The New Reality: Reservoir Management and Climate Change Adaptation

The Ottawa River, a vital watercourse that stretches over 1,130 km from its source east of the Dozois Reservoir to its confluence with the St. Lawrence River, is not immune to the effects of climate change. As warming temperatures, altered precipitation patterns, and extreme weather events become increasingly apparent, the need for adaptive strategies in river management has never been more critical. In particular, the management of reservoirs in the Ottawa River Basin requires a comprehensive re evaluation to address the changing flood risks brought about by the new climate reality.

Current reservoir management practices exhibit a glaring shortcoming in their lack of consideration for the anticipated impacts of climate change. The prevailing approach, focused on lowering reservoir levels based on average historical median guidelines, is inadequate in the face of evolving climate patterns. With climate-induced variables such as warmer winters, substantial snowpacks, late springs, rapid warm-ups, and heightened runoff, the risk of record-breaking floods looms larger than ever. This assertion is not merely speculative; over the last seven years, the Ottawa River has experienced three major floods ,one classified as 1 in 100 year floods and the other 2 as 1 in 50 year floods.

Effective reservoir management, particularly in the context of the Ottawa River Basin, involves a multifaceted approach to mitigate flood risks during the spring melt and runoff, or the freshet. Historically, lowering reservoir levels prior to the freshet has been a widely adopted practice in river management, especially in regions susceptible to significant snowmelt and spring rainfall. The primary objective of this practice is to create additional storage capacity within the reservoirs, thereby accommodating the surge in water volume during the freshet. By doing so, this approach seeks to curb the peak levels in the Ottawa River, thereby mitigating downstream flood risks.

The process of lowering reservoir levels before the freshet unfolds in a series of strategic steps. Authorities responsible for managing the reservoirs engage in close monitoring of weather conditions, snowpack levels, and other critical factors that contribute to the spring freshet. Unfortunately, weather pattern models have a high frequency of error rate due to the quick changing patterns of weather in the last decade. Using computerized models, they aim to predict the potential volume of water that will enter the river system during the melt. This predictive capacity is leveraged to balance water conservation aligned with power generation ahead of flood risk, ultimately guiding the unfair decision-making process in keeping a higher volume of water in the reservoirs during the final drawdown which directly effects the timeframe of the refill process which sets flow outlet from the reservoirs according to maximum level limits. In other words, the more water left in the reservoir the quicker it fills to maximum and has to be released.

As the spring melt approaches, water managers initiate a controlled lowering of reservoir levels. This involves the gradual release of water through dam outlets or other control structures.

The aim here is to create a surplus of storage space within the reservoirs, thereby pre-emptively accommodating the anticipated influx of water.

Once reservoirs are sufficiently lowered, a well-regulated inflow and outflow equilibrium is maintained until the spring melt commences. This period is characterized by low to medium flow rates as winter gives way to spring. As the melt progresses and the river's flow swells due to melting snow and rainfall, the reservoirs capture excess water while simultaneously releasing a portion to control the downstream flow. The refilling process is methodically managed through the regulation of outflow, effectively averting sudden and excessive surges in Ottawa River levels.

However, this strategy is not without its challenges. For a fair and balanced approach to the new climate reality reservoir operators must rethink their approach to old historical standards and move quickly to operate to the minimum operating guideline that is the widely accepted low level constraint of each Reservoir. The dynamic interaction between climate change-induced variables and the complexities of river hydrology requires a reimagined approach to reservoir management. In a changing climate landscape, the following adaptations are crucial to ensuring the efficacy of reservoir management practices:

1. **Climate-Informed Decision Making:** Reservoir management strategies must be augmented by integrating climate change projections and data into the decision-making process. This entails considering potential shifts in temperature, precipitation patterns, snowmelt timing, and the likelihood of extreme weather events.
2. **Updated Hydrological Models:** Hydrological models should be recalibrated to account for the evolving climate conditions. These updated models can provide invaluable insights into how climate change may alter river flows, reservoir levels, and overall flood risks.
3. **Flexible Reservoir Management:** Given the heightened uncertainty introduced by climate change, reservoir management strategies should exhibit adaptability. This adaptability might involve real-time adjustments based on evolving weather and climate data.
4. **Risk Assessment and Adaptation:** Regular risk assessments should be conducted to identify vulnerabilities in current reservoir management practices. Strategies for adapting to changing conditions and mitigating flood risks should be formulated and implemented.
5. **Infrastructure Investment:** Enhancing infrastructure, such as dams and spillways, can bolster reservoir capacity to effectively manage intense rainfall and rapid snowmelt, two outcomes increasingly linked to climate change.
6. **Public Awareness and Preparedness:** Downstream communities need to be educated about the escalating flood risks linked to climate change. Clear communication of emergency preparedness plans is essential to fostering resilience.
7. **Collaboration and Coordination:** The complexity of reservoir management necessitates collaboration among various stakeholders, including governmental bodies, agencies, and communities. A holistic approach considering both upstream and downstream effects is indispensable.

8. **Long-Term Planning:** Reservoir management strategies should align with long-term climate change projections. Such integration is vital for creating resilient and sustainable solutions.

In conclusion,

The intersection of reservoir management and climate change adaptation presents a pivotal challenge that demands innovative and dynamic solutions. The Ottawa River Basin's susceptibility to record-breaking floods underscores the urgency of revisiting and revamping existing practices. Climate-informed reservoir management strategies, grounded in sophisticated modeling, flexible approaches, and interdisciplinary collaboration, are key to mitigating the escalating flood risks associated with the evolving climate reality. Only through concerted efforts can we ensure the resilience of communities, ecosystems, and vital resources against the changing backdrop of climate change.

We are being put at higher peak flood risk without lower Reservoir and River levels before freshet. The current practice is to lower levels to average historical median guideline numbers in reservoirs and not the actual lower constraint number set by the Reservoir operators as a safe low limit to function at to prevent the new flood risk. Warm winters, high snow pack, rain/ice buildup, late spring, fast warm up, high runoff will all continue to contribute to record high flooding for the cycle we appear to be in as we had three major floods in the last 7 years. In the last 73 year we have had 13 major floods and 11 minor floods. In the past 11 years from 2013-2023 we have had a total of 5 floods which consisted of 1 minor flood and 4 Major floods with 3 of those causing extensive damage. That’s just slightly below an increase of 50% flood frequency in the last 10 years compared with the 73-year average. Its quite clear the frequency and intensity of the floods are increasing at an alarming rate. The following Reservoir charts have a 23-year timeframe that clearly shows the Reservoirs are not completely empty according to the low-level limit constraint guidelines set by the Reservoir operators themselves and the percentages of water left in them are unacceptable to the future climate change environment thrust upon us. Upon conclusion, it’s a well-established fact that much lower reservoir and river levels before the freshet have a direct impact on reducing the risk while lowering peak flooding.

❖ Please note the year 2016 for higher flood risk due to an unusual number of reservoirs with high levels at the beginning of freshet.

Dan Poole
Ottawa River Flood Alliance