Elbow River flood mitigation alternatives evaluated

The City of Calgary and Government of Alberta studied several options for flood mitigation on the Elbow River and decided to pursue a combination of new, taller gates at Glenmore Reservoir and the Springbank Off-stream Storage Reservoir as the best solution to protect Calgary's Elbow River communities. Below we explain the alternatives evaluated before deciding on this approach.

Background

As part of The City's Flood Expert Management Panel work in 2014, multiple options for structural flood protection for the Elbow River were considered. These were further studied during the Flood Mitigation Measures Assessment Project in 2016. The Province has also completed multiple studies to determine the most feasible upstream solution to protect Calgary. Below is the approach being taken as well as the alternatives evaluated.

Active projects

Calgary's Flood Resilience Plan relies on both watershed and community mitigation efforts on both rivers. For the Elbow River, the Provincial Springbank Off-Stream Storage Reservoir in combination with new gates on The City's Glenmore Dam will protect Calgary from a 2013-size flood. These projects will work together to reduce flood damages by over $3B through the next century.

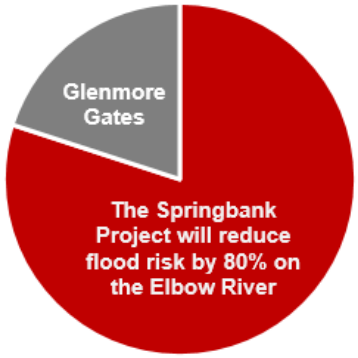

FIGURE 1 – FLOOD DAMAGES REDUCTION ON THE ELBOW RIVER

Glenmore Gates

With funding support from the Province, The City is increasing the height of gates on the Glenmore Dam, which will reduce flood risk on the Elbow River by 20% for a 2013-size flood. The new, taller gates on the Glenmore dam are expected to be functional by spring 2020 and will double the existing storage capacity of the Glenmore Reservoir.

Springbank Off-Stream Reservoir

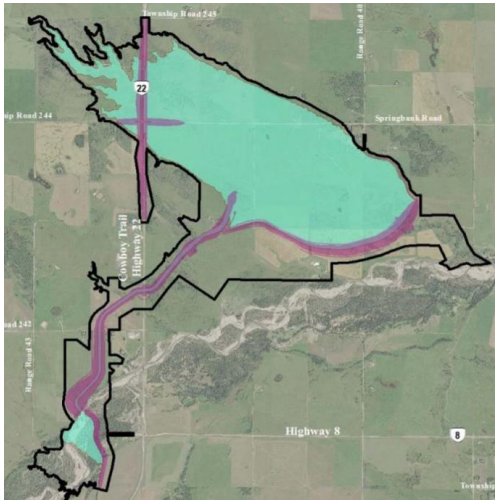

FIGURE 2 – SPRINGBANK OFF STREAM RESERVOIR LOCATION (COURTESY GOA)

The Springbank Project (SR1) has been studied extensively by independent technical experts and concluded to be the best flood mitigation option for the Elbow River. It is vital to protecting downtown Calgary, which is a fundamental component of our regional and provincial economy. SR1 has the best benefit-cost ratio and is the most responsible environmental option of the thoroughly studied range of alternatives. SR1 is able to capture floodwaters closest to Calgary and is off-stream, so will not impact habitat and river flows under normal conditions. It also provides a flood risk reduction to communities on the Bow River and South Saskatchewan River downstream (eg. Siksika Nation, Tsuut'ina Nation, Medicine Hat). The Province is committed to building the project by the end of 2022, and the project is currently undergoing a Federal Environmental Assessment.

Elbow River flood mitigation alternatives evaluated

Evaluated alternative: Glenmore tunnel

In this concept studied by The City in 2014, flood flows are conveyed from Glenmore Reservoir directly to the Bow River via a large concrete tunnel. Two alignment alternates were considered as shown in Figure 3. The tunnel would be drilled deep underground to limit disturbance to existing communities, roadways and utilities.

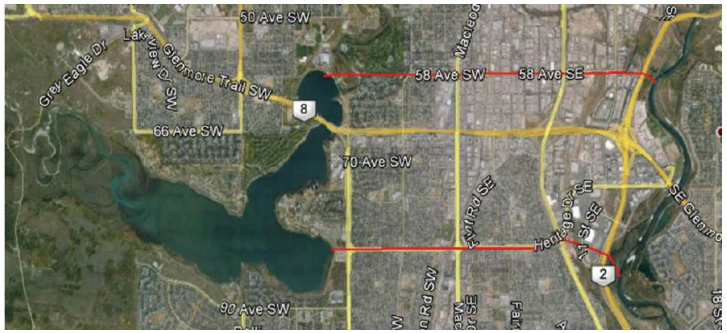

FIGURE 3 –TUNNEL CONCEPT BETWEEN GLENMORE RESERVOIR AND BOW RIVER

This option was not chosen for the following reasons:

- While the estimated cost was $500 million, it could be much higher due to technical challenges associated with tunnel drilling projects.
- Communities downstream of the tunnel outlet would not benefit from any flood mitigation provided.
- Lower benefit cost ratio compared with the upstream reservoir options according to a February 2015 Government of Alberta report.

Evaluated alternative: McLean Creek reservoir

The Elbow River Dam at McLean Creek (MC1) option was evaluated by The Government of Alberta in their 2015 Provincial Flood Damage Assessment Study. The MC1 option is located about 10 km upstream of Bragg Creek, on the Elbow River, upstream of the confluence of the McLean Creek with the Elbow River. The dam would be approximately 28 m high and 110 m wide. The McLean Creek Dam was not chosen by the Government of Alberta for a number of reasons, including:

- MC1 is further away from Calgary and would capture less floodwaters
- MC1 is located in an ecologically sensitive forest habitat
- MC1 would be constructed in-stream, resulting in significantly longer timelines with higher environmental impacts and more risky construction
- Higher potential for failure which could severely damage downstream communities of Bragg Creek and Redwood Meadows.

FIGURE 4 - MACLEAN CREEK RESERVOIR CONCEPT LOCATION (COURTESY GOA)

Evaluated alternative: Fish Creek diversion

The City completed a study in 2015 to assess the feasibility of diverting Elbow River flows from the Glenmore Reservoir to Fish Creek via an open channel. The channel would need to be lined with rock or concrete to mitigate erosion during a flood event. This option was not considered further, based on:

- A significant number of buyouts of residences and commercial centers would be required
- Extensive impacts to park land along the channel alignment
- Conflicts with existing utilities and major transportation routes, requiring additional infrastructure such as numerous new bridges
- Potential alignment options would infringe on Tsuut'ina land
- Potential for significant damage to Fish Creek channel, Fish Creek Park and the Bow River at the Fish Creek outlet
- Offers no flood protection benefit to downstream communities.

Elbow River flood mitigation alternatives evaluated

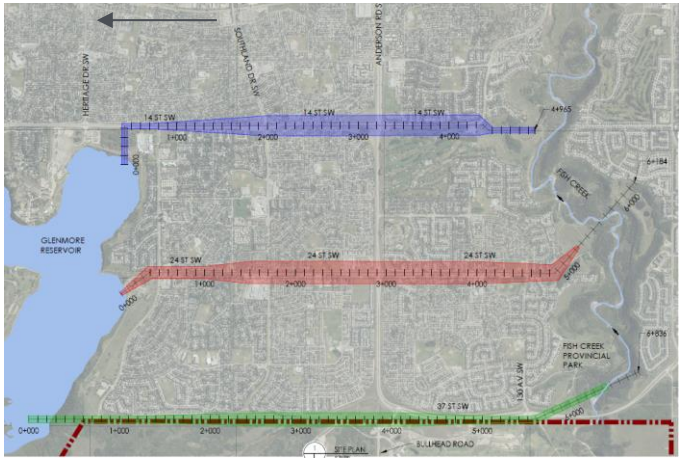

FIGURE 5 –OPTIONS FOR THE GLENMORE RESERVOIR – FISH CREEK DIVERSION TUNNEL (STANTEC, 2015)

Evaluated alternative: property buyouts

The financial and social costs of buying out at-risk properties was determined to be too high in The City's Flood Mitigation Measures Assessment. To mitigate a 2013-size flood on the Elbow River, The City would need to buy out 3,500 properties at an estimated cost of $43 billion. Buyouts would also significantly disrupt the character of established inner-city neighborhoods. Public uptake of buyouts offered by The Provincial government following the June 2013 flood was low, and buy-outs received little support during citizen engagement in 2016.

Evaluated alternative: Elbow River barriers

The City evaluated continuous flood barriers along the length of the Elbow River below Glenmore Dam. Over 14 km of barriers would need to be installed, with an average height ranging from 1.6 to 3.0 m. Due to the extent of private riverfront property and the extent and height of barriers required, acquiring land and constructing the barriers would be prohibitively expensive and would completely disrupt the fabric of some of Calgary's historic communities. The cost of building barriers to the same protection level as SR1 was nearly twice as much (>$800M). In addition to the significant social and environmental impacts, barriers would cause evacuation challenges, as bridges would have to be closed and gaps in the barriers blocked.

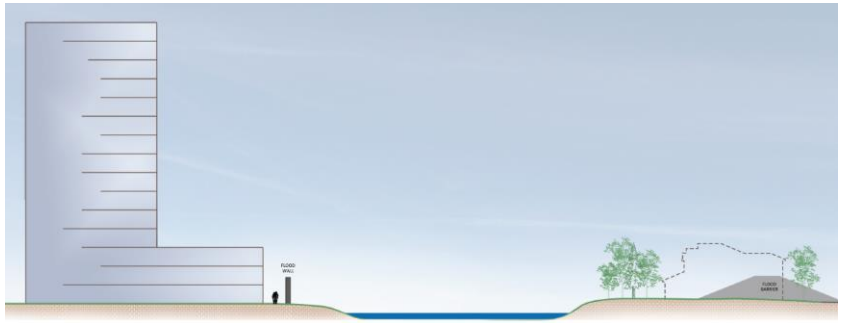

FIGURE 6 – ELBOW RIVER 1:200 YEAR BARRIERS RELATIVE HEIGHT

Evaluated alternative: Glenmore Reservoir dredging

Following the 2013 flood, The City examined how much storage space could be created by dredging Glenmore Reservoir. Comparing recent survey data with data from when the Glenmore Dam was built, it was found that only about 10% of the reservoir's storage has been filled with sediment. The volume of Glenmore Reservoir, and volume that could be gained by dredging are shown on the figure below, along with the storage volume required to mitigate a 2013-sized flood.

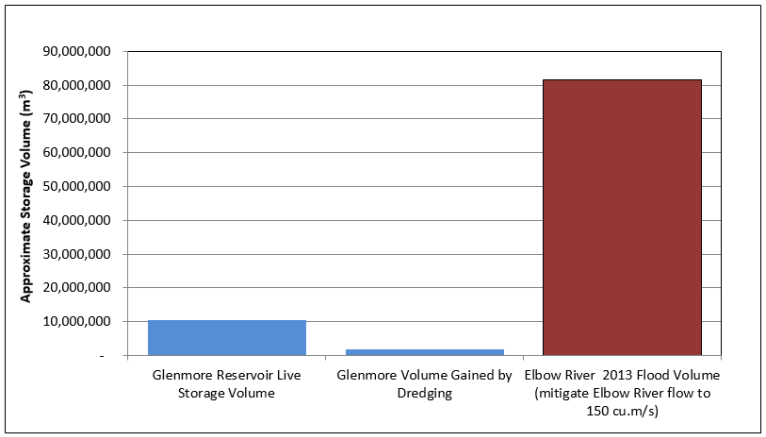

FIGURE 7 - RELATIVE STORAGE VOLUME GAINED BY DREDGING GLENMORE RESERVOIR

Elbow River flood mitigation alternatives evaluated

This alternative was not considered further as dredging provides limited additional storage volume, is likely to be temporary in nature and has the risk of environmental impacts and water quality impacts to our potable water source.

Other flood mitigation concepts

The Priddis Diversion was not deemed feasible in a 2015 Provincial report because diverting flow to Priddis Creek would double the flood flows in the creek, significantly impacting existing development and altering the natural channel.

A group of citizens have proposed the Tri Rivers Joint Reservoir (TRJR) concept as a solution to flooding on the Elbow, Highwood and Sheep Rivers together. In this concept, the reservoir is located in the upper catchment of the Sheep River and flows from the Elbow and Highwood Rivers are diverted to the Sheep River catchment using tunnels.

FIGURE 8 - LOCATION OF THE TRJR CONCEPT, TAKEN FROM THE TRJR WEBSITE

Based on the information available on the TRJR website, The City's does not believe that the TRJR concept is a realistic option for flood protection for Calgary given the extremely high anticipated cost to implement a project of this magnitude, limited potential flood mitigation benefits due to the proposed location, and the significant environmental impacts expected based on both the estimated size and proposed location.

Conclusion

More than five years after the 2013 flood, Calgary's downtown and Elbow River communities remain exposed to significant flooding risk and needs protection as soon as possible. This is why it is important to provide timely, cost effective, and practical flood risk management while respecting community values and staying adaptable to future uncertainties.

Two successive Provincial governments have conducted in-depth studies of Elbow River flood mitigation options and concluded that SR1 is the best project from a financial, social and environmental perspective. The Province has set aside money to build this project, and it is currently undergoing an exhaustive Federal environmental assessment. Over 1.2 million citizens are relying on the assessment to be completed in a timely manner and for SR1 to be built as soon as possible.

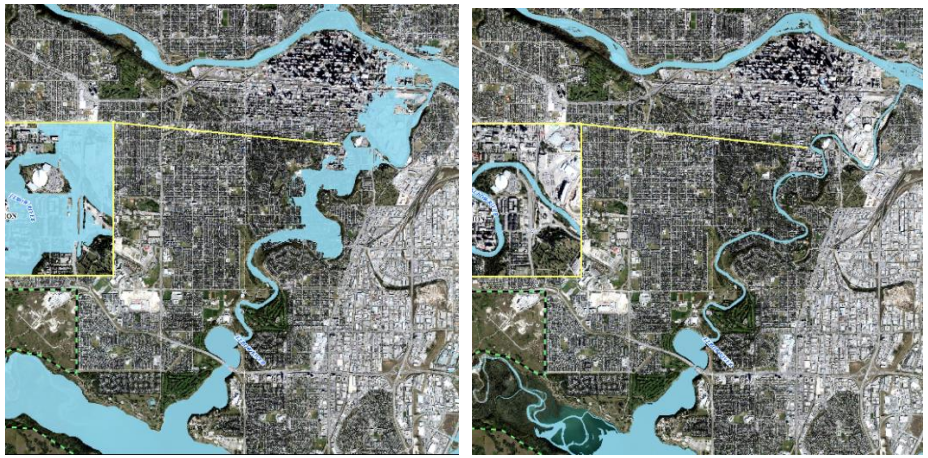

FIGURE 9 - THE 2013 ELBOW RIVER FLOOD EXTENTS (LEFT), AND WHAT FLOODING WOULD LOOK LIKE WITH THE SPRINGBANK PROJECT IN PLACE.

For more information on The City's flood mitigation and resiliency program please **contact 311** or visit **calgary.ca/floodinfo**