

FLOOD RESILIENCY AND MITIGATION



2016 Update Report

1. BUILDING RESILIENCY TO FLOODING

Since the 2013 floods, The City of Calgary has increased its resources and focus on building flood resiliency and mitigation. The 2013 floods caused significant social disruption and unprecedented economic damages, and we've been working to better understand flood risks while implementing new flood mitigation and resiliency measures.

To guide the flood resiliency program, The City supported the formation of an independent Expert Management Panel to make recommendations on flood resiliency shortly after the 2013 flood. The City is now implementing the 27 recommendations from the 2014 Report from the Expert Management Panel on River Flood Mitigation (PFC 2014-0512).

Building flood resiliency takes the whole community working together. It requires long-term commitment and collaboration across the Corporation, with other orders of government, community partners, and citizens.



Figure 1.0 Watershed Planning Strategic Goals

The City of Calgary takes an integrated approach to watershed management to protect public health, conserve our water resources, and support the needs of a growing city (Figure 1.0). Building resiliency to flooding is one of the four main goals of the strategic framework and is undertaken in the context of the entire watershed.

This report addresses the fourth goal of the framework, *Build Resiliency to Flooding*. An update of the status of the three other goals, *Protect our Water Supply*, *Use Water Wisely*, and *Keep our Rivers Clean* is addressed in a separate report to the Standing Policy Committee on Utilities and Corporate Services (2016 Watershed Planning Update, UCS2017-0267).

Expert Management Panel recommendations

This report highlights progress made in 2016 on the 27 recommendations developed by the Expert Management Panel. Water Resources is responsible for leading 18 of the 27 Expert Panel Recommendations, and coordinates and supports the remaining recommendations, led by Calgary Growth Strategies, Calgary Emergency Management Agency (CEMA), Customer Service and Communications, Calgary Building Services, and Environmental & Safety Management.

Figure 1.1 shows the strategic framework used for the Expert Management Panel's recommendations, and progress updates are organized on the five key areas identified in the framework.

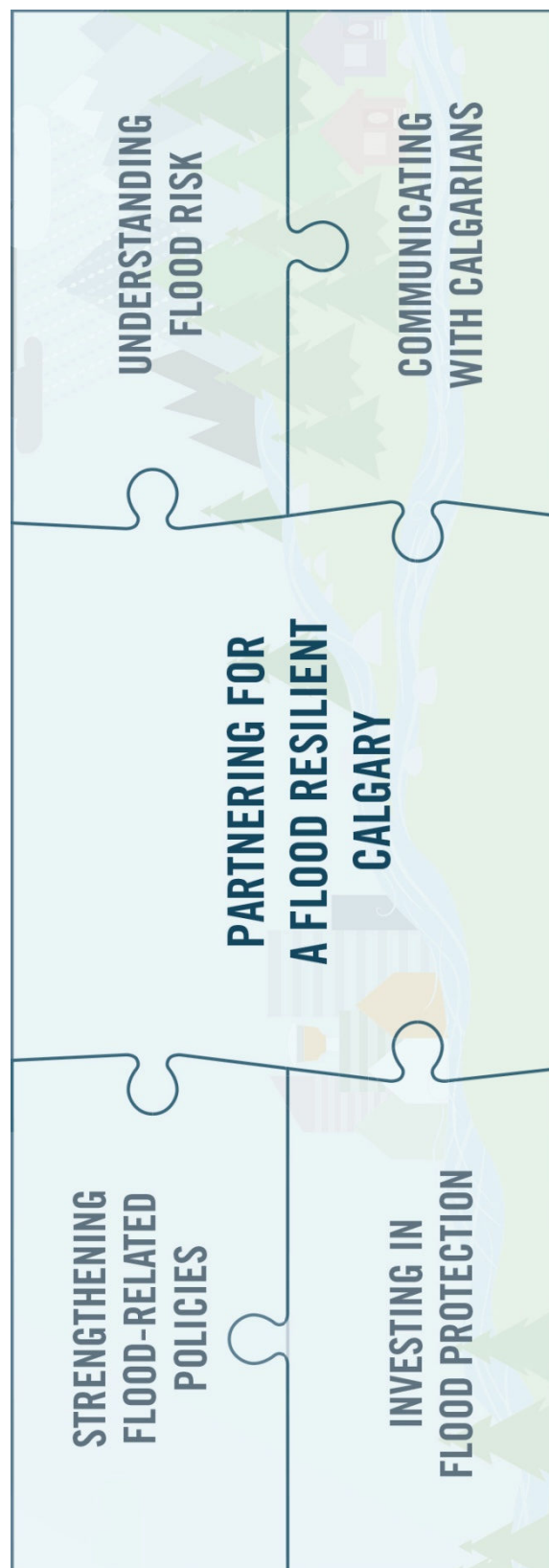


Figure 1.1 Flood Resiliency and Mitigation Strategic Framework

As of 2016, all recommendations have been initiated, are underway or are complete (Figure 1.2). Progress on specific recommendations is summarized in the sections below. The City of Calgary's 2016 Citizen Satisfaction Survey confirmed that building resiliency to flooding remains a priority for Calgarians (Figure 1.3). The City continues its strong commitment to moving Calgary toward a flood resilient future and this includes implementing the 27 recommendations from the Expert Management Panel.

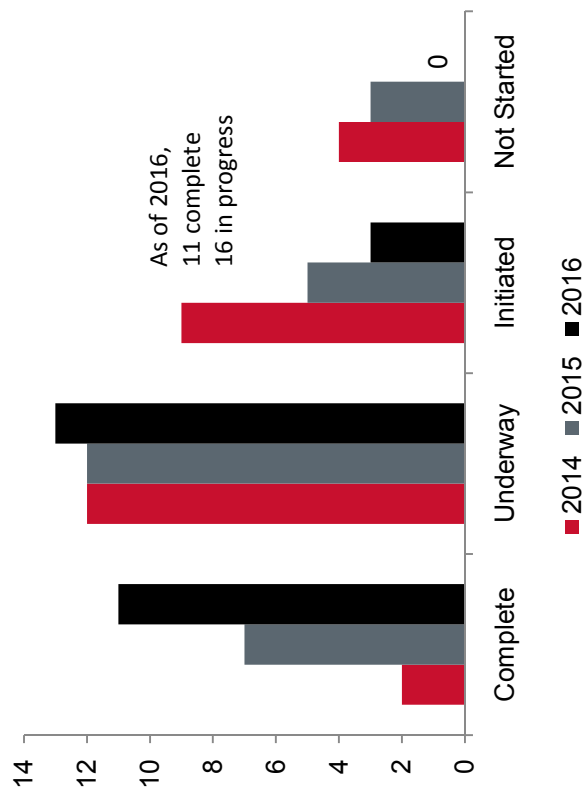


Figure 1.2 Progress on the 27 Expert Panel recommendations

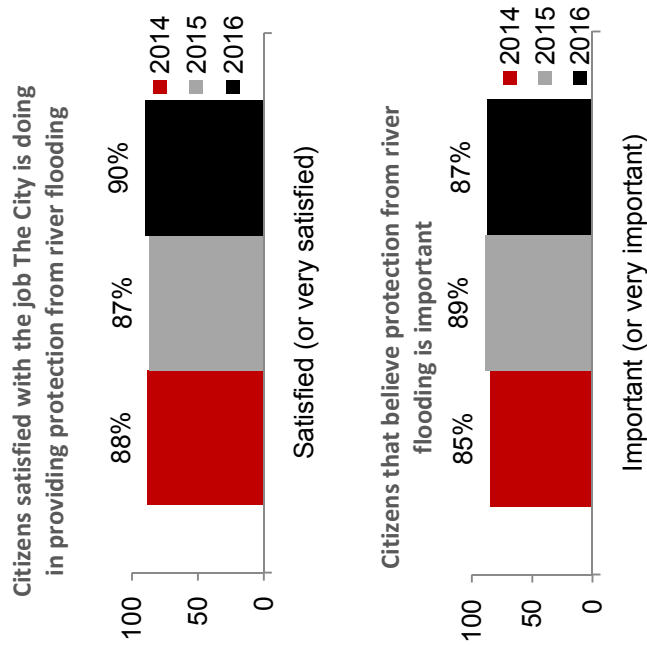


Figure 1.3 Results of Calgary's 2016 Citizen Satisfaction survey

2. UNDERSTANDING FLOOD RISK

There will always be a risk of river flooding and CEMA has identified flooding as Calgary's number one hazard and risk. The Expert Management Panel included several recommendations around understanding flood risk, which is one of The City's core strategies for building resiliency. In 2016 The City continued to conduct research, modeling, and monitoring to better understand Calgary's flood risk.

Understanding flood risk Expert Management Panel Recommendation	Status	Timeline	2016 update
Urge the Province to regularly review and update official flood hazard maps. (5b)	Underway	2017-2018	The City has been providing municipal perspectives and implications to the Province on Flood Hazard Area (FHA) maps and the implications of potential new land use regulations. The Province is planning to engage municipalities before FHA map finalization. Draft maps for engagement are expected from the Province in Q1-Q3 2017.
Develop a suite of watershed-scale climate models to capture various weather event scenarios, with input from regional partners, post secondary institutions and other orders of government. (5d)	Underway	2016-2018+	A feasibility study was completed in 2016 to explore the potential for a high-resolution climate model for Calgary. Next steps are to identify if, how, and when to proceed with recommendations to build the model.
Collaborate with academic and other partners to develop computer models that identify groundwater movement in Calgary in relation to flood conditions. (5e)	Underway	2016-2018+	In 2016, The City completed a preliminary assessment on groundwater impacts relating to flooding, which were included in The City's updated Flood Damage Assessment. This information was used to analyze potential new structural and non-structural mitigation measures for Calgary as part of the Flood Mitigation Measures Assessment project in 2016. The City also applied to the Federal Government's National Disaster Mitigation Program to pursue funding to complete a detailed risk assessment and further refinements on groundwater impacts for Calgary. The City is currently waiting on a decision from Public Safety Canada on funding.
Maintain a comprehensive flood risk database integrated with existing geographic information systems (GIS). (5c)	Complete	2015-2016	In 2016, The City produced a GIS package on flood risk damage profiles at the community level. This data was created as part of The City's Flood Damage Assessment and has been incorporated into The City's GIS database.
Publish up-to-date, graduated flood maps for public information. (5a)	Complete	2015	Inundation maps prepared by The City for up to 100-year return periods have been posted to Calgary.ca/floodinfo and are available to the public.

3. INVESTING IN FLOOD PROTECTION

Recognizing the scale of impact caused by flooding, continued significant investments are needed for flood mitigation. Citizens believe that investment in flood mitigation is important and The City is working with all orders of government to explore opportunities and secure funding for investments in flood resilience. In 2016, The City also applied for an additional \$19.5 million for five projects from the Alberta Community Resilience Program (ACRP).

Investing in flood protection Expert Management Panel recommendation	Status	Timeline	2016 update
Prepare a time-phased plan to modify structures that constrain river flow during flood events, such as pathways and bridges. (4b)	Underway	Ongoing	Flood levels are currently considered as part of lifecycle project planning and implementation. Repair and reconstruction of bridges and pathways after 2013 were designed to withstand the 100+ year level flood, as are current bridge construction projects. This recommendation is linked to The City's Climate Change Adaptation Plan.
Develop a comprehensive climate adaptation plan and implementation tools to reduce The City's infrastructure and operational vulnerabilities. (6d)	Underway	2017-2018	Over 140 staff and 30 managers Corporate-wide provided input into impacts and risks to the Corporation from various climate change scenarios in 2016. Recommended adaptation actions will be presented in a report to Council. Business units will develop specific adaptation actions to incorporate in the Business Planning and Budget Cycle process in 2018.
Connect with the provincial body overseeing flood protection and loss reduction and support the Province's continuing analysis of flood mitigation options and implementation of appropriate measures through the watersheds. (6b)	Underway	Ongoing	The City is participating as a co-chair in the Province's Bow River Advisory Group and participating in the Bow River Working Group to explore potential upstream flood mitigation on the Bow River. The City also participates in the Province's technical committee on the development of the Springbank Reservoir upstream of Calgary on the Elbow River, and connects with Provincial counterparts through regular meetings on watershed level solutions to flood mitigation.
Increase the operating water storage capacity of the Glenmore Reservoir on the Elbow River through modifications to the Glenmore Dam. (3b)	Underway	2015-2020	The Glenmore Dam infrastructure improvement program includes a project to elevate the dam's gates to help control flooding and manage water supply. Work to support the construction of the gates has started, and the project is expected to be operational in 2020. The elevated gates will increase capacity at the Glenmore Reservoir and, operated in tandem with the proposed Springbank Reservoir, will provide attenuation for a 2013-level flood on the Elbow River.

Investing in flood protection Expert Management Panel recommendation	Status	Timeline	2016 update
Construct additional or higher flood barriers in key locations throughout the city and update temporary flood barrier plans to protect against higher flood levels. (3d)	Underway	2014-2026+	Temporary barrier planning is updated on an annual basis as part of The City's Flood and Barrier Emergency Response Manuals. A number of new barriers have been initiated since 2013: Bonnybrook Wastewater Treatment Plant (underway), West Eau Claire (starts spring 2017), Heritage Drive (in design), Centre Street bridge gates (in design), Calgary Zoo (underway), Deane House (complete). The Flood Mitigation Measures Assessment and River Flood Protection Conceptual Design study will inform prioritization for future projects. Preliminary timeline subject to change.
Provide an annual update to City Council on progress related to the recommendations from the Expert Management Panel on River Flood Mitigation. (6f)	Underway	Ongoing	Annual updates are provided by Water Resources to Council's Standing Policy Committee on Utilities and Corporate Services.
Evaluate social, economic and environmental impacts of flood mitigation options. (6c)	Complete	2015-2016	A key piece of work completed in 2016 was a Flood Mitigation Measures Assessment project. A triple bottom line approach was used to assess possible flood mitigation measures to determine the most effective combination of measures for flood resilience. The assessment considered multiple concepts including watershed and community level structural measures, and a combination of these. Non-structural mitigation options, such as changes to building regulations, operational strategies, land use policy, and other measures were also considered. Citizen input was gathered through a Community Advisory Committee and public and stakeholder engagement to inform this project. Results of this study will inform recommendations for future investments in flood mitigation.
In partnership with the Province, compare the three major capital works options for mitigating floods on the Elbow River. (3a)	Complete	2015-2016	The Springbank Off-stream Reservoir was announced by the Province in 2015, and the Province has proceeded with this project, which is currently undergoing a federal environmental impact assessment.
Establish a permanent team within The City to oversee flood preparedness and resilience. (6a)	Complete	2015-2016	Funding requests for a permanent team were approved in December 2014. The Watershed Planning Division was established in 2015, and supports this team.

4. STRENGTHENING FLOOD-RELATED POLICIES

Land use policies, design standards, and flood-proofing building practices, when used alongside structural protection investments, can greatly enhance community resilience to flooding. The City remains committed to working closely with the Provincial and Federal governments on policy consultation regarding flood hazard area mapping, policy development, practices and regulations, and flood design levels.

Strengthening flood-related policies Expert Management Panel Recommendation	Status	Timeline	2016 update
Create graduated flood protection level requirements for City infrastructure. (1b)	Underway	2017- 2018+	Flood levels are currently considered as part of lifecycle project planning and implementation. For the Flood Mitigation Measures Assessment, a 1:200 level was used as reference. This recommendation is linked to the Climate Adaptation Program and CEMA's critical infrastructure strategy. A formalized Corporate-wide program, if deemed necessary, must consider future Provincial flood policies and Federal floodplain guidelines.
Expand the review of the Land Use Bylaw and other development regulations to update flood resiliency requirements for private property in flood risk areas. (1c)	Initiated	2017- 2018+	Amendments made to the Municipal Development Plan and Land-use Bylaw after the 2013 flood tightened requirements and allow discretionary approval for developments in the flood plain. Further changes must consider future Provincial flood policies and Federal floodplain guidelines, upstream mitigation, legislated protection levels, and further citizen engagement. The Flood Mitigation Measures Assessment will also inform potential future policy changes.
Review The City's existing land-use planning documents and develop amendments, new guidelines or policies that will minimize development in the floodplain over time. (4a)	Initiated	2017- 2018+	In 2016, The City participated in Public Safety Canada and Natural Resources Canada workshops to explore new national floodplain guidelines. The Flood Mitigation Measures Assessment will inform exploration of future policy changes, which are dependent on future Provincial flood policies and Federal floodplain guidelines, upstream mitigation, legislated protection levels, and citizen engagement.
Perform a social, economic and environmental analysis to evaluate the need for a minimum flood protection level above the 1:100 flood for land-use planning and structural protection across Calgary. (1a)	Underway	2017- 2018+	Area Structure Plans, Area Redevelopment Plans, building permits, City projects and approvals are currently reviewed to identify flood risks and structural requirements based on various flood protection levels. If a future Corporate program is developed, it must consider future Provincial flood policies and Federal guidelines, as well as further citizen engagement. For the Flood Mitigation Measures Assessment, a 1:200 level was used as reference.

5. PARTNERING FOR A FLOOD RESILIENT CALGARY

The City recognizes the important role partnerships play in implementing the Expert Management Panel's recommendations. The City depends on strong partnerships with the Province, other stakeholders such as TransAlta, flood-related organizations, citizens and communities upstream and downstream to build flood resiliency.

Partnering for a flood resilient Calgary Expert Management Panel Recommendation	Status	Timeline	2016 update
Strengthen partnerships with utility providers to improve resiliency of their infrastructure and operations, with first priority to energy supply and communication networks. (1d)	Underway	Ongoing	The Flood Emergency Response Manual is updated annually to ensure maximum protection of critical city infrastructure and vulnerable communities. CEEMA is also developing a critical infrastructure strategy. CEEMA has identified core utility providers and businesses as key stakeholders.
Pursue a common river forecasting platform with Alberta Environment and Parks (AEP) and TransAlta for faster and more accurate information and alerts about future flood events. (2a)	Initiated	2015-2018	The City is consulting with Alberta Environment and Parks regarding how to leverage forecasting data between both organizations as the Province explores an enhanced forecasting platform.
In partnership with Alberta Environment and Parks and TransAlta, expand the network of river and weather monitoring stations upstream of Calgary and protect stations from damage during flooding. (2b)	Complete*	2017	Since 2013, The City has repaired or replaced damaged monitoring stations and installed some new stations. *This recommendation is considered complete. However, as part of forecasting platform discussions (see 2a), future monitoring station installations by the Province would benefit The City of Calgary.
In partnership with the Province, develop a time-phased plan to remove buildings from areas with high flood risk, while minimizing the disruption to affected communities. (4c)	Complete*	2017	The voluntary Provincial buy-outs program is complete and the Province has begun demolition of properties. No further Provincial buy-outs are planned at this time. *This recommendation is considered complete but may be re-visited in the future, depending on potential future Provincial policy. Currently, the Province maintains ownership of the 19 properties in Calgary.
Continue to cooperate with TransAlta and the Province to increase flood storage on the Bow River through operation of existing TransAlta facilities. (3c)	Complete	2016	The Province and TransAlta have 5-year agreement in place for Ghost Reservoir operations, ending in 2021.
Host a national flood risk workshop to share best practices & develop a networking group. (6e)	Complete	2015	The City hosted the 2015 Livable Cities Forum on Building Flood Resilient Communities in September 2015 in partnership with CWRA and ICLEI Canada. Discussions to develop a national network for municipalities are ongoing.

6. COMMUNICATING WITH CALGARIANS

It is critical for The City to keep Calgarians informed, provide resources and engage with citizens when it comes to building flood resiliency. Since 2013, City staff has met regularly with citizens, community members, organizations, community action groups, flood task forces and media for engagement and to provide community-specific updates on flood mitigation and resilience strategies.

Communicating with Calgarians Expert Management Panel Recommendation	Status	Timeline	2016 update
Develop programs that support building owners to implement flood resiliency measures. (2e)	Underway	2017-2018	Flood Impacted People and Property Project (FLIPPR) concluded as of 2016. The Flood Permit Grant Program co-administered with Red Cross to provide permits to homeowners not eligible for the Disaster Relief Program ended as part of FLIPPR conclusion. CEMA implemented some programs for community resilience (READYCalgary), non-profit assistance during floods (EPIC Calgary), and business continuity (business continuity visits). In 2017, The City plans to explore the development of property level flood mitigation incentive and education programs for Calgarians.
Incorporate lessons learned from the 2013 flood to enhance communication channels to keep Calgarians informed of conditions that may lead to high river levels. (2c)	Complete	Ongoing	The City established cross-corporate communications plan and flood readiness communications plan, including providing information through annual open houses scheduled during flood season and regular newsletter and website updates.
Expand the flood risk communication strategy and provide information and tools that empower Calgarians to make informed choices and better manage their personal flood risk. (2d)	Complete	2015-2016	The City established a cross-corporate communications plan and flood readiness communications plan, including providing information through annual open houses scheduled during flood season and regular newsletter and website updates.

7. ACTIONS FOR 2017

The City of Calgary continues to work towards the implementation of the Expert Management Panel's recommendations to help build flood resilience in Calgary. With the completion of the Flood Mitigation Measures Assessment project, The City of Calgary has compiled recommendations that set the stage for a long-term flood mitigation plan. This plan will consider existing risks and uncertainties, while presenting an ideal set of recommendations based on the results of the Flood Mitigation Measures Assessment and feedback heard during the public engagement period.

For 2017, The City of Calgary will focus on developing an immediate and long-term implementation plan resulting from the recommendations from the Flood Mitigation Measures Assessment and prioritizing additional mitigation projects. The City will also continue working with the Province to support upstream mitigation measures and seek funding opportunities from both the Provincial and Federal governments to facilitate implementation of the long-term mitigation plan.

Planned Actions:

- Work with Council to advocate for an upstream reservoir on the Bow River and support the development of the Springbank Off-stream Reservoir by the Province.
- Continue to support upstream Provincial projects through the Springbank Reservoir Technical committee, Bow River Advisory Group, and the Bow River Working Group.
- Develop an implementation plan for a complementary barrier package for the Bow River, including construction sequence plan, funding approach, design, and community engagement planning. Continue developing current barrier projects.
- Explore the development of a property level mitigation program for Calgarians. This may include incentive and education programs for building resiliency at the property level.
- Continue advocating for appropriate Provincial flood policy and Federal guidelines through engagement with the Province and participation in national floodplain guideline discussions.
- Conduct further research of policy development for areas prone to flooding, in alignment with future Provincial flood policy and Federal guidelines.
- Deliver annual public flood and drought awareness communications.
- Implement select gravel bar removal and fish habitat improvement projects.
- Lead annual Flood, Water and Barrier Emergency Response Management updates.
- Monitor and forecast river hydrology with continual improvements.