years, using all available data, to evaluate trends in conveyance

B. What is the most critical aspect of the study/analysis? Why?
- Matching good flow data to good water level data, because all conveyance estimates are based on these data.

C. Which aspect of the analysis/modeling is weakest? Why? How can it be improved?
- Lumping channel section and roughness into an effective roughness (see below). This probably can not be improved because sufficient bathymetry data may not be available for years other than 2007.

D. Are there any other suggestions that are related to how this analysis may be used more effectively or the results explicated in a more understandable manner?
- Some of the detailed statistical analyses may be better placed in appendices.

Please indicate any confidential comments to the Co-Chair(s) of the Independent Peer Review Group in the space below. Comments for transmission to the author(s) should be on a separate sheet attached.

The authors have presented a thorough statistical analysis of inverse HEC-RAS modeling to evaluate conveyance changes in the St Clair River. The results indicate that reaches at the first channel bend downstream of Lake Huron have undergone increased conveyance since 1962, and that conveyance of reach DP-PE in this bend has increased with respect to all other reaches. This is where dredging and scour have changed the channel section since 1962 (Bennion 2007). Furthermore, conveyance in the river as a whole has also increased. The results appear to be sound, but I have the following comments.

P26 A single bathymetry was used for all years, thus changes in conveyance were parameterized using an "effective roughness". In other words, changes in both channel section and roughness were parameterized by changing Manning's n. This is clearly stated in the conclusions, but the authors should make this explicitly clear earlier in the report (e.g. p.26). This lumping of channel section and roughness is convenient because multiple model bathymetries need not be created. This is particularly important given that survey data are not available for every year between 1962 and 2007. However less information is derived from the modeling, because it is not known whether changes in section or roughness are causing the change in conveyance. Furthermore, unrealistic Manning's n values were sometimes predicted. The high effective roughness for reach DP-PE in the 1960s (n~0.4) is likely because the 2007 channel section is larger than it was in the 1960s. Particularly unreasonable effective roughness values were predicted

for reaches which did not converge to unique values (Table 7, p51). Have the authors verified that their "effective roughness" approach yielded stable model results? In particular, were water surface profiles reasonably continuous between sections? Possibly, better model results could have been obtained if channel sections for a given year had been input, and roughness calibrated to match water levels during that year.

P35 It appears that gauge datum values are in disagreement, given that negative water surface slopes were measured in the 2.4 km long PE-BR reach. The discrepancy may have arisen because the PE and BR gauges are operated by different agencies in different countries. The authors correctly point out that analysis of conveyance change is sensitive to errors in datum values for each gauge. Did the authors attempt to rectify gauge datum discrepancies? Furthermore, were gauge datum values stable over the study period?

P31 It appears that flow resistance was considered constant for a given year. Flow resistance is known to vary with flow stage, but this does not appear to have been considered directly in the modeling. Admittedly, the authors did use statistical analysis of the measured data to consider the influence of Q on conveyance ratios (Fig 8, p46). A more direct approach to assess conveyance changes while considering the influence of Q would have been to plot available Q data as a function of both S and year. Such a plot would demonstrate temporal changes in discharge for constant head (ie conveyance change), as well as changes in Q as a function of head during a given year. The latter should display a 0.5 power relation, and any deviation from a 0.5 power relation can be interpreted as the influence of Q on conveyance.

p17 The overbank roughness values in the standard HEC-RAS model are very low (assuming the overbank areas are vegetated). Were the overbank areas inundated in any of the model runs? If so, overbank flows may not have been simulated well (overpredicted), in which case conveyance estimates for the main channel may have been underpredicted. However, this possible error would have been consistent for all years, thus it likely would not influence the study conclusions.

p20 Longitudinal water profiles as a function of discharge are only parallel if flow is uniform for all discharges. Was this the case? Flow profiles are more likely to be non-uniform at low flows.

P28 Was eight hours sufficient to eliminate temporal correlation in water level time series? Given the generally steady flow in the St. Clair River, this would be surprising.

P29 The parameter SOSC is not defined.

Signature: _____ Date: _____