



VICTORIAVILLE

Reservoir restoration to ensure
continuous water supply

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Source: City of Victoriaville Facebook Page

THE SCIENCE

Municipalities around the country rely on reservoirs for potable water. More frequent floods and droughts can reduce the reliability of a reservoir's water supply. The amount of water available in reservoirs can also be impacted by sediment accumulation, which can worsen under increased erosion conditions upstream. Reservoir capacity can be significantly reduced over time when large volumes of accumulated sediments are left unattended. The hydrological implications of future climate conditions should be taken into account when designing, restoring, and planning the maintenance of water reservoirs.

THE TRIGGER

In 1977, the City of Victoriaville built the Beaudet Reservoir to ensure sufficient freshwater supply for its population and also to prepare for future drought conditions. Prior to that, the municipality was getting its supply directly from the Bulstrode River, but water flows were sometimes insufficient in the summertime. Once the Beaudet reservoir was built, the City noticed over time that it was losing 1% of its capacity annually. This situation highlighted the need to understand what was causing this phenomenon and then create a plan to ensure sufficient water supply for the community in the years to come.

The City of Victoriaville first started looking into the causes behind the water loss inside the reservoir over 20 years ago. Initial studies revealed that one of the main issues was the high amounts of sediments that had gradually filled the basin at the rate of approximately 16,000 m³ per year. These accumulations led to reduced water storage capacity, which was decreased by 41% between 1979 and 2018. The loss of average depth of the reservoir also led to an increase in water temperatures, which simultaneously increased the risk of cyanobacteria proliferation. This phenomenon, coupled with increased inputs of phosphates and nitrates coming from agricultural activities upstream and the loss of depth, created an environment prone to the proliferation of aquatic plants. The initial studies showed that if no mitigation actions were taken, the reservoir would gradually turn into a big swamp and would no longer be able to fulfill its primary role to provide sufficient drinking water to the population. The studies also highlighted current risks around water quality associated with the increased amounts of sediments. Recurring high-flow events in the Bulstrode River were responsible for increased erosion and transportation of sediments to the reservoir. Challenges around water quality were also expected to increase under future climate conditions and cause greater strain on water treatment systems if no action was taken.

THE APPROACH

The initial studies requested by the City of Victoriaville confirmed the need to take action to mitigate further degradation of the reservoir. City staff from various departments, consultants, and representatives from several provincial ministries started looking simultaneously into actions that could be taken around the reservoir as well as upstream to reduce the transportation of sediments. Different options



Figure 8: *Aerial view of the Beaudet Reservoir.*
(Source: City of Victoriaville)

were compared from an environmental, cost, and benefits perspective, and the results showed that working upstream to reduce the transportation of sediments wouldn't be as impactful given that most sediments came from natural erosion associated with the meandering character of the Bulstrode River:

The City and its various partners determined that, for optimal results, an initial dredge of the reservoir followed by recurrent dredging over time would provide the best outcome for the community. The targeted volume for the initial dredge was determined with a drought return period of 30 years while considering changes in topping flows under future climate conditions. While recurrent dredging can manage issues associated with water quantity, a separate plan needed to be implemented for water quality and for the disposal of sediments.

On the water quality front, it was decided that a separate water reservoir would be built adjacent to the current one to store clear raw water that can be used when water quality decreases in the main basin. The water will be pumped from the main reservoir into this additional storage basin under specific water conditions. This will allow the municipality to consistently maintain sufficient drinking water volumes for the population and ensure water is also available at all times for emergency use, such as firefighting needs.

The approach undertaken by Victoriaville also necessitated a plan for the disposal of accumulated sediments in the Beaudet reservoir. In order to manage the regular dredging process, the community decided to build a sediment dewatering plant next to the reservoir. The water collected at the plant will be returned into the reservoir and the dry sediments will first be used to fill a large hole where a public recreation

space will be created for community members. Once that hole is filled, sediments will be redirected to be used elsewhere in the community.

THE OUTCOME

The initial dredge as well as the construction process for the separate water reservoir and sediment dewatering plant started in the spring of 2021 and construction was expected to be completed in 2022. The dredging process will be conducted over an 11-week period annually for the next five years, followed by maintenance dredging beginning in 2028. Over 40 studies were completed prior to the construction to provide a greater understanding of the situation, including literature reviews, environmental impact assessments of specific adaptation solutions and feasibility studies.

The comprehensive approach followed by the City of Victoriaville will ensure the sustainability of the community's freshwater supply under current and future climate conditions. The rapid deterioration of the Beaudet Reservoir posed a significant threat to the community but the process that was implemented to determine how the reservoir could become more sustainable and climate resilient will provide long-lasting results for the population.

A WORD FROM VICTORIAVILLE

When asked what advice he would give to other municipalities interested in pursuing similar initiatives, Joël Lambert, Associate Director of Engineering and Environment Services for the City of Victoriaville, highlighted the need to foster strong relationships between the various partners on large infrastructure projects to ensure successful outcomes. "It is imperative to work as a team, both internally and externally to make sure all departments and stakeholders are aligned on desired outcomes and deliverables. We found it was key in Victoriaville to build on a unifying goal that brought benefits to all parties involved," said Mr. Lambert. He also emphasized the importance of investing time and resources to understand the current risks faced by the infrastructure that needs to be rehabilitated. "While it took a long time to get a comprehensive understanding of the situation we were dealing with and identifying the right adaptation solution for the community, it was key to do so to ensure public funds were invested in a way that would serve the population in the long run," he added.