



CALGARY

Investing in dam upgrades for future climate conditions

By Esther Lambert

Source: City of Calgary

THE SCIENCE

Dams are a vital type of water infrastructure that can provide multiple services to communities. Among some of their major functions are the provision of reservoirs for potable water; reduction in river flood flows during periods of heavy precipitation, and, in the case of Calgary, they are also part of the recreational landscape that attracts activities such as sailing, rowing, paddling, and cycling. Many dams, like Calgary's Glenmore Dam built in the 1930s, are approaching the end of their lifecycle and need to be rehabilitated and upgraded so that the services they provide can be sustained for the enjoyment of future generations.

The City's recent upgrades to the Glenmore Dam were implemented as part of a broader flood and drought resilience strategy. Rigorous scientific (e.g., hydrological) studies were undertaken and comprehensive options analyses were performed to determine an optimal infrastructure solution for water supply, flood protection, and dam safety. The result was that new flood gates were designed to meet these project goals.

THE TRIGGER

The Glenmore Dam and Reservoir, located on the Elbow River in southern Alberta, is a source of safe, reliable drinking water for Calgarians. It was constructed in 1933 as Calgary's primary source of drinking water. Eighty years later, in 2013, a major flood occurred, which resulted in \$2 billion in damages. Although not originally intended for flood resilience, the Glenmore Dam was invaluable during the flood as its operation reduced peak downstream flow by more than 40%. However, flood damage confirmed the need for lifecycle rehabilitation and an opportunity to improve operations to manage the variability of the Elbow River.

Following the flood, the City's water utility commissioned an extensive review of flood mitigation and resilience options. The dam upgrade project fell on the heels of a significant analysis looking at the variability of the Elbow River and Calgary's vulnerability to flood and drought. The study included a review of water supply over the next 70 years, which is part of Calgary's potable water long range plan.

THE APPROACH

While plans for rehabilitation started before the flood, the design process took place between 2017 and 2018. Construction was completed in 2020 and, in 2021, final adjustments were made to the automation systems and control structures. The City secured part of the funding from the Alberta Community Resilience Program that was available for projects addressing flood resilience following the 2013 flood.

To accommodate a changing climate, the City's approach is to pursue a suite of resilience measures that include upstream flow attenuation, community flood barriers, and flood-resilient land-use policy. Water Services executed the improvements to the Glenmore Dam, and other entities were charged with different measures; for instance, the Water Resources Business Unit commissioned the study that recommended a



Figure 20: *The Glenmore Dam overtopped during the 2013 flood but remained invaluable as its operation reduced peak downstream flow. (Source: City of Calgary)*

suite of resilience measures. New flood gates on the dam crest were recommended to increase its storage volume to complement the function of the Province's Springbank Off-stream storage reservoir project approved at the time and under construction today.

The operable gates can be raised to increase water supply through the dry winter when flows are low. For flood flows that could happen in the spring, the gates can be carefully raised in a manner that balances holding and releasing floodwaters. Its operation allows the City to respond to a diverse set of extreme weather and flooding events. Recognizing the recreation benefits of the infrastructure, there were also improvements to the pathway over the top of the dam through relocation of water and gas utility lines that allowed for more space for pathway users.

One of the greatest challenges in implementing this project was in developing the operational plan. This was an intricate process that involved operations staff, City experts, the consultant design team, and the contractor to meet high operational standards for the system.

THE OUTCOME

The operable steel gates built on the crest of the dam system double the storage volume available during a flood event. Analyses suggest this reduces the probability

of damage to downstream private and public property by about 50%. Drought vulnerability was also reduced tremendously now that the City has doubled storage capacity to make water available to citizens during periods of drought.

Calgary's Leader of Watershed Analysis, Mr. Frank Frigo, indicated that the City is better equipped to respond to climate change through diverse resilience measures, operational flexibility, and improved situational intelligence for the Bow and Elbow River basins. The hydrological studies conducted to support this work addressed flood resilience and drought resilience, in addition to identifying design parameters for lifecycle improvements.

Climate change continues to be an important consideration to the City. As more climate studies are completed, Calgary will develop strategies for improved operation for flood and drought conditions. As such, Calgary has forged a partnership with Global Water Futures, providing an opportunity to conduct further analyses to better predict the behaviour of the Elbow River.

A WORD FROM CALGARY

The importance of stepping back and taking the time to develop a holistic plan around resilience was a key piece of advice offered by Mr. Frigo. He urged municipalities to identify their priorities early and to start working towards them, as funding or other opportunities may come at any time and communities must be ready. He also reflected on the value of having taken a holistic approach for their flood resilience program, which frustrated some citizens due to increased complexity and time, but ensured key elements were not overlooked. He said "We want to make sure we understand the right suite of things. Until you really have a sense of what the ingredients are for the resilience meal, you can't buy the right groceries."

Similar sentiments were echoed by Andrew Forsyth, Planning Engineer with the City. He stated "It can be tempting to take a level of service approach, but it is more prudent to apply a wider and more strategic lens to guide design. Adaptability for current and emerging trends is ever-more important today, and a holistic strategy will best serve citizens through the future."