

October 21, 2013

**Baird**

Muskoka Lakes Association  
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Dear Mr. Logan:

### **Muskoka Lakes Flood Study Background Review**

oceans  
engineering  
lakes  
design  
rivers  
science  
watersheds  
construction

This letter presents the summary findings of our data collection and review of the causes and consequences of flooding in late April 2013 in the area surrounding the Muskoka lakes.

Baird undertook an initial review of the 2006 Muskoka River Water Management Plan with respect to whether the present approach to management of the system could be modified or improved to lessen the chance of a recurrence of the 2013 flood. Prior to conducting the detailed review and data analysis, we collected available information and took a 'first look' at readily available and relevant meteorological, water level and flow gauge data to understand the physical conditions that led to the flood. Our comments and recommendations are summarized below.

#### *Gauge Data and Literature Review*

The literature reviewed to date for this summary includes the Muskoka River Water Management Plan Final Plan Report (MNR, 2006) and the Bracebridge 2013 Flood Area Mapping (Town of Bracebridge, 2013). The Bracebridge 2013 Flood Area Mapping shows that flooding was widespread in riparian zones; however our initial review did not identify any specific structure in the vicinity of the town as the root cause of the flooding.

Gauge data (from the Environment Canada Water Office) at 14 stations in the Muskoka Lakes area, along with data from 3 meteorological stations in the region, were reviewed for the time period of the April 2013 flooding. Flood attenuation was observed at the lake gauges (where data were available) and the nature and effectiveness of the attenuation could be investigated as part of Phase 2 of this study.

The gauge data show that significant drawdown was undertaken in the lakes in the 2-3 weeks prior to the storm event that caused the April flooding. Comparing gauge data from the spring of 2012 to the spring of 2013, it appears that the same drawdown efforts were taken in both years. However, the gauge sites show a peak stage in spring 2013 that was 0.6m greater than the peak stage in spring 2012.

#### *Information Gaps*

In addition to the gauge sites available from Environment Canada, the Water Management Plan (WMP) indicates that other lake levels are monitored in the area. This additional lake level data could be useful in determining whether operators were executing the management plan as outlined, in order to determine if any areas were out of agreement with the WMP, which may have compounded the flooding effects further downstream. Lake level data could be analyzed to evaluate whether the appropriate drawdown levels were achieved prior to the flood events in order to determine whether or not the management plan is functioning as desired. Much of this information was obtained under the FOI request made by MLA (see below).

The 8 dams immediately upstream from Bracebridge on the North and South Branch of the Muskoka River are operated as run of river structures to pass flood events. All of these locations have water level gauges. This water level data will be important to the analysis of whether or not there is an area within the watershed that can be targeted for flood reduction actions, or alternatively to determine if it is the overall network of dams operating as a system that leads to widespread flooding during large storm events. Any further information on how the dams were operated during the April flood event will be of great use in determining a recommended course of action to help prevent such flood impacts in the future. We anticipate that this information will only be available via consultation with MNR.

An ARPS model has been developed for the watershed as part of the Watershed Management Plan Report. The documentation regarding model development was not provided, nor was it found to be readily available through online research. Additional information on this model would be useful in determining the validity of the WMP study findings, and it would help in the interpretation of the potential causes of flooding in April 2013.

Additional information on the available storage within each of the lakes is necessary to determine if management improvements can be made in the future. The model details should give greater insight into the surveyed storage available and how that corresponds with the modelling assumptions made and the decisions made for the revised management plan.

The lake level data, in conjunction with storage information throughout the watershed, may allow for specific recommendations on ways to decrease flooding through the region if it's clear where storage potential is being underutilized. Conversely, analysis of this information may indicate that there simply isn't enough storage in the system to handle that magnitude of event, given the constraints of homes, buildings, and other infrastructure constructed along the lake shorelines. Datum conversion data from MNR would also be useful so that the gauge records can be compared to the GSC datum referenced in the Water Management Plan.

#### *Information Obtained by Freedom of Information Request*

MNR provided the ledgers of dam operations for the region from November 2012-May 2013. Unfortunately, the explanation of ledger entries was withheld by MNR. Interpretation of the ledger entries will require further interaction with MNR technical staff. However, the daily lake levels recorded in the ledgers are of future benefit in interpreting conditions leading up to the flood.

The FOI request also led to the release of the dam operation manuals by MNR. These are of value in that they contain the operational approach at each dam with respect to general operating procedures, seasonal changes, response to wet weather events, removal and replacement of stop logs, gate operations etc.

#### *Interviews with MNR Staff*

We were unable to conduct telephone interviews with agency staff, and we therefore cannot comment in detail on whether the actions of the relevant agencies (OPG; MNR and others) were appropriate without detailed discussions with the agencies involved.

*Recommendations for Next Steps*

Our review and data gathering exercise has collated a significant amount of data with respect to the overall behavior of the Muskoka Lakes system. Further, detailed analysis could provide insights into the precise timing and functionality of each lake and watercourse in the system. However, without a significant amount of interaction with MNR technical staff, we may be unable to determine the precise causes of the flood event.

We recommend that the Association may wish to focus on working with MNR to further understand whether future modifications to the water management plan are warranted. Since so much of the system is not actively controlled or is run-of-river, structural enhancements to the dams and other control structures may be required to maximizing upstream storage to the greatest extent possible. In the Muskoka River Dam Operation Manual, MNR notes that

“Flood forecasting and flood operation of the Muskoka River system is beyond the scope of this manual and the subject of a possible future manual”

We recommend that development of an integrated forecasting and operational management system for the area would be a worthwhile endeavour that would assist in responding to potential flood situations by allowing for coordination across the system to maximize flood storage. We recommend that the Association engage with MNR to advocate for the development of such a system, and for the future manual identified by MNR.

Baird could proceed with Phase 2 of our analysis, and we anticipate that such an analysis may potentially assist in identifying areas for potential enhancement. However, we suggest that the resources of the Association may see greater benefit from advocating for a more thorough, integrated flood management system to be developed by MNR.

Please contact me if you would like to discuss any aspects of this letter.

Sincerely,  
Baird & Associates



Alex Brunton, Ph.D.  
Associate