WELCOME!

River Flood Mitigation Engagement Sessions

October - November 2016

Agenda

- Welcome and housekeeping items
- Project introduction
- Overview of table discussion process
- Presentation of 3 structural mitigation concepts
- Table discussions – 3 structural mitigation concepts
- Brief reporting back from tables

Break
Shuffle table participants

- Presentation of potential non-structural measures
- Table discussions – non-structural measures
- Brief reporting back from tables
- Closing remarks/next steps/adjournment

Public Engagement Program

3 Pop-up Events

Oct. 12, 11 am – 2:00 pm, Bow River Pathway at Eau Claire
Oct. 13, 11 am – 2:00 pm, CORE Shopping Centre
Oct. 15, 2 pm – 5 pm, Elbow River Pathway at Stanley Park

6 World Café Style Workshops

Oct. 18, 6 pm – 8:30 pm, Hillhurst Sunnyside Community Association
Oct. 20, 6 pm – 8:30 pm, Riverbend Community Association
Oct. 22, 9:30 am – noon, Bowness High School
Oct. 24, 6 pm – 8:30 pm, Cliff Bungalow-Mission Community Association
Oct. 27, 6 pm – 8:30 pm, Southern Alberta Pioneers Memorial Building (Rideau)
Nov. 1, 6 pm – 8:30 pm, Alexandra Centre Society (Inglewood)

2 Public Information / Open House Sessions

Nov. 3, 6 pm – 8:30 pm, Riverbend Community Association
Nov. 5, 9:30 am – noon, Queen Elizabeth Elementary School

Online Engagement

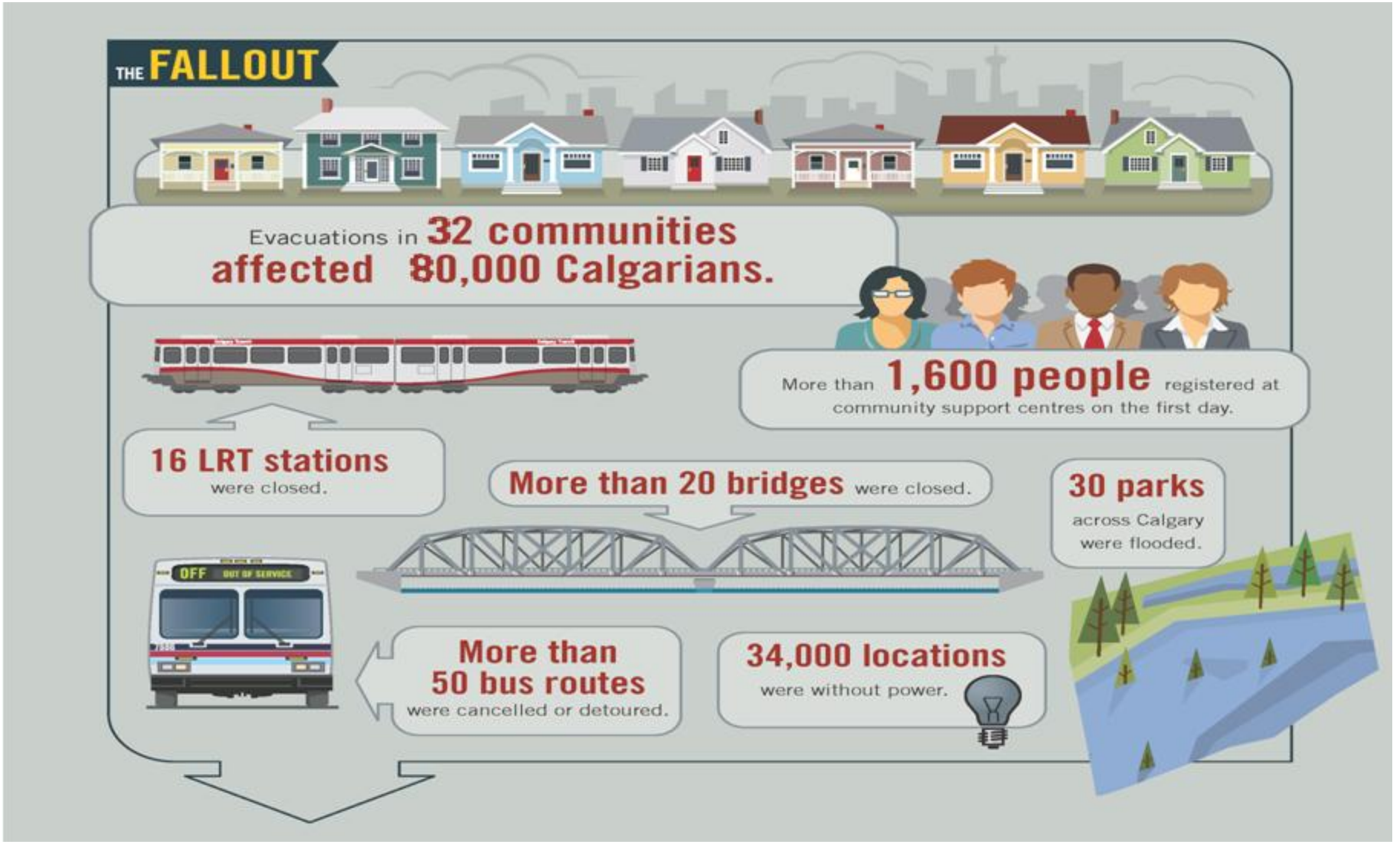
Online engagement will be designed to gather the same input as the in-person activities.

Ground Rules of Engagement

- We minimize distractions.
- We balance air time fairly.
- We speak one at a time.
- We listen to understand before we speak.
- We can disagree respectfully.
- We can change our mind.
- We will respect personal and group privacy when using social media tools.

River Flood Mitigation & Resiliency

The 2013 Flood



Building Resiliency

- Building resilience to flooding requires many different measures.
- It is a long-term process and will not happen overnight.
- We need strong partnerships with the Province, business, community leaders, and citizens.

Flooding and Nature

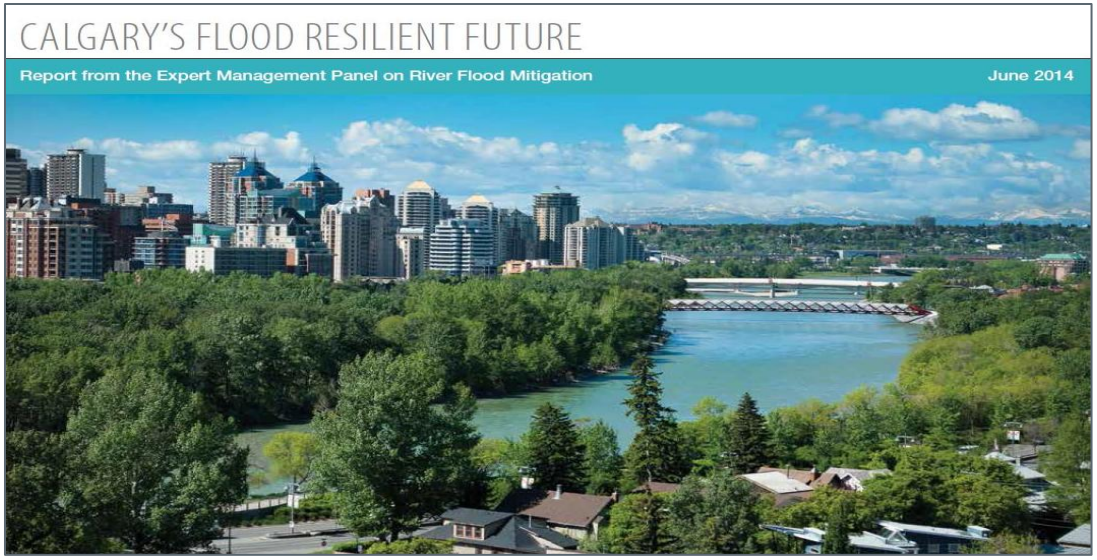
River floods:

- Are a natural process that benefits the floodplain environment
- Brings water and nutrients, regenerates the ecosystem
- Can carve new channels, changing its course, or deposit gravels, creating gravel bars.

In urban environments, both the river and development must be wisely managed, acknowledging and giving room to the river to allow for natural processes wherever possible.

City of Calgary River Flood Mitigation

- One of the recommendations was a study to find out:
  - how much damage floods could do in Calgary
  - how various mitigation measures could reduce the damage.
- This is the Flood Mitigation Measures Assessment study.



Next Steps

Recommendations to Council

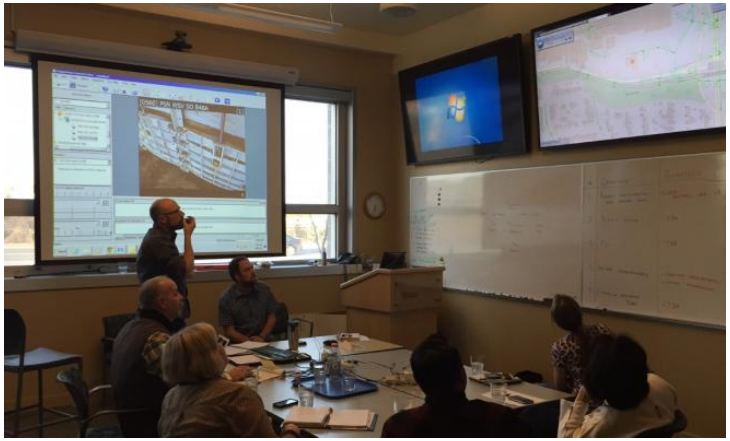
- Based on study results and community input, Administration will make recommendations on flood mitigation to Council in early 2017.

Decisions about flood mitigation should be:

- Based on sound science and a good understanding of the river and our risk.
- Economically sound.
- Enduring .
- Reflective of citizens' perspectives.

What is The City doing?

- Emergency response plans.

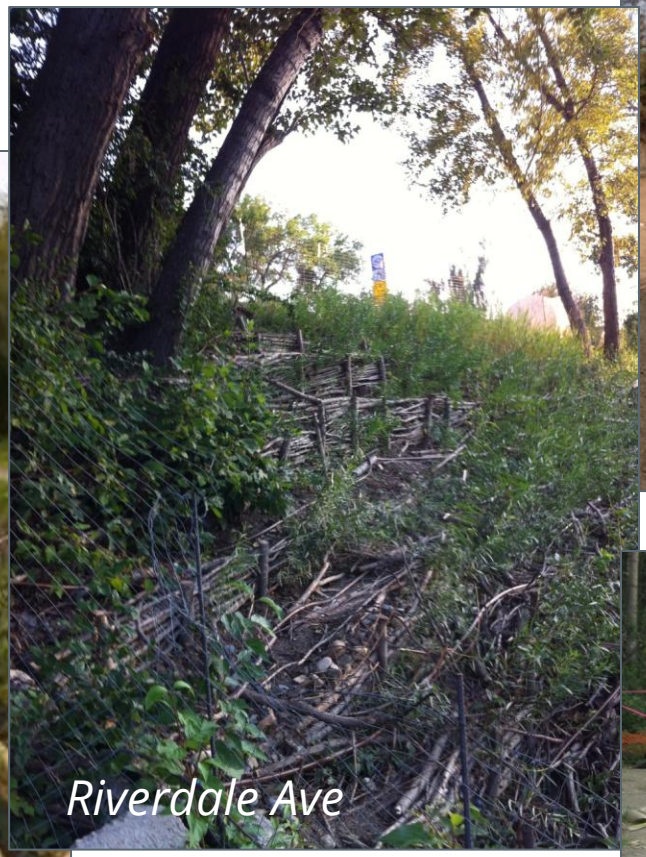


What is The City doing?

- Emergency response plans.
- Repairing and protecting river banks.

Bank repair and protection


Discovery Ridge

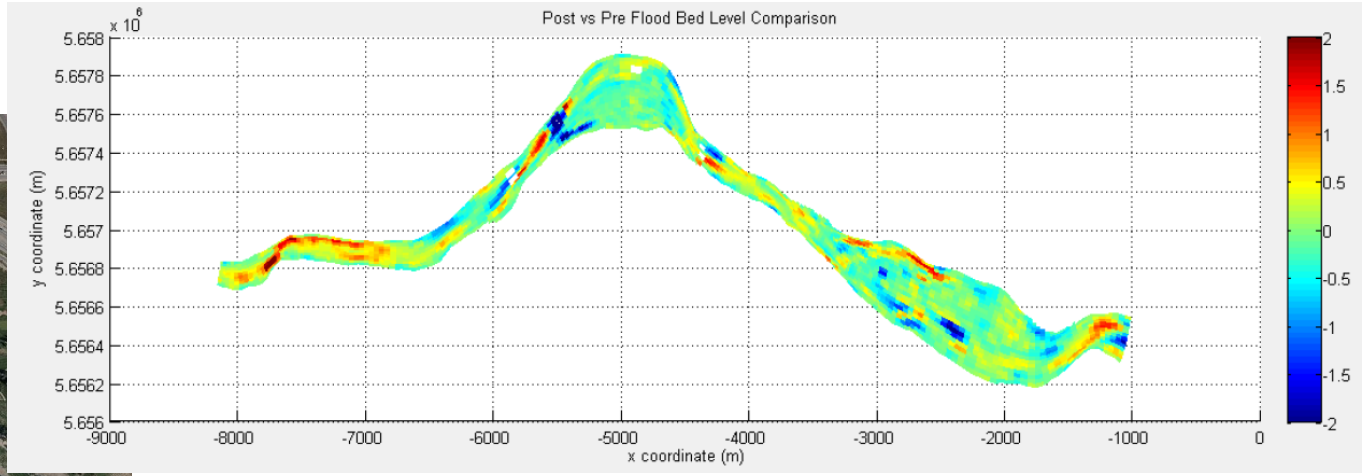

Riverdale Ave


Elbow River at Ramsay

Bow River at Glenmore Trail

What is The City doing?

- Emergency response plans.
- Repairing and protecting river banks.
- Updated flood policy in MDP and Land Use Bylaws.
- Studies of the river to understand how it changed in 2013, and how it will change in the future.



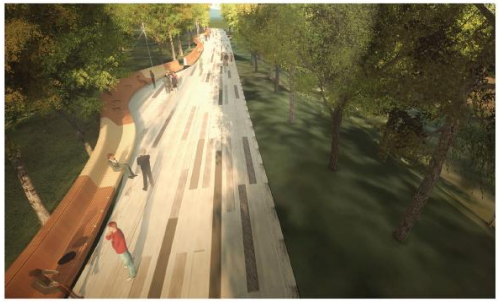
What is The City doing?

- Emergency response plans.
- Repairing and protecting river banks.
- Updated flood policy in MDP and Land Use Bylaws.
- Studies of the river to understand how it changed in 2013, and how it will change in the future.
- Technical studies to assess mitigation options.
- Mitigation projects.

What is The City doing?

Mitigation projects

- Installing gates on the crest of Glenmore Dam.
- Barriers at Bonnybrook, Centre Street Bridge, Heritage/Deerfoot, West Eau Claire, the Zoo.
- Removal of river channel constrictions (debris, select gravel bars).
- Stormwater outfall gates to prevent river backup into communities.
- Improvements to storm and sanitary lift stations.

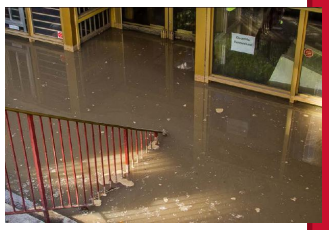


What is The City doing?

- Emergency response plans.
- Repairing and protecting river banks.
- Updated flood policy in MDP and Land Use Bylaws.
- Studies of the river to understand how it changed in 2013, and how it will change in the future.
- Technical studies to assess mitigation options.
- Mitigation projects.
- Working with Province on upstream mitigation.
- Helping businesses, organizations and citizens and communities build resilience.
- Collecting input on how Calgarians view flood resiliency, river health and flood mitigation.

Flood Mitigation Measures Assessment

- In 2015, The City of Calgary hired IBI Group to assess how much damage floods could do in Calgary.
- Their model looked at the latest hydrology, groundwater, social and environmental considerations.



Buildings & contents affected by floodwater

Displacement
Business interruption
Traffic disruption
Stress
Loss of life
Health effects
Loss of recreation
Loss of community services
Environmental damage

Flood Mitigation Measures Assessment

In Calgary, without any mitigation, floods over the next 100 years could cause damage equal to

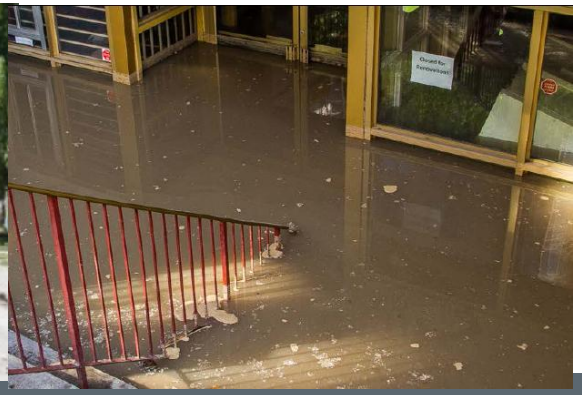
$170M / year

("average annual damages")

But we have some mitigation in place and more being built. This mitigation, including projects built since 2013, reduces the potential flood damage to

$115M / year

30%



Mitigation Options

Existing/Underway

- **Technical / Structural**
  - Raising gates on Glenmore Dam
  - Modified operation of existing facilities (e.g., Ghost Reservoir)
  - Increasing river conveyance capacity
  - Bank stability
  - Healthy riparian areas
  - Springbank Reservoir (SR1)
  - Permanent Barriers (underway)

- **Non-structural**

  Existing land use regulation

  Emergency response

  Improved forecasting, warning time

  Education

For Discussion

- Springbank Reservoir (SR1)
- New reservoir on Bow River
- Permanent Barriers

- Flood-proofing buildings (e.g., elevating, flood gates)
- Removing buildings from the floodway
- Restricting land uses in flood hazard area

Focus for tonight's discussion

River flood mitigation

Please feel to provide feedback to The City on additional topics using your feedback form:

- Springbank Reservoir – design or whether it is a go/no-go
- Options previously determined "off the table", including:
  - Dredging Glenmore Reservoir or the rivers
  - Diversion Tunnel from Elbow River to Bow River under SE Calgary
  - Provincial alternatives for upstream on Elbow River
  - Removing all properties from flood hazard area
- Related hazards – groundwater, drainage (sanitary & storm)
- Insurance

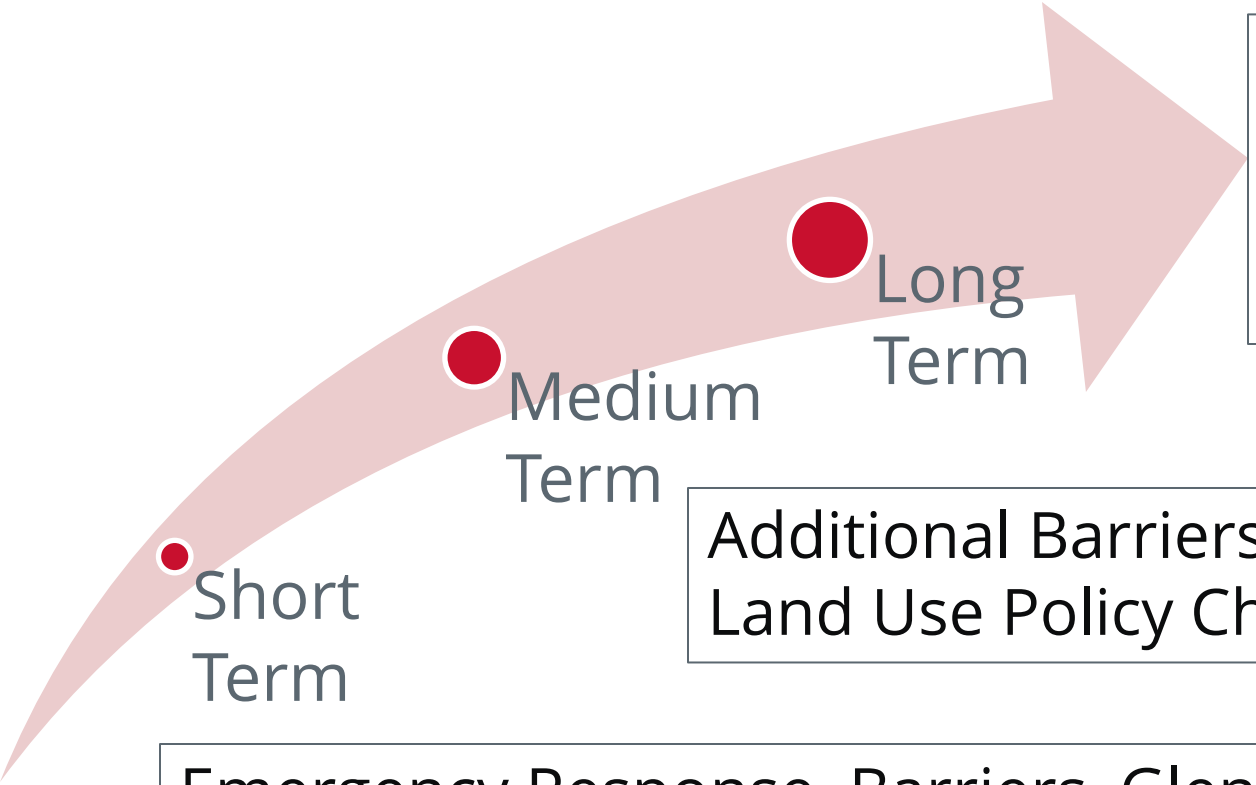
Uncertainties Remain

- River as a natural system

- Provincial Flood Mitigation
  - Springbank Reservoir
  - Bow River Working Group process
  - Updated floodplain mapping
  - New flood regulation/policy

- Federal Policy/Guidelines

Pathway to Resiliency



City-wide resiliency through Barriers / Reservoirs / Land Use Policy

Additional Barriers
Land Use Policy Changes

Emergency Response, Barriers, Glenmore Gates, TransAlta Agreement, Drainage Improvements, Education

We Want to Hear from You

Listen – Assess - Decide

Listen to perspectives

Present recommendations

Re-assess solutions

Community Engagement Activities

- Professional Public Survey (telephone, random) on values around river and flood mitigation
- Community Advisory Group (Mar-Nov 2016)
- Engage portal Online Public Input tool (Mar-Sept 2016)
- **Broad public consultation – in person and online (Oct-Nov 2016)**

What we hear will influence the flood mitigation recommendations put forward to City Council in early 2017.

Community Engagement

How community input is used:

1. To inform Administration's flood mitigation recommendation report to Council.
2. To understand the impacts of various flood mitigation measures on citizens, so that implementation can be designed to maximize benefits and minimize impacts.
3. To shape future public reporting and engagement on flood mitigation.
4. The public engagement report on what he heard will be part of the report to Council and will be shared with the public.

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Mitigation Concepts

There are four mitigation concepts for discussion:

Structural Measures		
Concept 1 Reservoirs	**Concept 2** Barriers	**Concept 3** Reservoir (Elbow) & Barriers (Bow)
Non-structural Measures		
Policy, bylaws & land use regulation		

- These are ***preliminary concepts for discussion only.***
- Significant work has been done to explore the feasibility, costs, benefits, and potential locations/layout of structures.
- Analysis of each concept is ongoing. Neither The City nor other orders of government have committed to them.

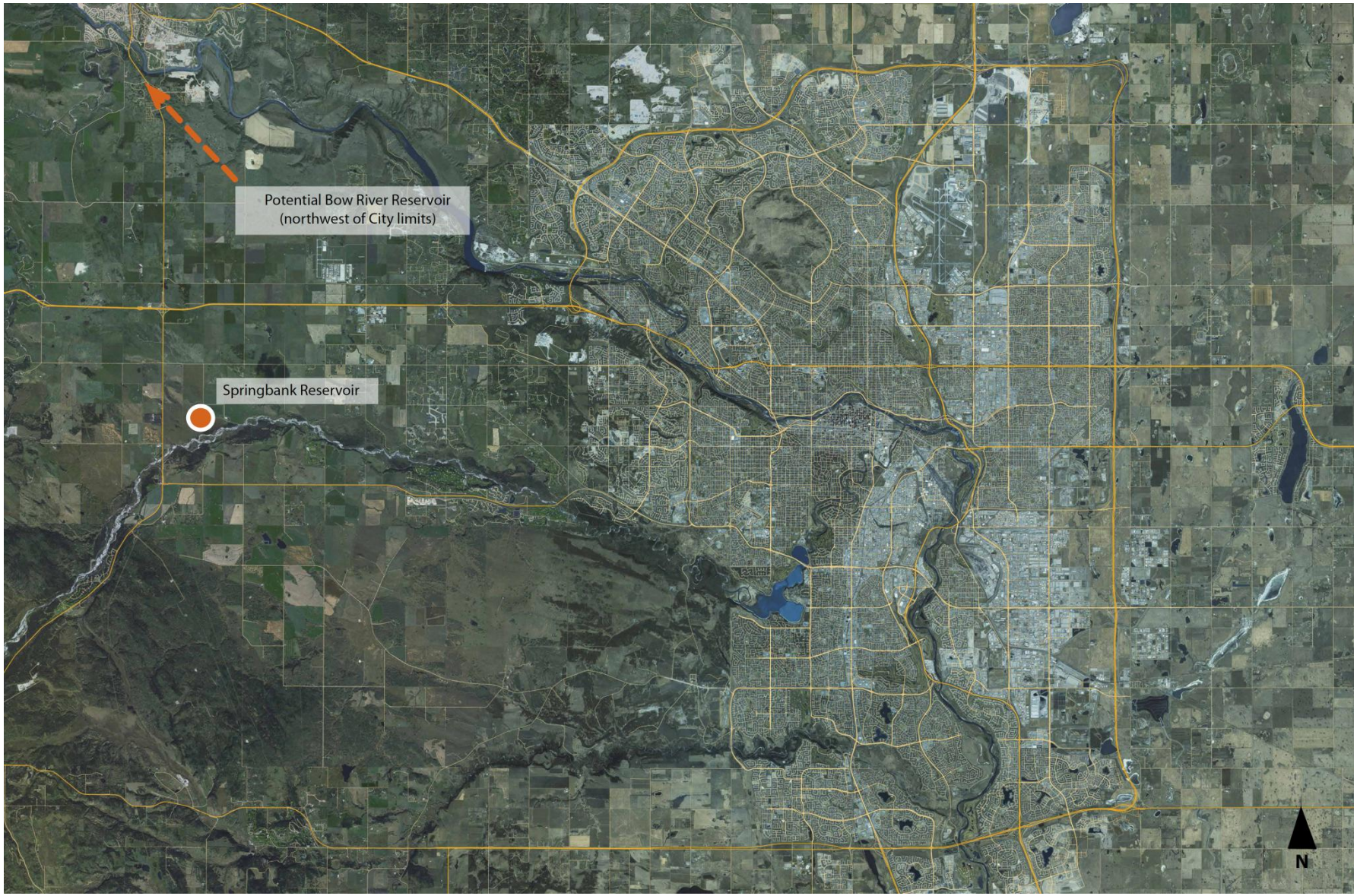
Concept 1 - Reservoirs

Springbank Reservoir (Elbow River)

New Reservoir upstream of Calgary (Bow River)

Concept 1 - Reservoirs

Preliminary Concept
For Discussion Only



Concept 1 - Reservoirs

Springbank Reservoir (Elbow River)

New Reservoir upstream of Calgary (Bow River)

- The Government of Alberta has committed to Springbank Reservoir.
- It is currently in a provincial and federal Environmental Impact Assessment process.
- Springbank Reservoir is intended to be a “dry reservoir”.
- Together with the upgraded gates being installed on the Glenmore Dam, the two structures are intended to mitigate a 2013-sized event.

Concept 1 - Reservoirs

Springbank Reservoir (Elbow River)

New Reservoir upstream of Calgary (Bow River)

- The City is participating in the Bow River Working Group process with the Province and other watershed stakeholders.
- The Working Group is investigating alternatives for flood and drought mitigation structures upstream of Calgary.
- Structures are at an exploratory stage, with no commitment by the Government of Alberta.
- Opportunities for drought mitigation, hydro-electric power and recreation are being considered.
- The total mitigation provided by a new reservoir is uncertain.

Concept 1 - Reservoirs

Cost	$ 1.9 billion
Benefits	$2.6 billion
Benefit-cost ratio (= benefits/costs)	1.4
Estimated remaining average annual damages	$34 million per year

Costs are preliminary estimates. The estimates shown include benefits, capital and operating costs over a 100 year period.

Concept 1 - Reservoirs

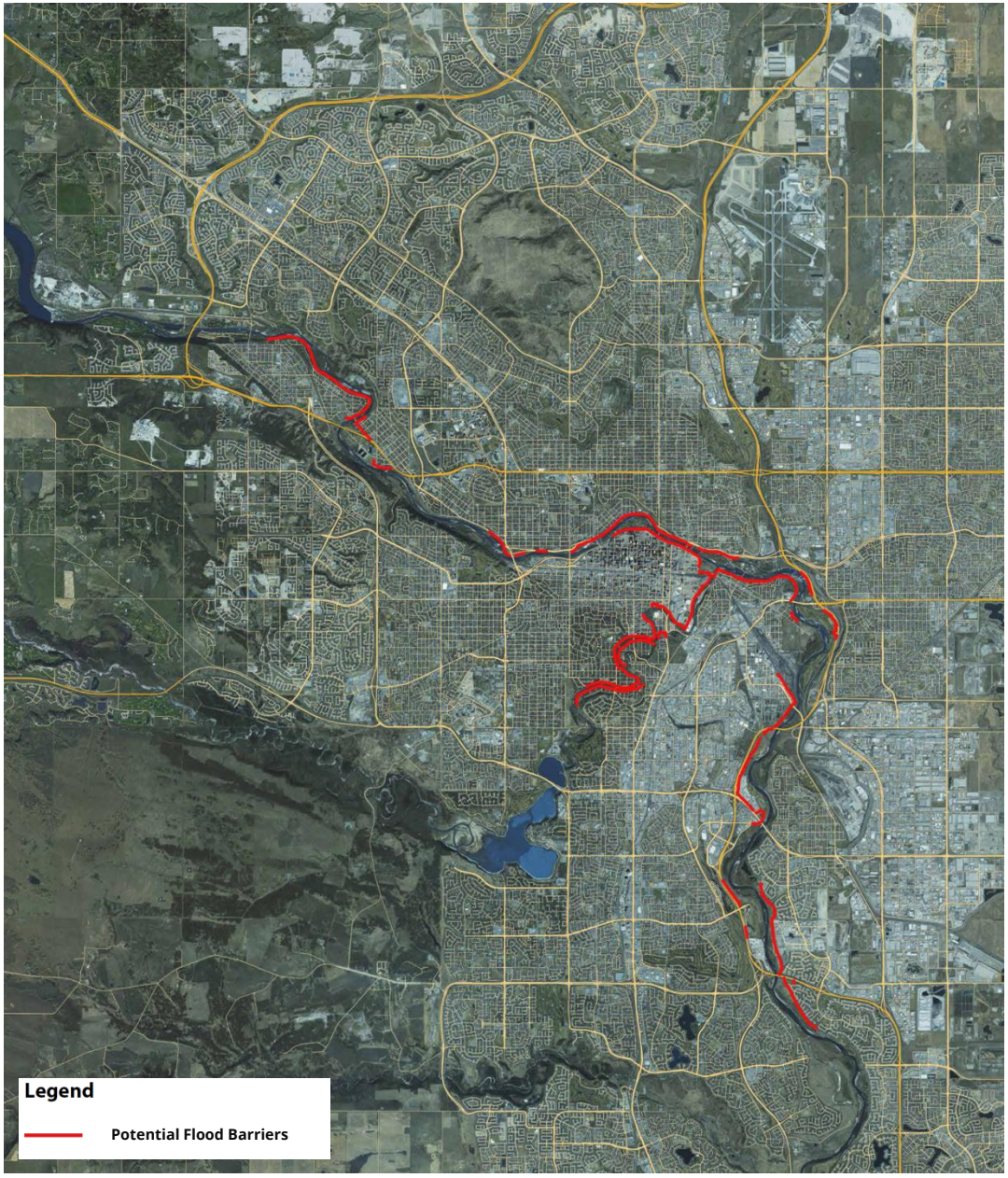
- Reservoirs can provide some **reduction in groundwater flooding** during a river flood**, by lowering river levels** during the flood event.
- For floods smaller than the event the reservoir was designed for, communities downstream would **not necessarily need to be evacuated**.
- Multiple stakeholders involved
- Dams and reservoirs can take a long time to approve and build.
- The construction of the dams and reservoirs can have significant environmental impacts.
- While rare, there is the risk that dams can fail, which could cause catastrophic flooding.
- Events larger than the reservoir is designed for may result in flooding downstream – but the dam still provides benefit – the flooding would be less than if the dam was not in place.

Concept 2– Barriers

Barriers along the Elbow River and the Bow River

Concept 2 - Barriers

Preliminary Concept
For Discussion Only



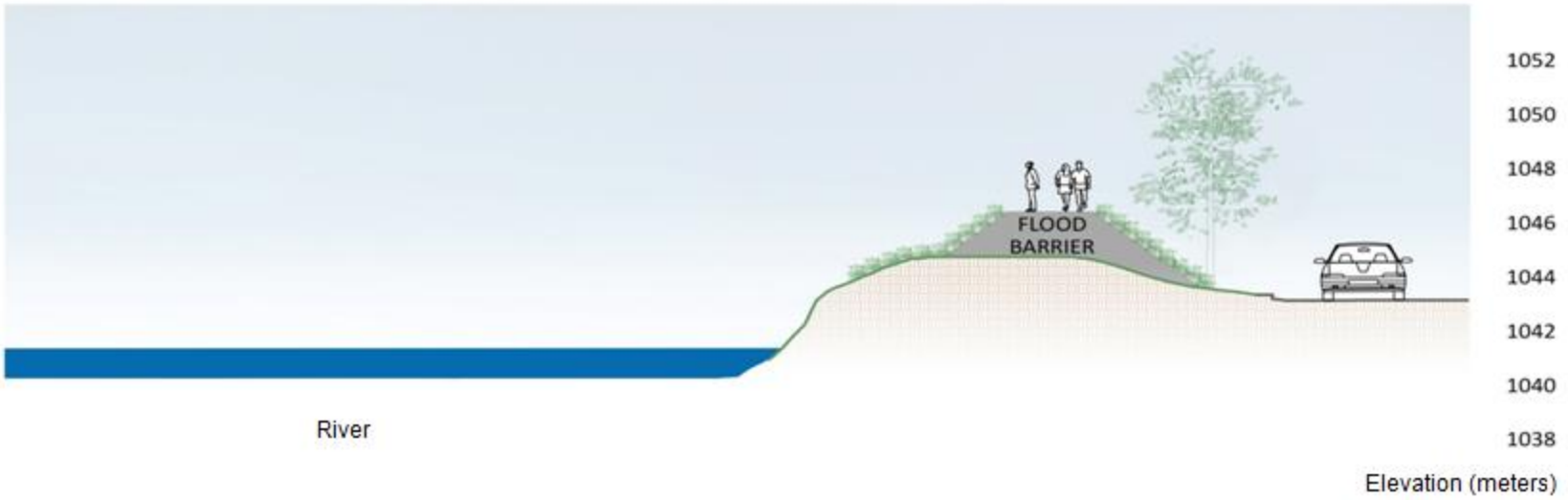
Concept 2 - Barriers

- The City completed a study to identify all spill locations across the city, for various size floods.
- Preliminary designs were completed to assess the costs and benefits of building various heights of barriers at each spill point.
- Barriers can be:
    - Concrete wall
    - Earth berm
    - Combination of wall and berm.

Concept 2 - Barriers

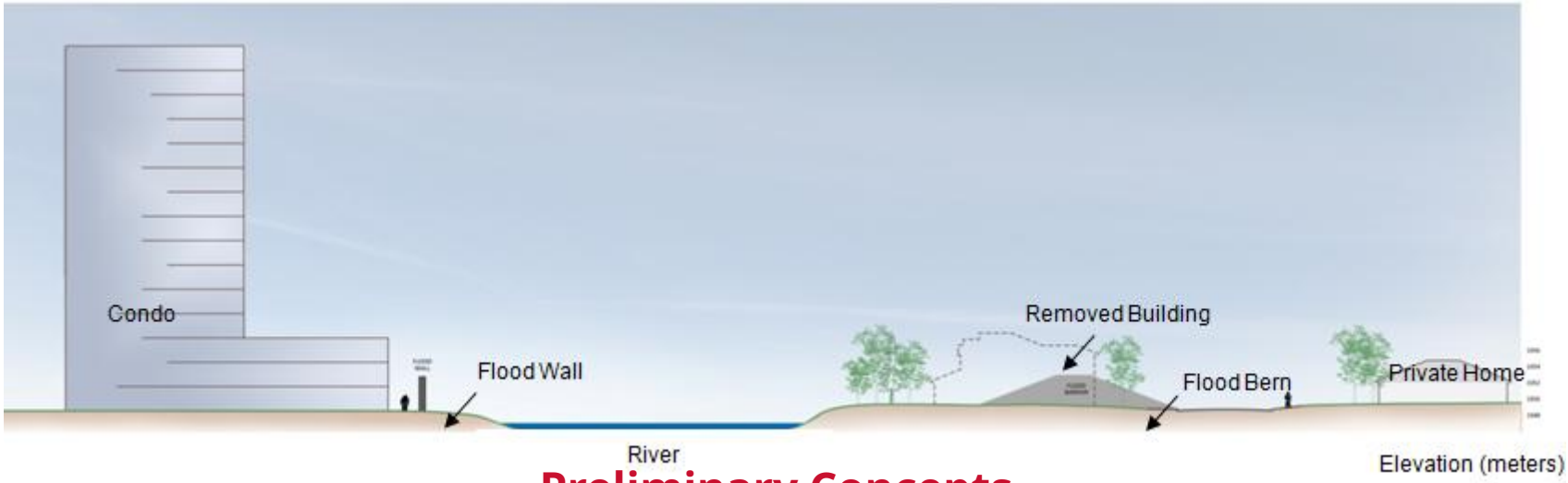
Example Barriers

Preliminary Concepts
For Discussion Only



Concept 2 - Barriers

Example Barriers



Preliminary Concepts
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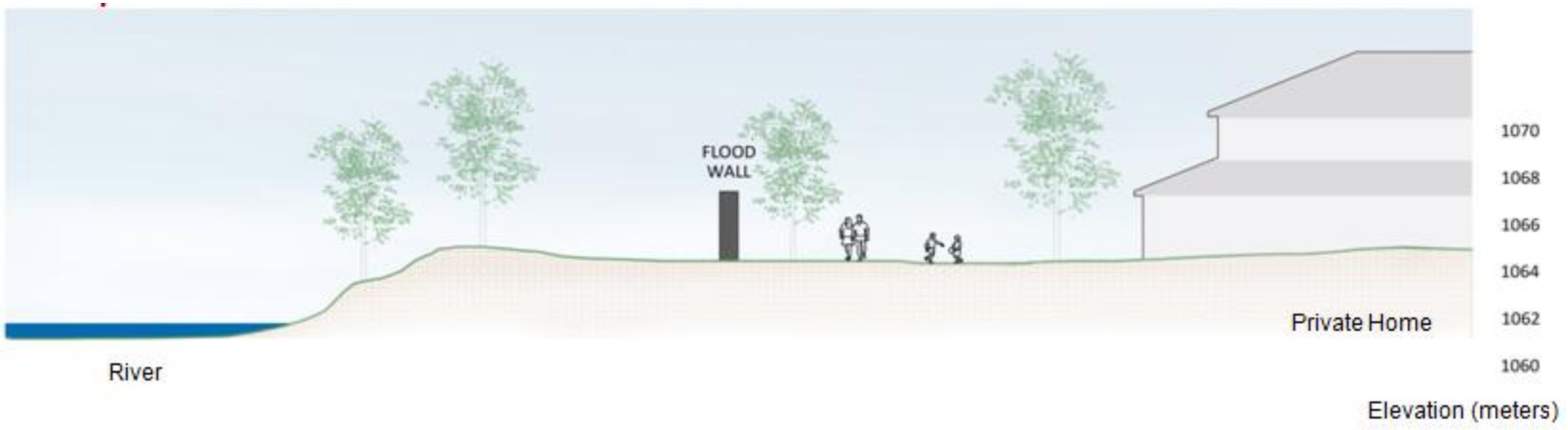


Concept 2 - Barriers

Cost	$ 1.8 billion
Benefits	$1.9 billion
Benefit-cost ratio (= benefits/costs)	1.1
Estimated remaining average annual damages	$57 million per year

Costs are preliminary estimates. The estimates shown include benefits, capital and operating costs over a 100 year period.

Concept 2 - Barriers

- Building barriers within the city limits **can be done by The City in stages**.
- Extending the barriers underground to **protect against groundwater** flooding from the river is possible, **but costly**. It could double the cost of the barrier.
- It will take time to approve and build all the barriers.
- The length and height of barriers required to protect all at-risk communities are significant.
- Many barriers will require purchase of land along the river where space is needed to build the barrier.
- Barriers will change the **visual aesthetics** of the river and nearby communities, and may affect the location and number of **access points** for recreational activities.

Concept 2 - Barriers

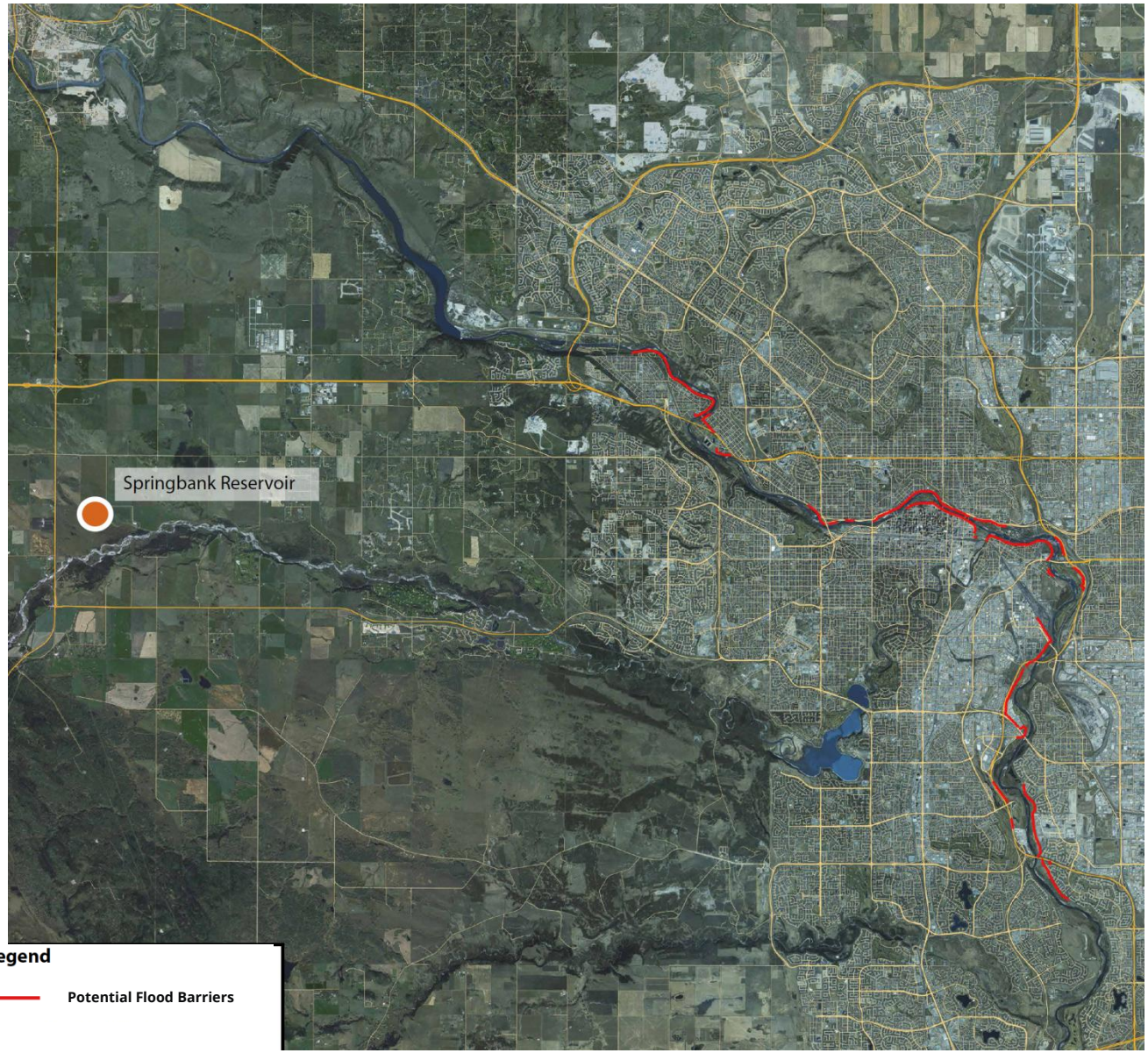
- There is **significant impact to the natural riverbank environment**, including drainage and interactions between the river and floodplain areas.
- Barriers **do not provide any additional benefits to the watershed**, such as drought management, energy generation or recreation.
- If an event larger than they were designed for occurs, water will flow over the barrier. These situations would cause water to flow into communities that were considered protected.
- Depending on the size of a flood event, communities protected by barriers may **still need to be evacuated** for safety.

Concept 3 – Reservoir (Elbow) + Barriers (Bow)

Springbank Reservoir (Elbow River)

Barriers on the Bow River

Concept 3 – Reservoir (Elbow) + Barriers (Bow)



Preliminary Concept For Discussion Only

Concept 3 – Reservoir (Elbow) + Barriers (Bow)

Cost	$ 1.01 billion
Benefits	$2.5 billion
Benefit-cost ratio (= benefits/costs)	2.4
Estimated remaining average annual damages	$37 million per year

Costs are preliminary estimates. The estimates shown include benefits, capital and operating costs over a 100 year period.

Table Discussion Question #1

What are the strengths and weaknesses of the 3 structural concepts and why?

What do you think the three concept's benefits and impacts will be on:

- The way the community looks, feels, and moves?
- Providing equal protection from river flood to all citizens/communities?
- The amenities/services in your community?
- The health of the rivers and floodplain as it flows from the mountains, through the city and to other communities downstream?
- The long-term supply and quality of water for our community?
- Protecting Calgary's economic core? Should downtown be protected to a higher level?
- The city as a whole?

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Non-Structural Measures

What are non-structural measures?

- Policies
- By-laws
- Land use regulation
- Operating procedures
- Emergency response plans
- River forecasting models

- Combine in various ways with structural mitigation measures

- Do not keep floodwater out, but reduce damage and safety risk

Non-Structural Measures

Non-structural Measures for Discussion:

1. Removing some or all buildings from the floodway
2. Further restricting re-development in the floodway
3. More stringent flood proofing regulations in flood hazard area
4. Not allowing basements in new developments in the flood fringe
5. Not allowing basement secondary suites in flood fringe
6. Prohibiting or regulating to a higher degree, land uses that are at increased risk in flood emergencies within the flood fringe (e.g., hospitals, assisted living, protective & emergency services)

Non-Structural Measures

- Implementation details to be determined
- Where these measures are in place, there are still high impacts/damage and evacuation is necessary when flooding occurs
- Further public engagement will accompany further refinement of these options if pursued

Today we are looking for your initial thoughts on these potential measures

Table Discussion Question #2

Considering social, environmental and economic implications, what do you think the potential benefits and impacts of the non-structural measures are?

Think about how this concept could potentially impact:

- The way the community looks, feels, and moves?
- Reduction of damages from river flooding to all citizens/communities (impacts to personal property, business operation, public safety, etc.)?
- The amenities/services in your community?
- Protecting Calgary's economic core?
- The City as a whole?

We are looking for preliminary public feedback on these measures in order to further improve city flood resiliency over the long term.

Thank You

for your time and perspectives