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November 15, 2012

Panel Chair
Joint Review Panel for the Jackpine Mine Expansion Project
Energy Resources Conservation Board
9915 Franklin Avenue
Provincial Building, 2nd Floor
Fort McMurray, AB T9H 2K4

Dear Chairman,

Re: Undertaking regarding page 15 of Gosselin et al (2012) of the Royal Society of Canada Expert Panel reply to criticism by Dr. Timoney.

In cross examination on November 8, 2012, I was asked to comment on points made by Gosselin et al. (2012) in their reply to criticism by Dr. Kevin Timoney about the Royal Society of Canada Expert Panel Report: *Environmental and Health Impacts of Canada's Oil Sands Industry* (Gosselin et al 2010). Specifically the following passage was raised (page 15):

"Although there is a recorded recent trend of decreasing river flow rates as mentioned above, we cite in Section 3.3, the study of Sauchyn and Kulshreshtha (2008) that reports that the greatest precipitation increase predicted by the Canadian Coupled Global Climate Model 2 will be for an area that contains the oil sands region. Increased precipitation will be expected to cause increased flow rates in the Athabasca River."

This brief passage provided from Gosselin et al (2012) offers a highly selective excerpt from Sauchyn and Kulshreshtha (2008) that does not well reflect what is in Sauchyn and Kulshreshtha (2008) nor does the implication reached by Gosselin (2012) in the second sentence above follow hydrologically from the first sentence, given current scientific understanding of climate change and its hydrologic implications. In explanation, please consider the following points:

- Sauchyn and Kulshreshtha (2008) provide not one Global Climate Model (GCM) result, but an *ensemble* of GCM results compared against a projection based on only natural variability (i.e., without greenhouse gases forcing the climate) to yield percentage change in precipitation for Alberta, Saskatchewan, and Manitoba. It is implied by Gosselin et al (2012) that the precipitation increase is taken from only the CCGCM2 which is not a fair reflection of the work presented by Sauchyn and Kulshreshtha (2008).
- While it is true that the oil sands region is located within the general area (within the three provinces where) a higher change in precipitation is expected, the increase shown in Sauchyn and Kulshreshtha (2008) for annual precipitation is typically in the range of only 10-20% to the 2050s (and seasonally may be a little higher or a little lower).
- The precipitation projections of GCMs are known to be far less reliable than their temperature projections and thus it is held that precipitation projections should generally be interpreted with caution.
- With respect to water balance projections for major rivers in snow-dominated regimes (such as the Athabasca River), the increased temperatures are expected to result in a declining snow pack and

earlier peak flows, and combined with higher summer temperatures, these changes are expected to lead to a decrease in flowrates in the fall and late summer. See, for example, Barnett *et al* 2005. With precipitation increasingly falling as rain rather than snow, it will generally be lost from the basin more quickly.

- Loss of glacial mass is a further contributor to a decline in the recession-limb flowrates of major rivers draining eastward from Canada's Rocky Mountains (Rood *et al* 2005), thus exacerbating the declines noted in the previous point. Demuth and Pietroniro (2001) looked at this situation in the North Saskatchewan River basin and found the minimum and mean streamflows in the North Saskatchewan River basin to already be in decline in its glaciated headwater basins due to decline in glacial mass.

The net outcome of the above changes is expected to be a decline in river flows, not an increase as stated by Gosselin *et al* (2012). And as I showed in my November-08-2012 presentation to the Joint Review Panel, there are signs evident in the Athabasca River hydrograph (below Fort McMurray) that this pattern may already be taking shape. As a result, the conclusion of the above passage from Gosselin *et al* (2012) is unjustified by the information it provides and the information it references. In fact, Chapter 2 (Warren and Egginton 2008) in the same compendium from which Sauchyn and Kulshreshtha (2008) is found, provide background information to Sauchyn and Kulshreshtha (2008):

"Although many areas of the country are expected to experience an increase in precipitation (see Figure 14), this may not be sufficient to offset the AET [actual evapotranspiration] increase due to temperature rise. In the Great Lakes area, for example, a 1°C increase in mean annual temperature was associated with a 7 to 8% increase in AET (see Fernandes *et al* 2007) resulting in a decrease in water availability." (emphasis added).

It is evident that Gosselin *et al* (2012, p15) have provided an invalid interpretation when they say that Athabasca River flows will increase due to climate change.

Yours sincerely,



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References

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- Rood SB, GM Samuelson, JK Weber, and KA Wywrol 2005. Twentieth-century decline in streamflows from the hydrographic apex of North America. *Journal of Hydrology* 306:215-233.
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