

ENVIRONMENTAL ASPECTS OF RIVER ICE JAMMING ON THE PEACE-ATHABASCA DELTA

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ABSTRACT

Delta ecosystems are frequently comprised of a myriad of channels and lakes, the latter of which can be subdivided according to the degree to which they are connected to the main flow system. The dynamics of such lakes, in terms of their overall biological structure and productivity, depend on their flooding and flushing during high-stage events. In warm temperate climates, such flooding can only be produced by high flow conditions. In cold regions environments, however, flooding of high-elevation or "perched" lakes can be produced by high flow events and/or ice-jam backwater. Often the flood levels produced by ice-jams, even at relatively low discharge, far exceed those possible under open-water conditions and for much greater discharge. Such ice-induced flood levels have been found to be critical to the flooding of perched lake environments in, for example, the Mackenzie River and Peace-Athabasca Deltas. Unfortunately, in the latter case, the magnitude and frequency of high-elevation flooding has been reduced over the last two decades and significant impacts have occurred to the perched lake environments. The reduction in flooding has been attributed to the reduction of spring ice jamming, which in turn is related to changes in the flow regime and most probably the regulation effects produced by a dam on upper portions of the Peace River. In an attempt to restore, at least localised, flooding of some of the perched basins, a project has been initiated

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to create artificial ice dams on Delta tributaries. It forms part of a multi-agency three year management plan for the Peace-Athabasca Delta. This presentation reviews the hydrologic sensitivity of the perched lake system, the environmental changes that have occurred over the last two decades due to the lack of flooding, historical records of peak flows and water levels at a station near the delta, and the current and potential other approaches to creating artificial ice dam flooding.

DISCUSSION

Bill Mackay:

Where did ice jams occur in the Peace River historically? Were they at Peace Point?

Reply:

The main site of historical ice jams on the Peace River is Rocky Point, although other jams affecting the delta may also develop where the Peace River meets the Slave River. Long-term hydrometric data (approximately 1959-on) are, unfortunately only available for an upstream station located at Peace Point.

Maurice Sydor:

Are we seeing that if controls are being used to modify the flow/level regime, then is the question of using dams or mobile gated structures (ie. Slave dam, delta, channel centres) being considered as an alternative as well?

Reply:

As part of the overall Peace-Athabasca Technical Studies, other remedial measures are also being evaluated. These include gated structures for major channels and even small-scale pumping systems for localised flooding of specific perched basins.

Mike Ferrick:

Since it is possible that the hydroelectric flow control dam has created the lack of flooding in the delta, is it possible to use the dam to obtain the necessary flow for jam creation and perched lake flooding?

Reply:

Use of the dam to create a spring flood wave of sufficient magnitude to cause an ice jam near the Peace-Athabasca Delta has significant physical and economic implications. A major sustained flow release would be necessary since any short-term flow release from the dam would be severely dampened by the time it reached the delta, some 1100 km downstream. Moreover, it remains to be proven how important the spring flows originating upstream of the dam were in producing ice jams near the Peace-Athabasca Delta - the focus of current research. The more important role of

regulation in affecting ice-jam formation may in fact be related to elevated freeze-up levels.

Martin Jasek:

Have you looked at or modelled the discharge necessary (under ice jam conditions) to flood these perched lakes?

Reply:

An ice-jam model study is being initiated in 1994/95 to assess this question. Detailed cross-sections will be made of major ice jam sites and a model, such as RIVJAM, used to predict various water levels under various flow scenarios. A companion study will also be looking at the water balance of representative perched basins to evaluate how important ice-jam flood water is to the long-term survival of these basins.

Patricia Chambers:

Are artificial ice jams being used in other areas of the world to flood wetlands?

Reply:

This is the first time that artificial ice jams/dams have been used in an attempt to initiate such flooding. Other ice-engineering structures such as cryopiles, however, have also been attempted with slightly different purposes. For example, such structures were constructed on the Peace-Athabasca Delta in the 1970's, as an alternative to the current rock-filled weirs.

Geoff Power:

A discussion could be started on the subject of conservation. One working definition is "wise use of" the resource. Using this definition Parks Canada may opt to use the present conditions as an example of succession. It could be a teaching tool. The artificial ice dam flooding on the other hand may be an example of landscape restoration. I suggest a clear definition of conservation and the aims of landscape management is required before anything is attempted?

Reply:

The point is a valid one and the focus of continual debate when it comes to questions

of "ecosystem management". It will surely arise as part of the environmental impact assessment that must be undertaken before artificial ice jamming can be used in the hope of any degree of "landscape restoration".