

# **Road to Resilience**

## **2020 Overland Flood Considerations Update**

Presenter: Matthew Hough, DCAO

Department: Office of the Deputy Chief Administrative Officer

Meeting Date: July 28, 2020

# Introduction

- Team overview
- Defining resiliency
- Evidence based decision making

# History of Floods

- Fort McMurray is situated near the confluence of the Athabasca and Clearwater rivers
- Downtown, Waterways, Ptarmigan Court, and Draper have a long history of flooding
- There have been at least 17 floods since 1835, all but one of which were ice jam floods

# April 2020 Flood

- April 26, 2020 ice jam flood affected Taiga Nova and area, Downtown, Longboat Landing, Ptarmigan Court, Waterways and Draper
- Water level in the Athabasca River reached 1 in 100 year level



# April 2020 Flood

What does  
25 km of ice  
look like?



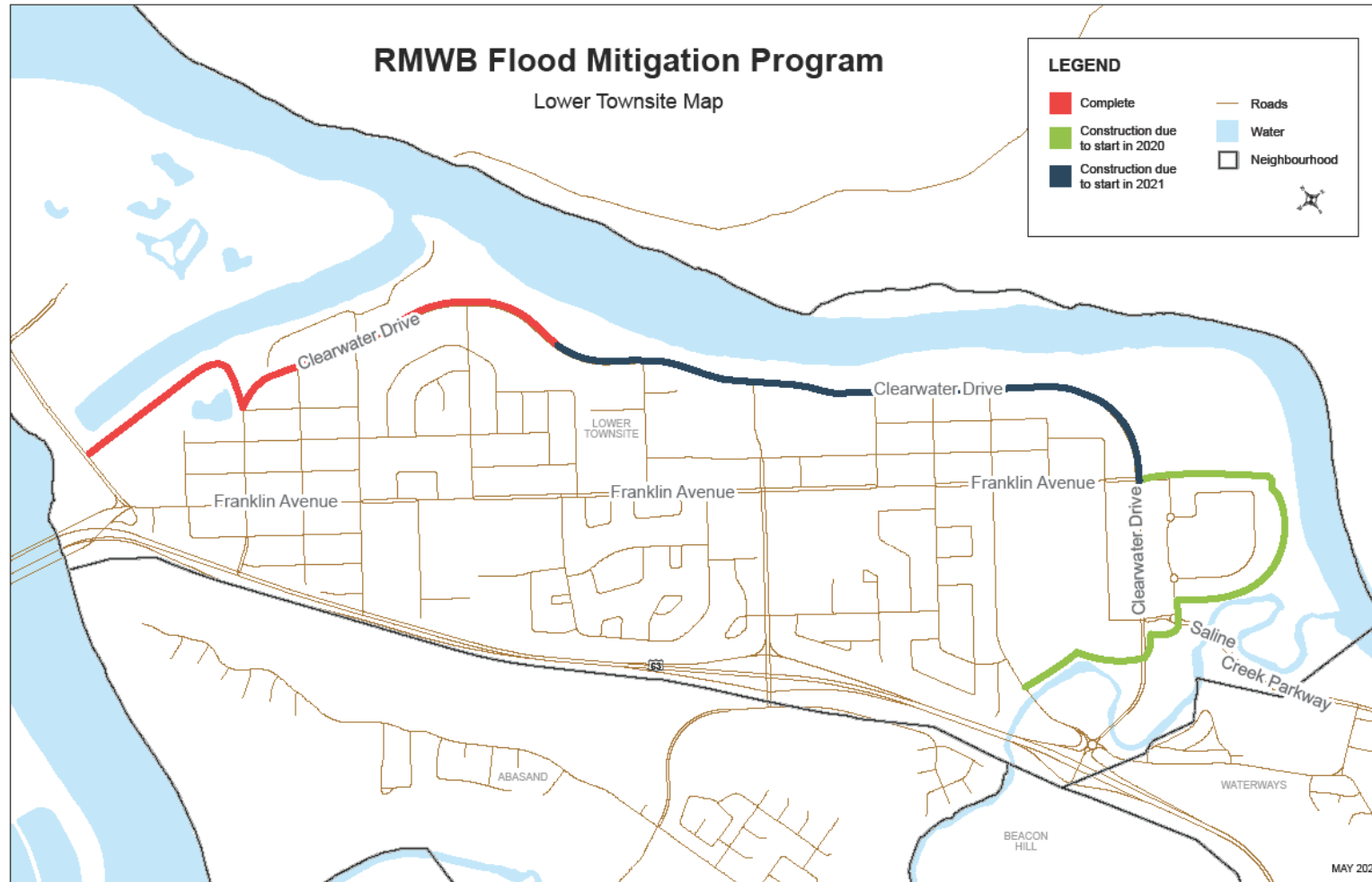
# Other Ideas

- Explosives
- CF-18s
- Heavy equipment
- Ice management experts

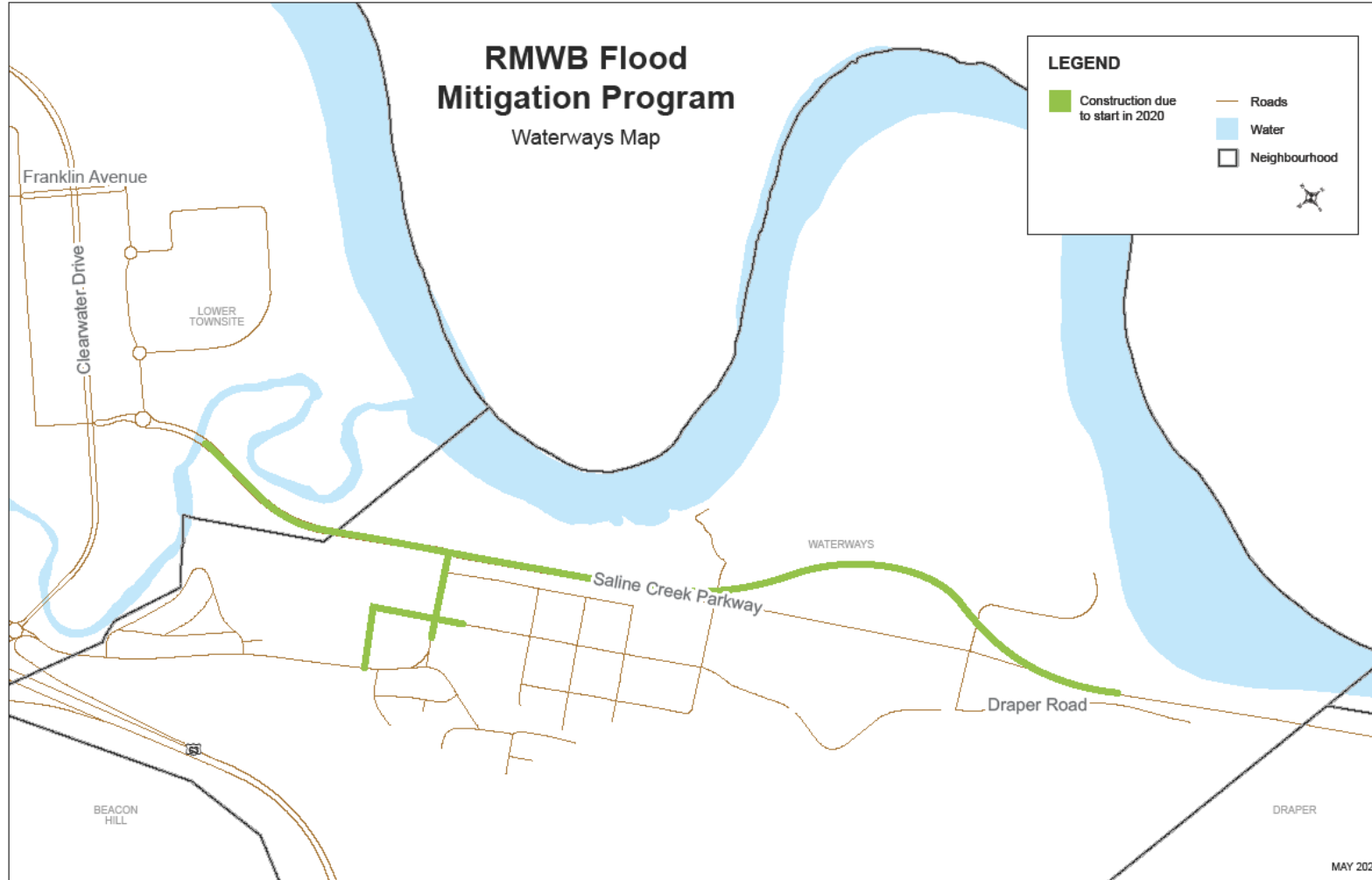
# Pre-2020 Flood Mitigation Program

- Historical focus was on structural treatment measures
- December 2016 - focus on structural barriers
  - Berms, retaining walls, berms/retaining walls
- February 2018 - approved Flood Mitigation Program
  - GOA's minimum flood elevation level of 250 metres
  - \$150 M

# Flood Mitigation Infrastructure Downtown - Reaches 1 - 9



# Flood Mitigation Infrastructure Waterways – Reaches 10 and 11

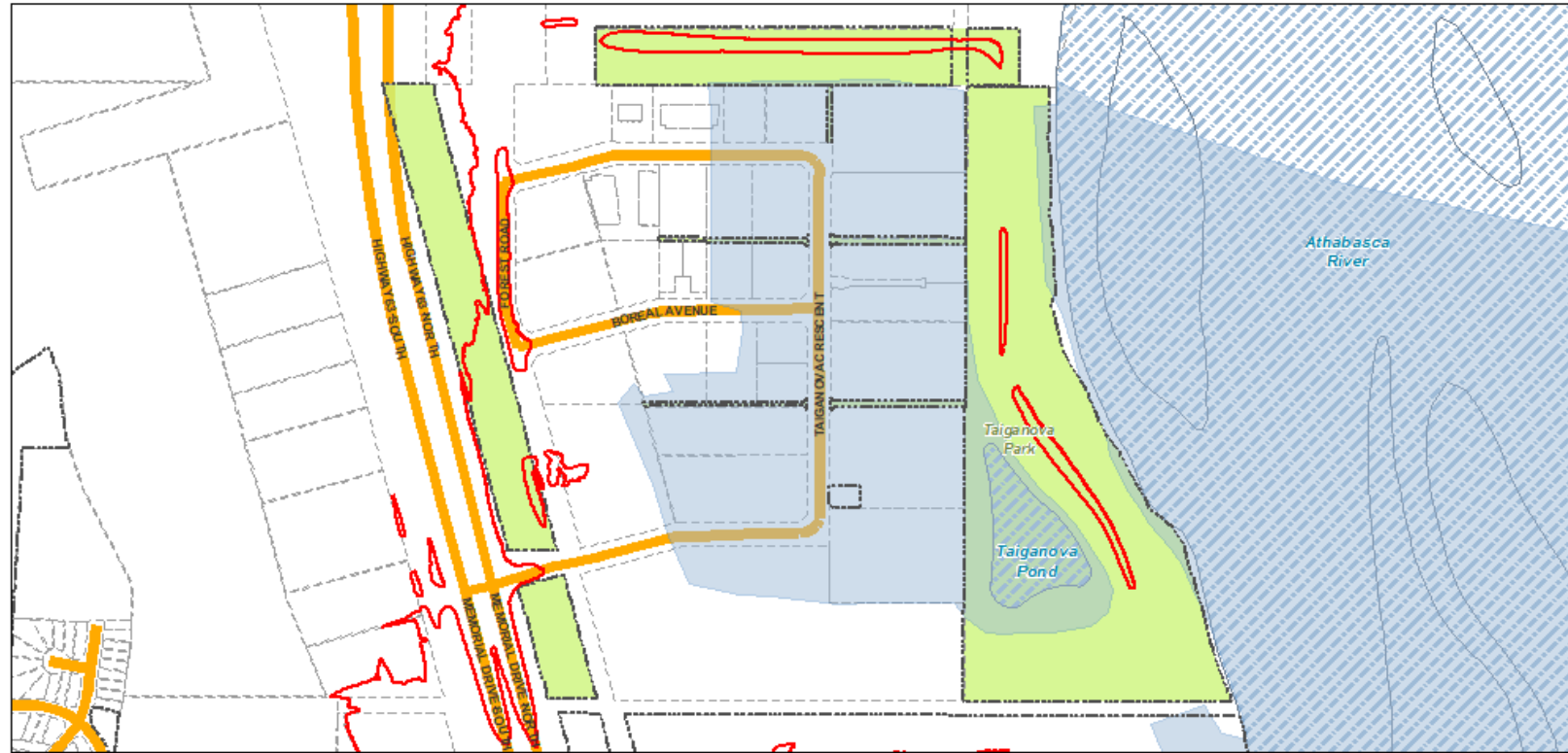


# 2020 Flood Event

The following series of maps shows the extent of flooding in:

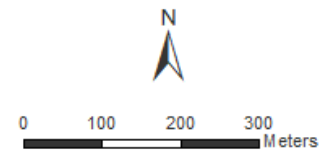
- TaigaNova Eco-Industrial Park
- Downtown Fort McMurray
- Ptarmigan Court
- Waterways
- Draper

## FLOOD EXTENT MAP FOR TAIGA NOVA



-  250 Meter Elevation
-  Survey Parcels
-  RMWB Lands
-  Park / Green Space
-  Flood Extent 2020 (Natural Resources Canada)
-  Roads
-  Waterbodies

DISCLAIMER: Flood Extent data derived from satellite imagery and depicts maximum extent of overland flooding on April 29, 2020.



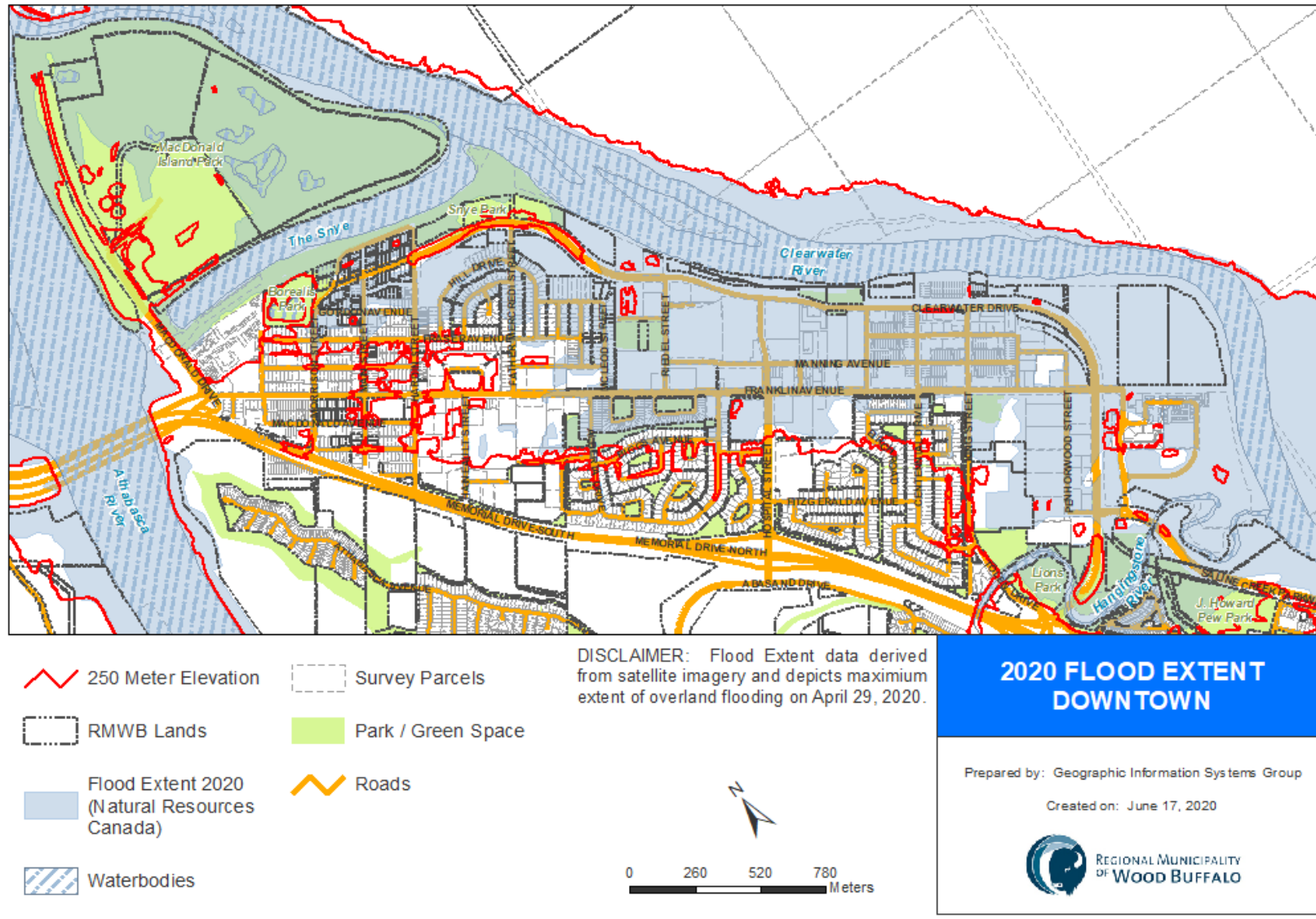
### 2020 FLOOD EXTENT TAIGA NOVA

Prepared by: Geographic Information Systems Group

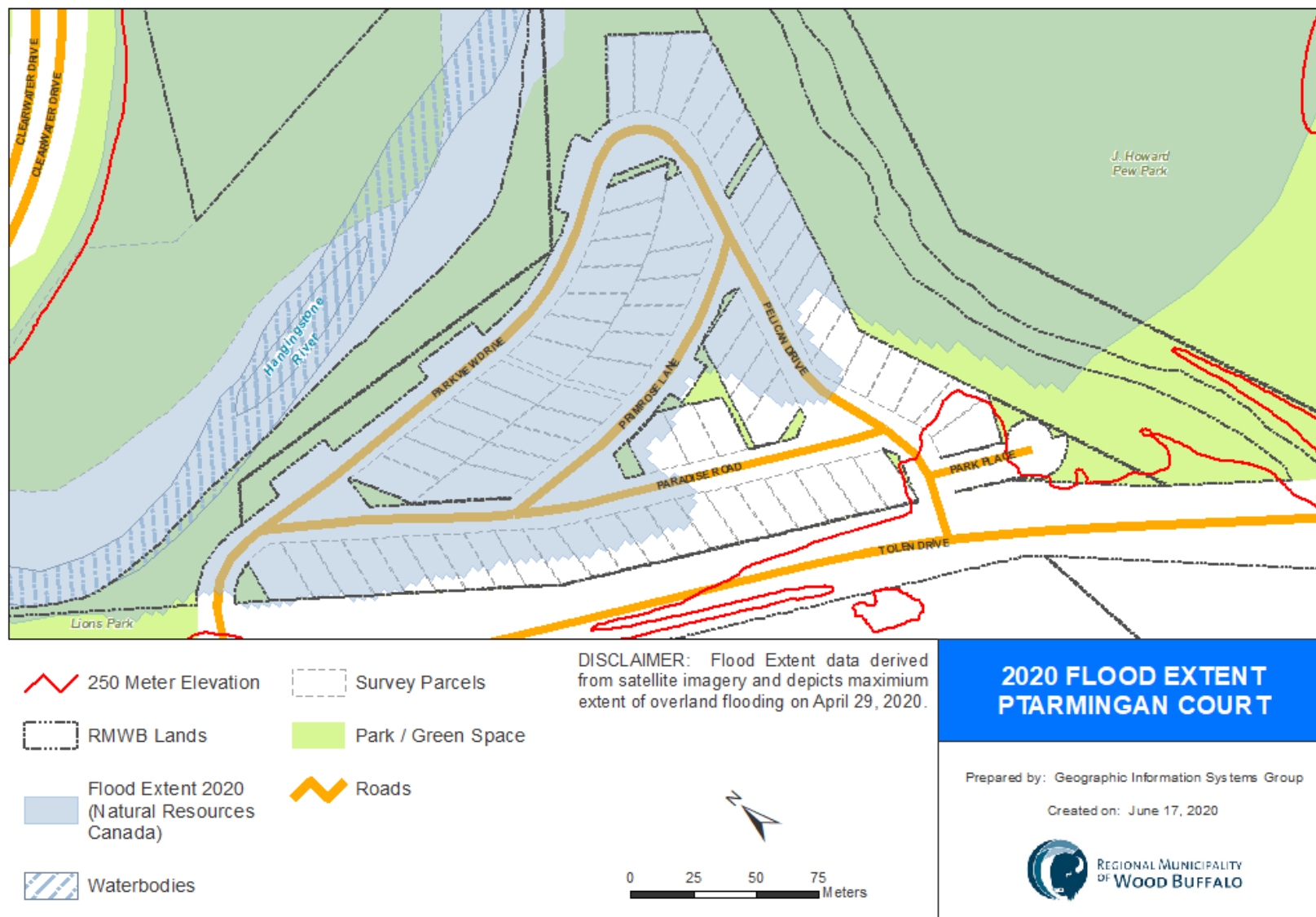
Created on: June 17, 2020



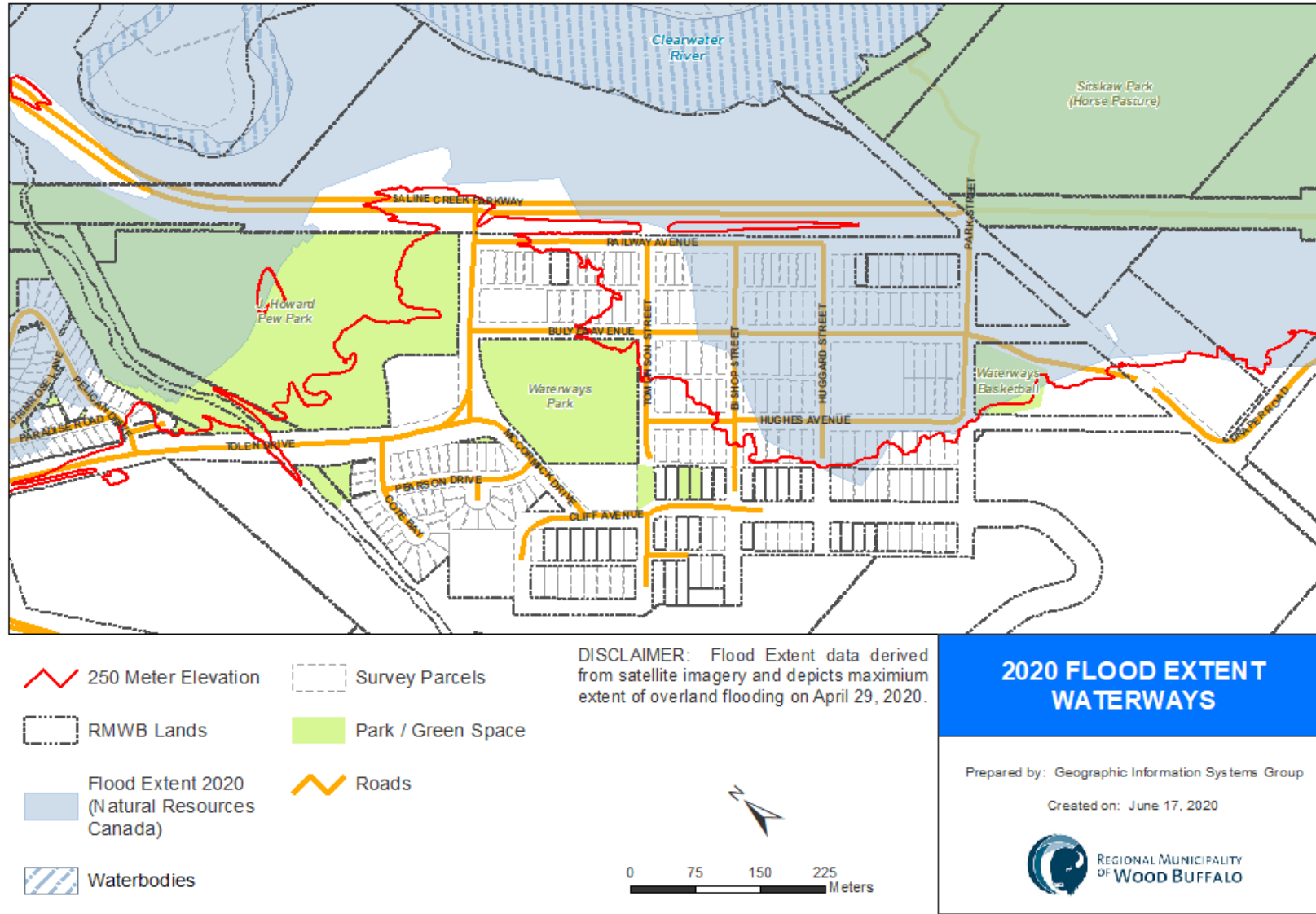
## FLOOD EXTENT MAP FOR DOWNTOWN



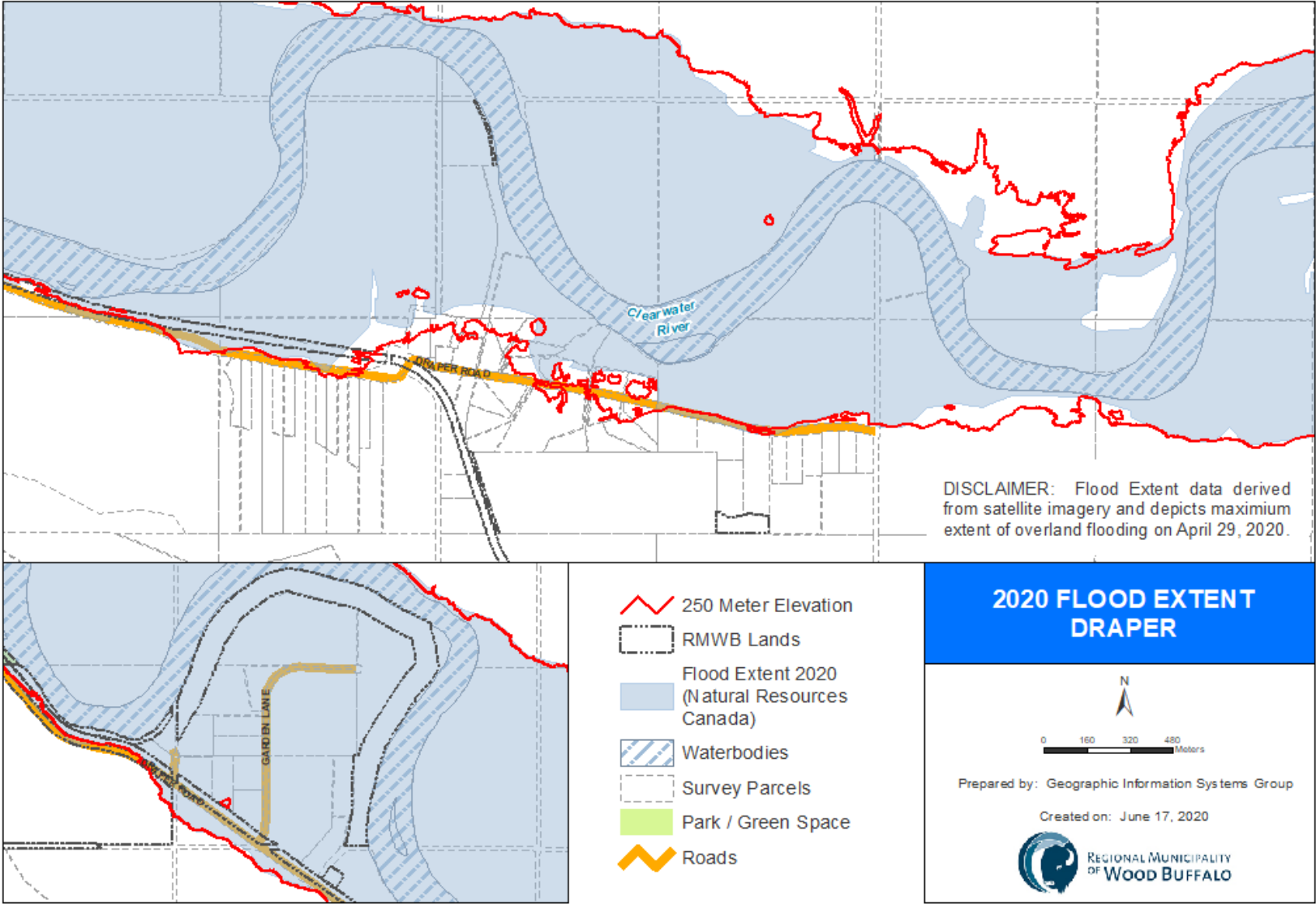
## FLOOD EXTENT MAP FOR PTARMINGAN COURT



## FLOOD EXTENT MAP FOR WATERWAYS



FLOOD EXTENT MAP FOR DRAPER



# Community Conversation

- June 23, 2020
- Surveys
- July 14, 2020
- Townhall
- Facebook Live
- Flyers
- Social media

# Key Considerations

- Improve Community Resilience
- Six Distinct Areas
- Community Conversation
- Evaluate Development Options
  - Technical approach using *CSA 31000-10: Risk Management – Principles and Guidelines*
- Recommendations

Either we  
protect areas  
from flooding  
and preserve  
access to DRP  
OR  
Buy out  
affected  
properties

# Land Use Bylaw Provisions

- Due to the unpredictable nature of flood levels, berms can eventually fail or be overtopped
- Flood provisions in the LUB provide added protection

Elevate property, structures  
Elevate utilities, mechanical

Restrict land uses  
Restrict development  
Limit expansions

# Math on Floods

- Floodplain designations vary, with jurisdiction adopting a flood level of 1:100, 1:200, or higher
- In Alberta, floodplains are based on 1:100 flood event
- 1:100 threshold is lowest level of protection
- Risk percentage by year

# Funding Assistance

## Disaster Funding Assistance Arrangements (DFAA)

- Federal Government reimburses Provinces for a portion of disaster response and recovery costs, for weather-related disasters.
- Annual cost for DFAA has been increasing steadily:
  - \$54 million per year from 1970 –1994
  - \$291 million from 1995 – 2004
  - \$410 million between 2005 – 2014

# Funding Assistance

## Disaster Funding Assistance Arrangements (DFAA)

| Province | \$ all years | % of total | Per capita | 2005-2014 | % of total | Per capita |
|----------|--------------|------------|------------|-----------|------------|------------|
| NL       | 296          | 4%         | 561        | 174       | 4%         | 329        |
| PE       | 32           | 0%         | 220        | 3         | 0%         | 21         |
| NS       | 134          | 2%         | 143        | 16        | 0%         | 17         |
| NB       | 269          | 3%         | 357        | 87        | 2%         | 115        |
| QC       | 2,062        | 25%        | 251        | 166       | 4%         | 20         |
| ON       | 387          | 5%         | 28         | 125       | 3%         | 9          |
| MB       | 1,505        | 18%        | 1,174      | 767       | 19%        | 598        |
| SK       | 914          | 11%        | 812        | 812       | 20%        | 722        |
| AB       | 2,325        | 28%        | 564        | 1,758     | 43%        | 427        |
| BC       | 391          | 5%         | 84         | 162       | 4%         | 35         |
| NT       | 9            | 0%         | 200        | 6         | 0%         | 131        |
| YT       | 25           | 0%         | 693        | 12        | 0%         | 332        |

Note: Alberta received more than \$2.3 billion from the DFAA (1970 – 2014)

# Funding Assistance

## Provincial Disaster Recovery Programs

- Disaster recovery is funded through Disaster Recovery Programs (DRP)
- Federal DFAA is shared with provinces as follows:

| Eligible cost sharing of provincial expenses after per capita threshold met | Government of Canada Share |
|-----------------------------------------------------------------------------|----------------------------|
| First \$3.07 (per capita)                                                   | 0%                         |
| Next \$6.15 (per capita)                                                    | 50%                        |
| Next \$6.15 (per capita)                                                    | 75%                        |
| Remainder                                                                   | 90%                        |

# Policy Shift

- Federal and Provincial governments are analyzing frequency of disasters and increasing recovery costs.
- Indications at Federal and Provincial level that distribution of disaster recovery funding will shift due to increasing costs.
- This will result in disaster recovery costs being redistributed to municipalities and property owners.

RMWB must position itself for a shifting policy landscape at the Federal and Provincial levels.

# Intent

What we know:

- Funding model will change
- Expectation and responsibility will be redistributed
- To remain eligible for DRP, areas must be protected
- Insurance more difficult and/or expensive to access

RMWB must increase community resilience  
over the long term.

# Analysis

Key terms for the evaluation:

**Community Resilience:** ability of a community exposed to hazards to resist, absorb, adapt to and recover from the effects of a hazard in a timely and efficient manner

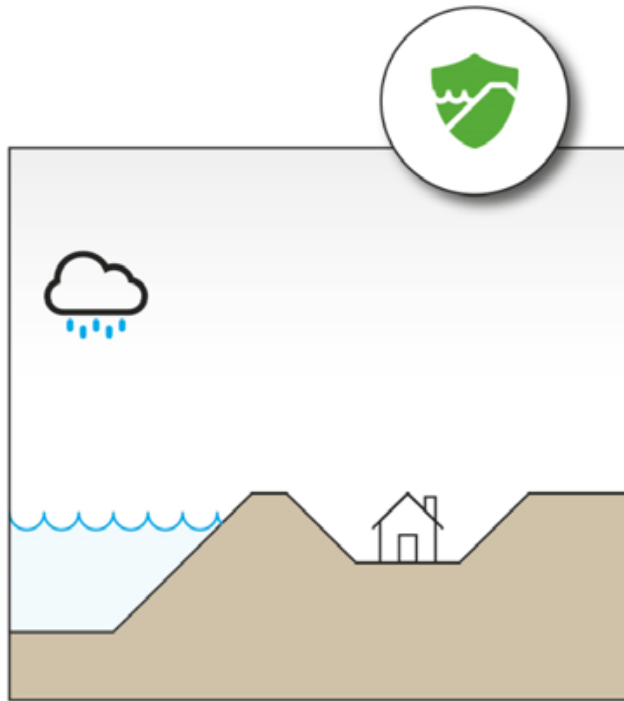
**Disaster Risk:** the potential disaster losses, in lives, health status, livelihoods, assets and services

**Residual Risk:** the risk remaining after risk treatment

# Resiliency Options

1. Flood Mitigation
2. Flood Provisions (Land Use Bylaw)
3. Limited Development Below 250
4. Buyout
  - Below 250m or all properties
  - Land Swap
5. Mix and match the options

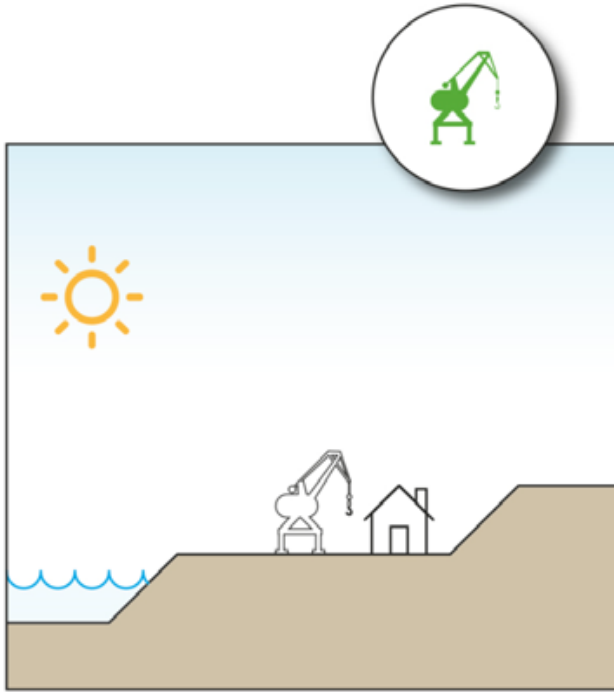
# Resiliency Options



Flood  
Mitigation

In the RMWB, this takes the form of berms and retaining walls which are meant to hold back flood waters from at least a 1:100 flood event. The RMWB's current plan includes sections (known as Reaches).

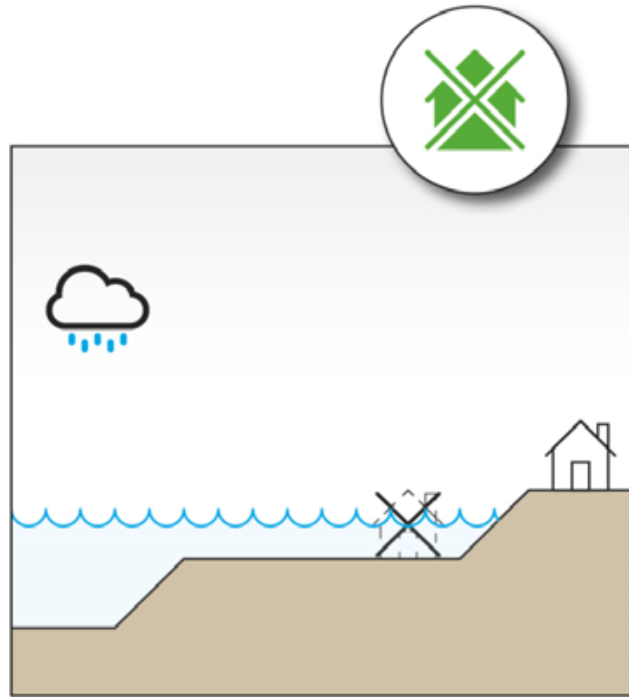
# Resiliency Options



Provisions are intended to provide an added level of protection for properties, and are undertaken at the site-level by developers, builders and property owners.

Land Use Bylaw  
Provisions

# Resiliency Options



Limited  
Development  
Below 250

This is a more restrictive approach, where rather than simply flood-proofing a structure, development within the flood hazard area would be restricted entirely. For example, existing buildings could be allowed to remain and owners would be permitted to construct new additions or expansions **ONLY** below a certain size, while new development could be prohibited or uses be restricted.

# Evaluation Areas

Taiga Nova Eco-  
Industrial Park &  
Area

Downtown

Longboat Landing

Ptarmigan Court

Waterways

Draper

# TaigaNova & Area

1. Flood mitigation partially exists in the area.
2. 81 private properties and 65 businesses.
3. 66 private properties (81% of the total) are below the 250m elevation. 42 (52%) affected by the 2020 flood.
4. 15 private properties (19% of the total) are above the 250m elevation. None affected by the 2020 flood.

# TaigaNova & Area: Scoring Matrix

| Evaluation Criteria    |          | Weight | Policy Options Evaluation |                                   |                                                                   |                                                                  |                                                  |                                   |
|------------------------|----------|--------|---------------------------|-----------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------|-----------------------------------|
|                        |          |        | Flood Mitigation only     | Flood Mitigation & LUB Provisions | Flood Mitigation, LUB Provisions & Limited Development below 250m | Flood Mitigation, LUB Provisions & Buyout Below 250m / Land Swap | LUB Provisions and Buyout Below 250m / Land Swap | Buyout all properties / Land Swap |
| Minimize Cost          |          | 4      | 1                         | 1                                 | 1                                                                 | 7                                                                | 6                                                | 8                                 |
| Minimize Residual Risk | Social   | 1      | 6                         | 5                                 | 4                                                                 | 1                                                                | 2                                                | 3                                 |
|                        | Built    | 1      | 6                         | 5                                 | 4                                                                 | 2                                                                | 3                                                | 1                                 |
|                        | Economic | 1      | 6                         | 5                                 | 4                                                                 | 2                                                                | 3                                                | 1                                 |
|                        | Natural  | 1      | 6                         | 5                                 | 4                                                                 | 3                                                                | 2                                                | 1                                 |
| Total Score            |          |        | 28                        | 24                                | 20                                                                | 36                                                               | 34                                               | 38                                |
| Total Treatment Cost   |          |        | \$25.2M                   | \$25.2M                           | \$25.2M                                                           | \$375.7M                                                         | \$350.5M                                         | \$463.4M                          |
| Flood Mitigation Costs |          |        | \$25.2M                   | \$25.2M                           | \$25.2M                                                           | \$25.2M                                                          | ~                                                | ~                                 |
| Buyout Costs           |          |        | ~                         | ~                                 | ~                                                                 | \$350.5M                                                         | \$350.5M                                         | \$463.4M                          |
| Reclamation Costs      |          |        | ~                         | ~                                 | ~                                                                 | ***                                                              | ***                                              | ***                               |
| Total Cost Saved       |          |        | ~                         | ~                                 | ~                                                                 | ~                                                                | \$25.2M                                          | \$25.2M                           |
| Flood Mitigation       |          |        | ~                         | ~                                 | ~                                                                 | ~                                                                | \$25.2M                                          | \$25.2M                           |
| Net Cost               |          |        | \$25.2M                   | \$25.2M                           | \$25.2M                                                           | \$375.7M                                                         | \$325.3M                                         | \$438.2M                          |
| Net Cost Per Capita    |          |        | \$336                     | \$336                             | \$336                                                             | \$5,009                                                          | \$4,337                                          | \$5,843                           |

# TaigaNova & Area: Recommended Option

Enhance and  
construct flood  
mitigation

+

Introduce  
enhanced LUB  
provisions

+

Limit development  
below 250m

# Downtown

1. Flood mitigation underway.
2. Population of 10,273 (2018 Census) and 5,871 private properties.
3. 4,014 private properties (68% of the total) below 250m. 2,582 (64%) affected by the flood.
4. 1,857 private properties (32% of the total) above 250m. 44 (2%) affected by the flood.

# Downtown: Scoring Matrix

| Evaluation Criteria        |          | Weight | Policy Options Evaluation |                                   |                                                                    |                                                                   |                                                   |                                   |
|----------------------------|----------|--------|---------------------------|-----------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------|-----------------------------------|
|                            |          |        | Flood Mitigation          | Flood Mitigation & LUB Provisions | Flood Mitigation, LUB Provisions, & Limited Development below 250m | Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap | LUB Provisions, and Buyout Below 250m / Land Swap | Buyout all properties / Land Swap |
| Minimize Cost              |          | 4      | 2                         | 2                                 | 2                                                                  | 10                                                                | 9                                                 | 14                                |
| Minimize Residual Risk     | Social   | 1      | 6                         | 5                                 | 4                                                                  | 2                                                                 | 3                                                 | 1                                 |
|                            | Built    | 1      | 6                         | 5                                 | 4                                                                  | 2                                                                 | 3                                                 | 1                                 |
|                            | Economic | 1      | 6                         | 5                                 | 3                                                                  | 2                                                                 | 4                                                 | 1                                 |
|                            | Natural  | 1      | 6                         | 5                                 | 4                                                                  | 3                                                                 | 2                                                 | 1                                 |
| Total Score                |          |        | 32                        | 28                                | 23                                                                 | 49                                                                | 48                                                | 60                                |
| Total Treatment Cost       |          |        | \$70M                     | \$70M                             | \$70M                                                              | \$1.37B                                                           | \$1.3B                                            | \$1.9B                            |
| Flood Mitigation Costs     |          |        | \$70M                     | \$70M                             | \$70M                                                              | \$70M                                                             | ~                                                 | ~                                 |
| Buyout Costs               |          |        | ~                         | ~                                 | ~                                                                  | \$1.3B                                                            | \$1.3B                                            | \$1.9B                            |
| Reclamation Costs          |          |        | ~                         | ~                                 | ~                                                                  | ***                                                               | ***                                               | ***                               |
| Total Cost Saved           |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | \$70M                                             | \$111.4M                          |
| Flood Mitigation           |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | \$70M                                             | \$70M                             |
| Jubilee Maintenance        |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | ~                                                 | \$2.3M                            |
| Clearwater Design & Const. |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | ~                                                 | \$36M                             |
| 4-Laning Franklin Ave.     |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | ~                                                 | \$1.5M                            |
| Infrastructure Rehab       |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | ~                                                 | \$1.6M                            |
| Net Cost                   |          |        | \$70M                     | \$70M                             | \$70M                                                              | \$1.37B                                                           | \$1.23B                                           | \$1.79B                           |
| Net Cost Per Capita        |          |        | \$933                     | \$933                             | \$933                                                              | \$18,267                                                          | \$16,400                                          | \$23,867                          |

# Downtown: Recommended Option



# Longboat Landing

1. Flood mitigation underway.
2. Population of 720 (2018 Census) and 360 private properties.
3. All 360 private properties (100% of the total) below 250m. All were affected by the flood.
4. No private properties are above 250m.
5. No scoring evaluation has been conducted.

# Longboat Landing: Recommended Option



# Ptarmigan Court

1. Flood mitigation not planned.
2. Population included within Waterways (population 232) in the 2018 Census.
3. 68 private properties (99% of the total) below 250m.  
49 are developed.
4. 1 private property (1% of the total) above 250m but is vacant.

# Ptarmigan Court: Scoring Matrix

| Evaluation Criteria    |          | Weight | Policy Options Evaluation |                                   |
|------------------------|----------|--------|---------------------------|-----------------------------------|
|                        |          |        | Flood Mitigation          | Buyout all properties / Land Swap |
| Minimize Cost          |          | 4      | 5                         | 1                                 |
| Minimize Residual Risk | Social   | 1      | 2                         | 1                                 |
|                        | Built    | 1      | 2                         | 1                                 |
|                        | Economic | 1      | 2                         | 1                                 |
|                        | Natural  | 1      | 2                         | 1                                 |
| Total Score            |          |        | 28                        | 8                                 |
| Total Treatment Cost   |          |        | \$22.8M                   | \$21.8M                           |
| Flood Mitigation Costs |          |        | \$22.8M                   | ~                                 |
| Buyout Costs           |          |        | ~                         | \$14M                             |
| Reclamation Costs      |          |        | ~                         | \$7.8M                            |
| Total Cost Saved       |          |        | ~                         | \$22.8M                           |
| Flood Mitigation       |          |        | ~                         | \$22.8M                           |
| Net Cost               |          |        | \$22.8M                   | \$0.00                            |
| Net Cost Per Capita    |          |        | \$304                     | \$0.00                            |

# Ptarmigan Court: Recommended Option

Buyout all  
properties

# Waterways

1. Flood mitigation planned but not started.
2. Population of 232 (2018 Census), and 164 private properties.
3. 94 private properties (48% of the total) below 250m.  
43 are developed.
4. 68 private properties (42% of the total) above 250m.  
48 are developed.

# Waterways: Scoring Matrix

| Evaluation Criteria      |          | Weight | Policy Options Evaluation |                                   |                                                                    |                                                                   |                                                |                                   |
|--------------------------|----------|--------|---------------------------|-----------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------|-----------------------------------|
|                          |          |        | Flood Mitigation Only     | Flood Mitigation & LUB Provisions | Flood Mitigation, LUB Provisions, & Limited Development below 250m | Flood Mitigation, LUB Provisions, & Buyout Below 250m / Land Swap | LUB Provisions & Buyout Below 250m / Land Swap | Buyout all properties / Land Swap |
| Minimize Cost            |          | 4      | 5                         | 5                                 | 5                                                                  | 8                                                                 | 1                                              | 4                                 |
| Minimize Residual Risk   | Social   | 1      | 6                         | 5                                 | 4                                                                  | 2                                                                 | 3                                              | 1                                 |
|                          | Built    | 1      | 6                         | 5                                 | 4                                                                  | 2                                                                 | 3                                              | 1                                 |
|                          | Economic | 1      | 6                         | 5                                 | 4                                                                  | 2                                                                 | 3                                              | 1                                 |
|                          | Natural  | 1      | 6                         | 5                                 | 4                                                                  | 3                                                                 | 2                                              | 1                                 |
| Total Score              |          |        | 44                        | 40                                | 36                                                                 | 41                                                                | 15                                             | 20                                |
| Total Treatment Cost     |          |        | \$40M                     | \$40M                             | \$40M                                                              | \$75.5M                                                           | \$35.5M                                        | \$72.3M                           |
| Flood Mitigation         |          |        | \$20M                     | \$20M                             | \$20M                                                              | \$20M                                                             | ~                                              | ~                                 |
| Secondary Egress Road    |          |        | \$20M                     | \$20M                             | \$20M                                                              | \$20M                                                             | ~                                              | ~                                 |
| Buyout Costs             |          |        | ~                         | ~                                 | ~                                                                  | \$25.5M                                                           | \$25.5M                                        | \$56.7M                           |
| Reclamation Costs        |          |        | ~                         | ~                                 | ~                                                                  | \$10M                                                             | \$10M                                          | \$15.6M                           |
| Total Cost Saved         |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | \$40M                                          | \$41M                             |
| Flood Mitigation         |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | \$20M                                          | \$20M                             |
| Secondary Egress Road    |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | \$20M                                          | \$20M                             |
| Landscaping Improvements |          |        | ~                         | ~                                 | ~                                                                  | ~                                                                 | ~                                              | \$1M                              |
| Net Cost                 |          |        | \$40M                     | \$40M                             | \$40M                                                              | \$75.5M                                                           | \$0.00                                         | \$31.3M                           |
| Net Cost Per Capita      |          |        | \$533                     | \$533                             | \$533                                                              | \$1,007                                                           | \$0.00                                         | \$417                             |

# Waterways: Recommended Option

Introduce  
enhanced LUB  
provisions

+

Buyout properties  
below 250m

# Draper

1. No flood mitigation planned.
2. Population is 187 (2018 Census) and 98 private properties.
3. 64 private properties (65% of the total) below 250m.  
34 are developed.
4. 34 private properties (35% of the total) above 250m.  
28 are developed.

# Draper: Scoring Matrix

| Evaluation Criteria         |          | Weight | Policy Options Evaluation |                                   |                                                                   |                                                                  |                                                  |                                   |
|-----------------------------|----------|--------|---------------------------|-----------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------|-----------------------------------|
|                             |          |        | Flood Mitigation Only     | Flood Mitigation & LUB Provisions | Flood Mitigation, LUB Provisions & Limited Development below 250m | Flood Mitigation, LUB Provisions & Buyout Below 250m / Land Swap | LUB Provisions and Buyout Below 250m / Land Swap | Buyout all properties / Land Swap |
| Minimize Cost               |          | 4      | 6                         | 6                                 | 6                                                                 | 9                                                                | 1                                                | 1                                 |
| Minimize Residual Risk      | Social   | 1      | 6                         | 5                                 | 4                                                                 | 2                                                                | 3                                                | 1                                 |
|                             | Built    | 1      | 6                         | 5                                 | 4                                                                 | 2                                                                | 3                                                | 1                                 |
|                             | Economic | 1      | 6                         | 5                                 | 4                                                                 | 2                                                                | 3                                                | 1                                 |
|                             | Natural  | 1      | 6                         | 5                                 | 4                                                                 | 3                                                                | 2                                                | 1                                 |
| Total Score                 |          |        | 48                        | 44                                | 40                                                                | 45                                                               | 15                                               | 8                                 |
| Total Treatment Cost        |          |        | \$118M                    | \$118M                            | \$118M                                                            | \$166.8M                                                         | \$48.8M                                          | \$76.9M                           |
| Flood Mitigation Costs      |          |        | \$118M                    | \$118M                            | \$118M                                                            | \$118M                                                           | ~                                                | ~                                 |
| Buyout Costs                |          |        | ~                         | ~                                 | ~                                                                 | \$40M                                                            | \$40M                                            | \$60.3M                           |
| Reclamation Costs           |          |        | ~                         | ~                                 | ~                                                                 | \$8.8M                                                           | \$8.8M                                           | \$16.6M                           |
| Total Cost Saved            |          |        | ~                         | ~                                 | ~                                                                 | ~                                                                | \$118M                                           | \$150.3M                          |
| Flood Mitigation            |          |        | ~                         | ~                                 | ~                                                                 | ~                                                                | \$118M                                           | \$118M                            |
| Rural Water Sewer Servicing |          |        | ~                         | ~                                 | ~                                                                 | ~                                                                | ~                                                | \$27M                             |
| Private Service Connections |          |        | ~                         | ~                                 | ~                                                                 | ~                                                                | ~                                                | \$5M                              |
| Community Gathering Place   |          |        | ~                         | ~                                 | ~                                                                 | ~                                                                | ~                                                | \$300,000                         |
| Net Cost                    |          |        | \$118M                    | \$118M                            | \$118M                                                            | \$166.8M                                                         | \$0.00                                           | \$0.00                            |
| Net Cost Per Capita         |          |        | \$1,573                   | \$1,573                           | \$1,573                                                           | \$2,224                                                          | \$0.00                                           | \$0.00                            |

# Draper: Recommended Option

Buyout all  
properties

# Recommended Motion

Continue with Flood Mitigation efforts and work towards implementation of the following recommendations as outlined below with the intent of bringing a report back to Council on the progress no later than September 15, 2020.

- **Downtown:** Proceed the Municipality's pre-existing approved structural flood mitigation project, in addition to limiting development below 250m, while at the same time introducing enhanced flood provisions in the Land Use Bylaw for development above 250m.

# Recommended Motion

- **Longboat Landing:** Proceed the Municipality's pre-existing approved structural flood mitigation project, in addition to limiting development below 250m, while at the same time introducing enhanced flood provisions in the Land Use Bylaw for development above 250m.
- **Waterways:** Engage with individual property owners and residents residing in areas under 250m on the buyout of properties; and proceed with enhanced flood provisions in the Land Use Bylaw for development above 250m.

# Recommended Motion

- **Ptarmigan Court:** Engage with individual property owners and residents on the full buyout of all properties in this area.
- **Draper:** Engage with individual property owners and residents on the full buyout of all properties in this area.

# Next Steps

- Ongoing community conversation
- Timelines
- Decisions

# Thank You