Managing River Ice Risk in Alberta

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Summer and breakup flood level frequency analyses for the Athabasca River at Fort McMurray



Gerard and Karpuk (1979)

Athabasca River at Fort McMurray

"...The winter of 1874-75 was a bitter one, with deep snow and never a thaw until April. On the 2nd or 3rd of that month, however, a further heavy fall of snow was followed by a sudden rise in temperature. The change of weather and the weight of melting snow caused the ice for the 85 mile stretch of rapids above the fort [Fort McMurray] to breakup, and it came down the Athabasca with terrific force. On striking the turn of the stream at the post it blocked the river and drove the ice 2 miles up the Clearwater [a major tributary] in piles 40 to 50 feet high. In less than an hour the water rose 57 feet, flooding the whole flat and mowing down trees, some 3 ft in diameter, like grass..."



Ice Jam Flood Mitigation: Considerations



- Type of river ice jam
- Size of the river (Flow and Velocity)
- Location and type of floodplain development
- Ecology

- Risks of mitigation activity
- Effectiveness of proposed mitigation
- Time for mitigation activity hours to years
 - Cost of mitigation

Ice Jam Flood Mitigation in Alberta

- Freeze up, winter and break up river ice jams
- Large rivers with high velocities in northern Alberta
 - Peace River flow is influenced by hydro electric operations
 - Athabasca River flow is unregulated
- Residential and industrial development
- Ecological considerations:
 - fish
 - other aquatic life





Ice Jam Flood Mitigation in Alberta

X Ice Weakening

X Ice cover or jam blasting
X Ice cover dusting
X Excavation
X Warm water

Structural controls



S. Beltaos

Regulatory controls
 Monitoring and Forecasting
 River flow control



Ice Jam Flood Mitigation in Alberta

Regulatory and Planning:

- Structural controls
 - Regulatory controls

Operational Response:Monitoring and ForecastingRiver flow control





Reduce risks: before a potential river ice event

- Identify the hazard
- Appropriate floodplain development
- Be aware of hazardous activities in the floodplain area
 - Water ApprovalsCompliance "Sweeps"



Managing Risk: Aerial Observation

Development of river ice processes

- Location of freeze up front

- Potential for severe freeze up jams to develop
- Timing for flow regulation
- Monitor changing river basin & ice conditions
 - Potential basin runoff
 - Development of open water leads
 - Development of upstream ice jams

Managing Risk:

monitoring and forecasting river ice events

Manual Observations

- Ground
- Aerial

Remote Monitoring

- Gauging stations
- Satellite images

➢ Models

- Long lead outlook
- Forecast models





Managing Risk: Aerial Observation



Real time monitoring of river ice runs for emergency response groups



Peace River Freeze Up Jam

ISSUE: High freeze up water levels cause residential groundwater seepage

Considerations

 Operation of inter-provincial hydro electric facility

Risk of freeze up jam is increased by weather which cannot be accurately forecast 3+ days in advance.



Peace River Freeze Up Jam

- Control flows during freeze up
 - Flow volume and flow fluctuations
- Develop mitigation plan should severe freeze up occur

reservoir storage

- Lower flows if feasible





Develop mitigation plan should severe freeze up occur

- Lower flows if feasible
- Increase flows
 - » promotes frazil ice redistribution
 - » More efficient channel hydraulics
 - » More effective use of reservoir storage
 - » Limited returns ?

Develop mitigation plan for severe river ice break up conditions develop

Lower flows if feasible



Committee on River Ice and the Environment (CRIPE)



Thank you !



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