



Calgary



# Calgary's Flood Resilient Future

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ISC: Unrestricted



## The Bow and Elbow Rivers – How do they flood?

- 9000 km<sup>2</sup> of steep, high, mountain catchment
- Limited reservoir or lake storage
- ‘Delayed’ mountain snowmelt runoff-June
- Widespread rains in May-Jun



Flood risk is a natural consequence of upstream geography, topography and meteorology





# Our Hydrology and Meteorology lead to...



**Equivalent Annual Risk of \$170M/year (2013)**

**~\$1.8B of Direct and Indirect Economic Impact from 2013 Alone**



# Calgary's Holistic Resilience Approach

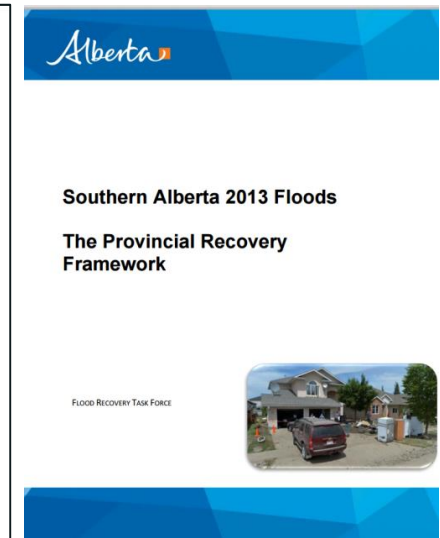
## 2013 Expert Flood Panel

- 27 Recommendations
- Resilience **bigger than Calgary**
- Resilience is complex
- Study and combine solutions:
  - Local & regional
  - Structural & non-structural
  - Infrastructure, Operations & Policy
- City lead **local** mitigation;  
Province lead **regional** mitigation

### CALGARY'S FLOOD RESILIENT FUTURE

Report from the Expert Management Panel on River Flood Mitigation

June 2014





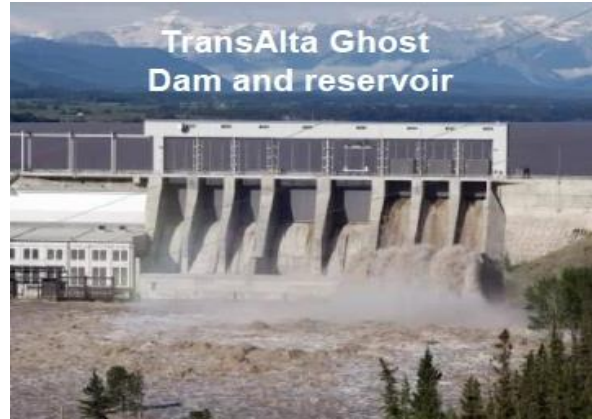


# Key measures studied / combined

## New reservoirs upstream



## New operational efficiencies



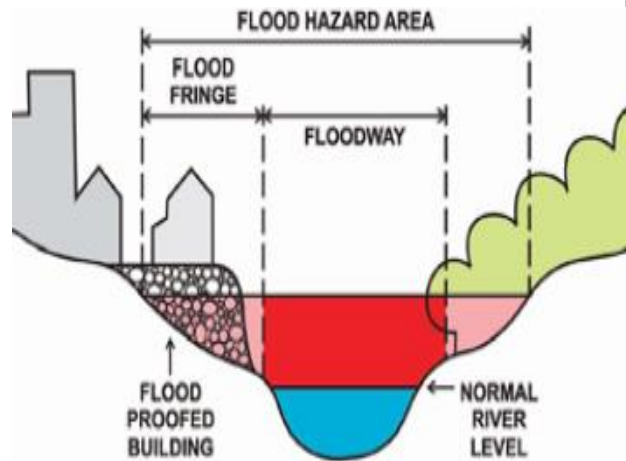
## New community flood barriers & local improvements



## New property-level programs



## Update land use policy & development



## Improved forecasting/emergency response





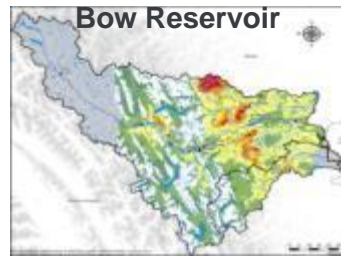
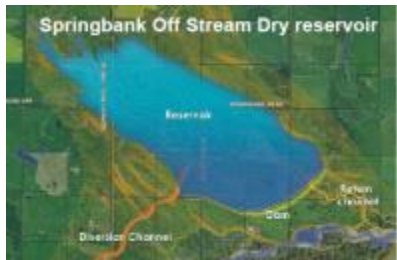
# Structural Mitigation : The Backbone of Flood Resilience for Calgary

## Elbow River

**Springbank Reservoir  
+ new Glenmore gates**

## Bow River

**New upstream reservoir (BRWG)  
+ TransAlta agreement  
+ Local barriers & Drainage Works**



- + Land use policy and building regulations
  - + Education and awareness
  - + Emergency preparedness, response, forecasting
- Plan endorsed by Council in 2017

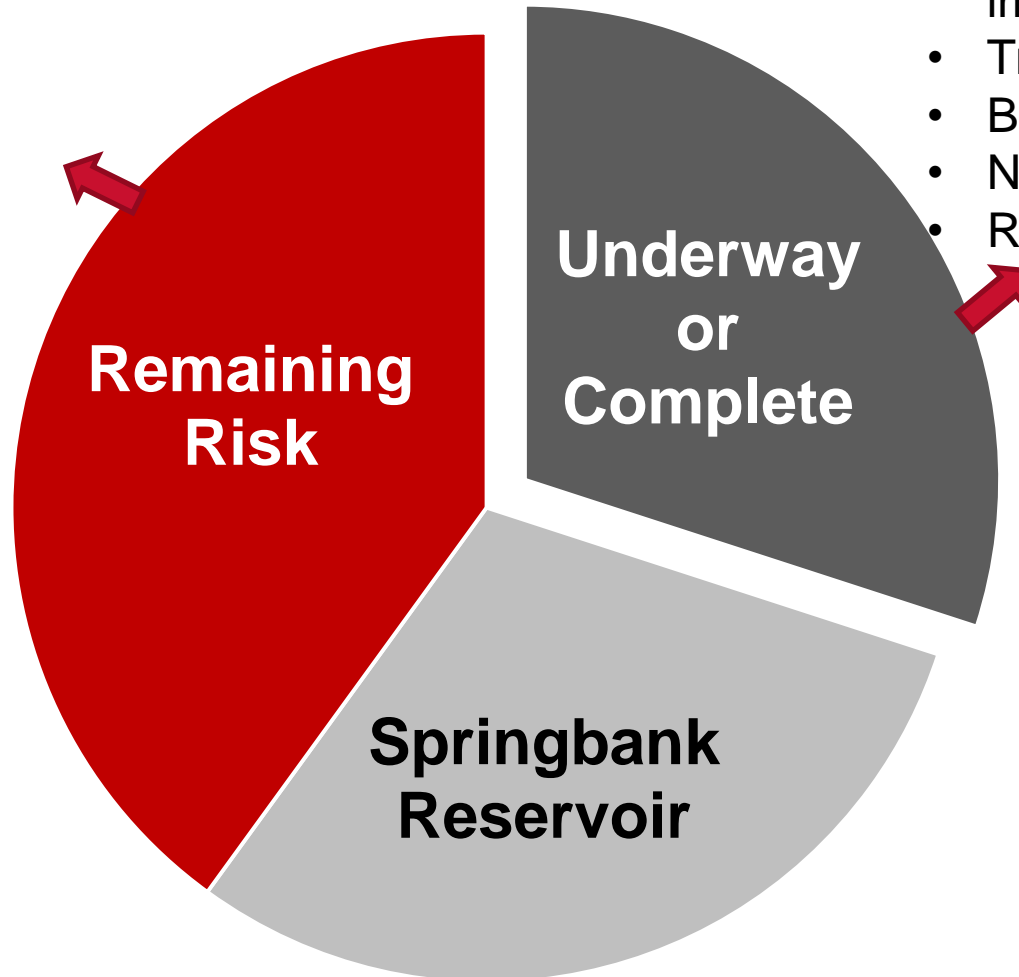


# What's been Done Since 2013

## Calgary River Flood Risk

- Bow upstream reservoir
- Local barriers / floodwalls
- Emergency Response

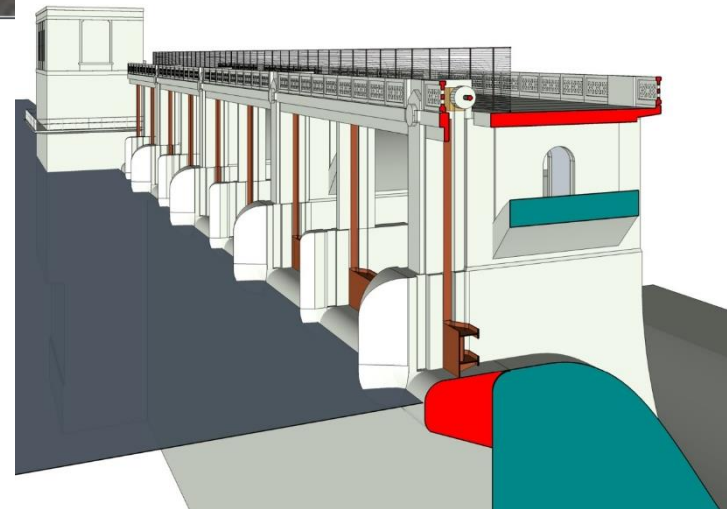
- Glenmore Dam Gates
- River bank strengthening
- Drainage system improvements
- TransAlta Operations
- Barriers / Floodwalls
- New bridges
- Riparian restoration





# Glenmore Dam Crest Gates

- Under construction
- Doubles flood storage
- \$70M improvement, \$7M from Provincial ACRP program
- Offers 20% of storage needed for Elbow River communities

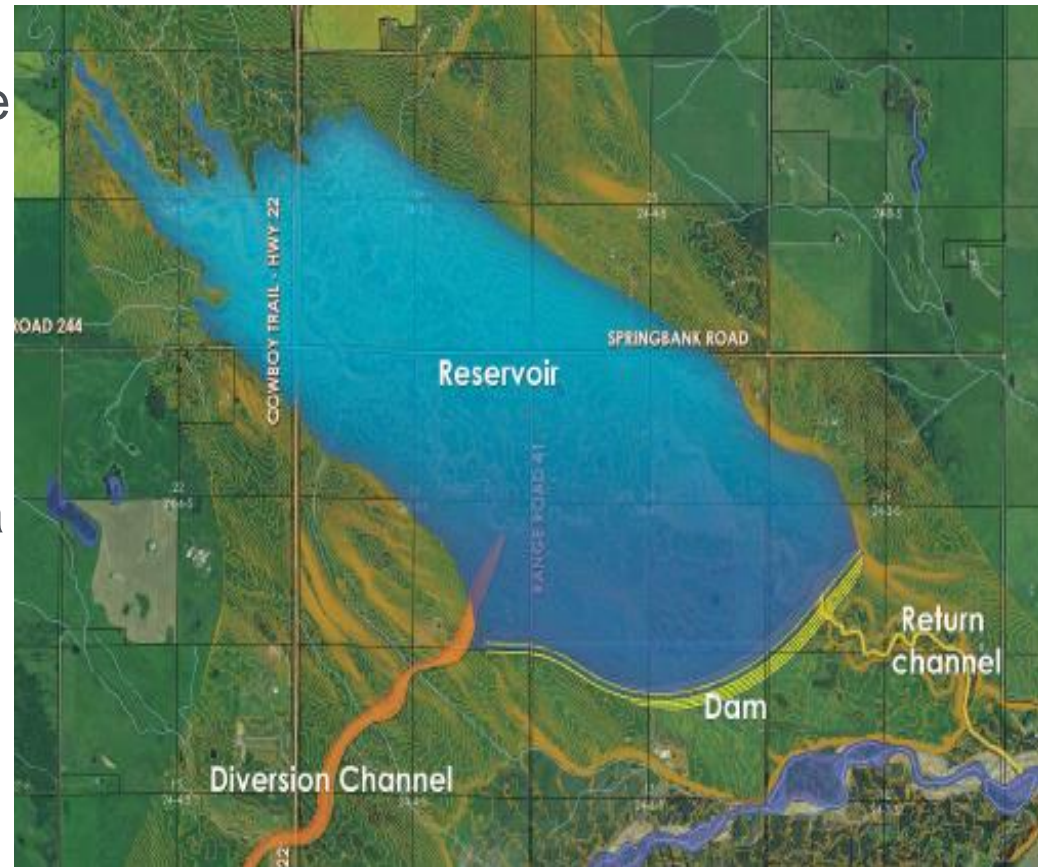






## Springbank Off-Stream Reservoir

- 5 times the storage of Glenmore
- 80% of mitigation needed for Elbow
- with Glenmore gates, protects Elbow to 2013 level
- Large upstream catchment area
- Off-stream – little to no impact on normal streamflow, habitat, water quality and function



- **Together with Glenmore gates** eliminates need for other structural protection on Elbow
- **Cannot reasonably be replaced by local barriers** on lower Elbow
- Less expensive than buy-out, barriers or Diversion tunnel



## McLean Creek Dam

- Major environmental & habitat impact
- 30% smaller catchment area – less effective
- Construction & operation complexity / risk

## Tri-Rivers Proposal

- Cost & engineering feasibility unclear
- Water licensing impacts
- Major environmental and habitat impact

## Local Protection (Barriers and Floodwalls)

- Conceptual design costs greater than benefits for Elbow River communities
- Environmental, social impacts unacceptable

## Other Concepts Studied and Turned Aside:

- Dredging Glenmore Reservoir
- Diversion of Elbow to Fish Ck
- Community/Property Buy-out
- Land Use Regulation (without structural flood mitigation)
- Insurance (without structural flood mitigation)
- Emergency Flood Response (without structural and other non-structural mitigation)





# New Upstream Reservoir on the Bow River

Bow River Working Group – Led by Province and City

May 2017 Report shortlisted 3 of 14 options

Province proceeding with feasibility study of top options

\*No single new dam is big enough on its own, and will take time, so Bow River communities also need local works

A single new dam can:

- Reduce 2013 flood to  $\sim 1200 \text{ m}^3/\text{s}$   
(not zero damage)
- Decrease erosion, groundwater and sewer backup at intermediate floods and eliminate damages for small flood events





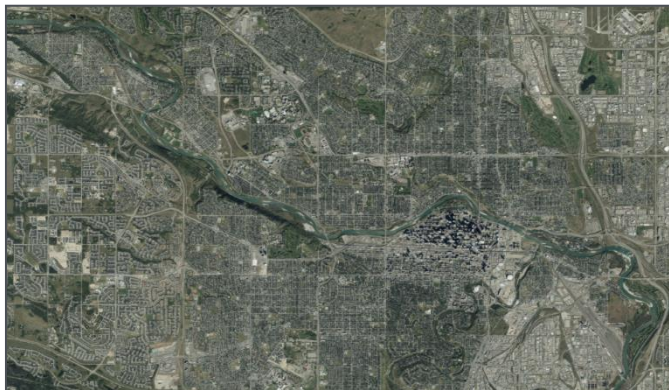
## 2013 flood unmitigated

(what would have happened if no action was taken)



## 2013 FLOOD ACTUAL

(City and TransAlta operations, Glenmore Dam Operation, emergency response)



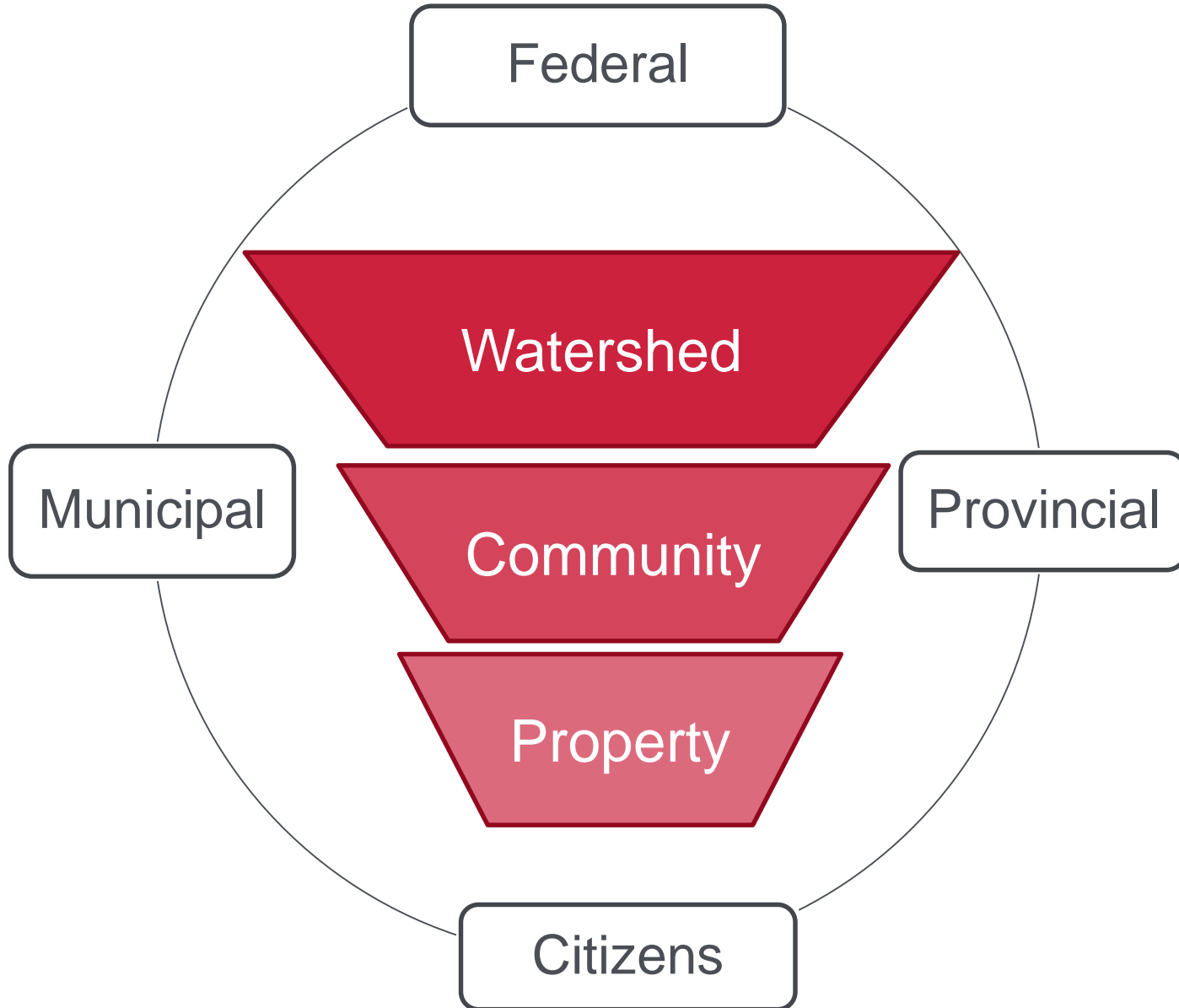
## 2013 flood with full flood resilience plan in place

(New upstream reservoirs, enhanced operations, community barriers, emergency response)





# Resiliency through integrated levels of flood mitigation





**Calgary floods due to the nature of upstream lands**

**River flood risk needs a comprehensive, combination of solutions, supported by a backbone of major new reservoir infrastructure**

**Damages will exceed infrastructure costs, if solutions are not implemented in a timely manner**

**Analysis shows SR1 is the most resilient, effective, practical and environmentally responsible option for the Elbow River**

**Bow River communities cannot be adequately protected without additional upstream reservoir storage**



Thanks for your attention.  
Questions?