Common Problem, Alternative Approaches: Comparing Floodplain Mapping Efforts in Alberta and Montana

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River Engineering and Technical Services Section
Government of Alberta

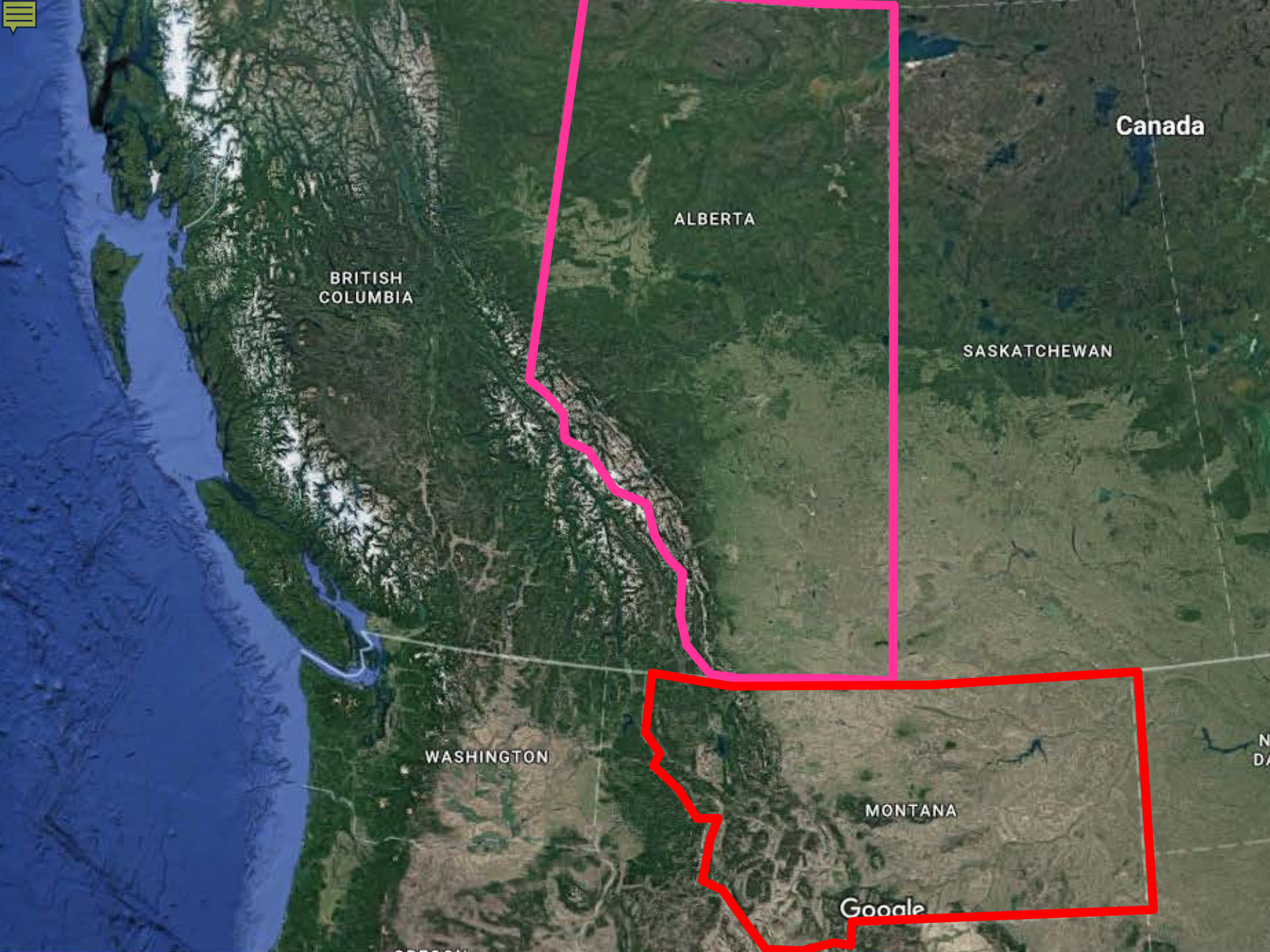
Association of Montana Floodplain Managers Annual Conference
Missoula, Montana
March 9, 2017

Presentation Outline

- **About Alberta**
  - Alberta Delegation (Bryce)
  - Recent Disasters (Peter)
  - Current Floodplain Mapping Program (Adam)

- **Montana-Alberta Comparison** (Bryce)
  - Technical
  - Role of Governments
  - Implementation Strategies
  - Future Challenges

- **Questions**


Canada
ALBERTA
BRITISH
COLUMBIA
SASKATCHEWAN
WASHINGTON
MONTANA
Google

Northwest Territories
Alberta
Hay River Basin
Plus Great Slave Basins
Saskatchewan
Peace/Slave
River Basin
Fort McMurray
Peace River
Athabasca
River Basin
Beaver
River Basin
Edmonton
North
Saskatchewan
River Basin
British
Columbia
Calgary
South
Saskatchewan
River Basin
High River
Continental Drainage
Mackenzie
(Arctic Ocean)
Nelson-Churchill
(Hudson Bay)
Missouri-Mississippi
(Gulf of Mexico)
Milk River Basin
Montana

Our Office
Edmonton

Alberta Environment - River Engineering and Technical Services Section

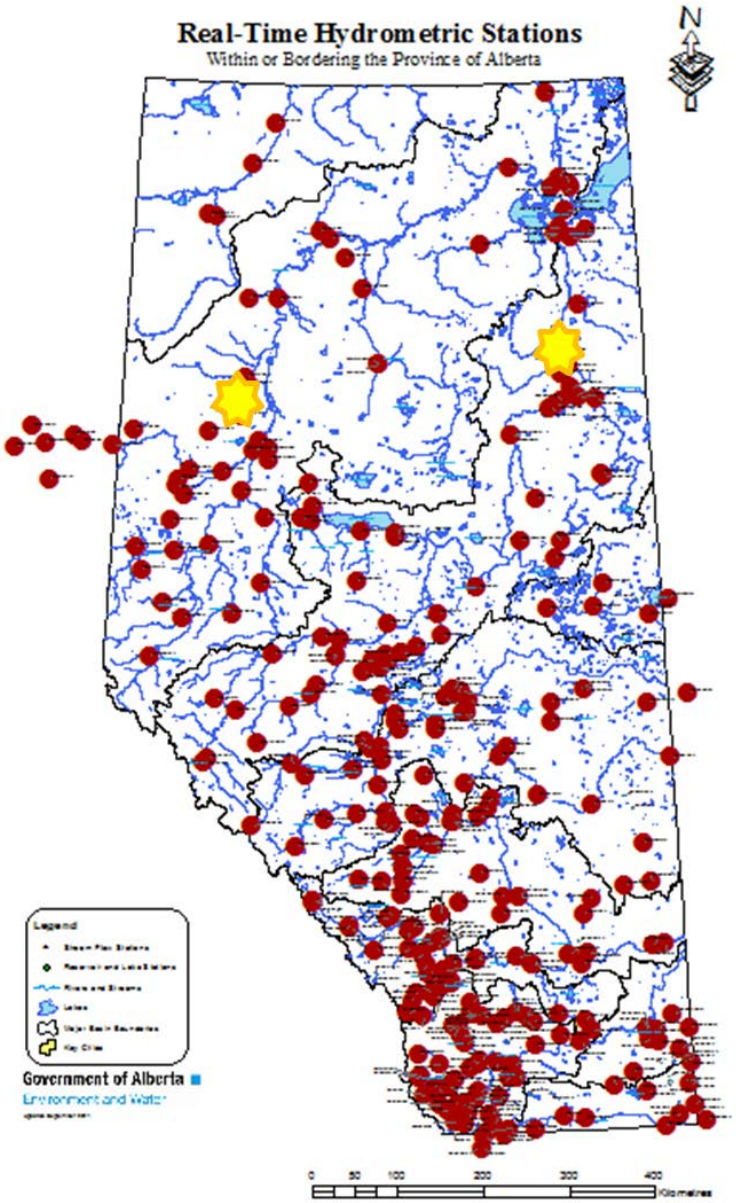
Forecasting

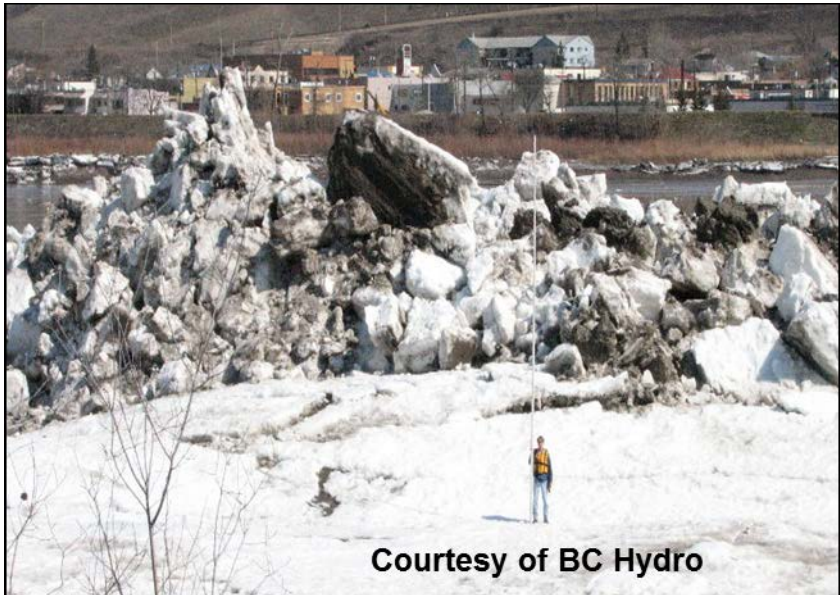
- Flood operating procedures for Government owned dams
- Near real-time monitoring and reporting
- Forecasting floods
- Forecasting water supply
- Ice monitoring, ice jam risk evaluation

Mapping

- Flood Hazard Identification Program
- River engineering advisory services
- Flood documentation, including high water mark collection
- Steep Creek and channel migration initiatives

Real time Hydrometric Stations



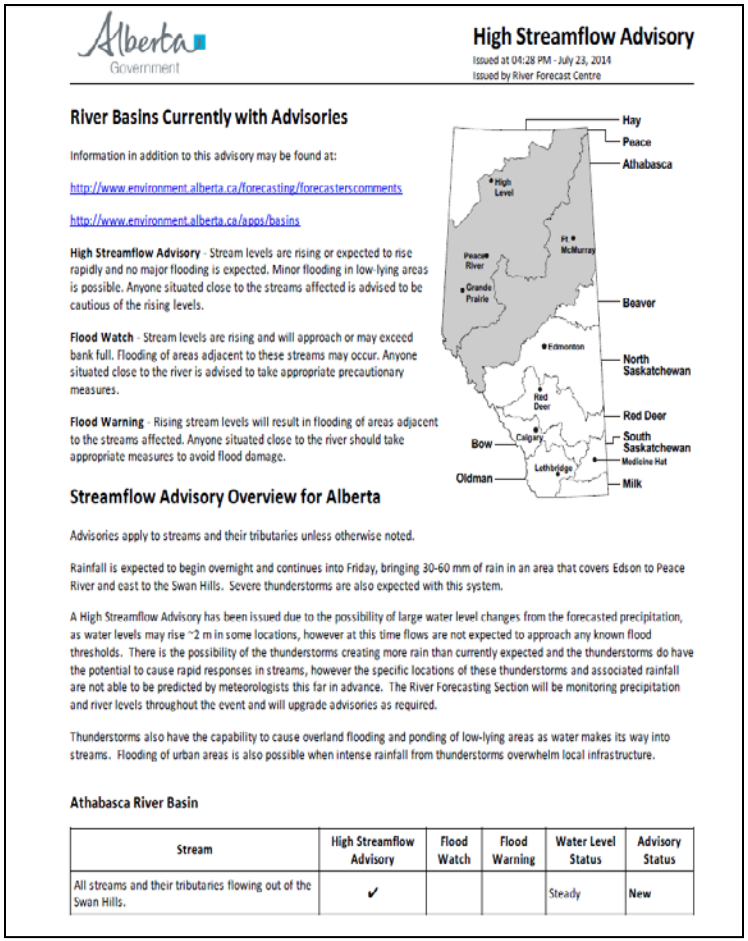


Courtesy of BC Hydro

Forecasting – Operations based Communication

- **Forecaster's Comments**
  - Twice weekly or more often
- **Ice Observation reports**
- **Advisories, Watches, Warnings**
  - Ice jams, summer flooding, spring runoff
- **River Application for web and smart phone**

rivers.alberta.ca



Alberta Government

High Streamflow Advisory

Issued at 04:28 PM - July 23, 2014
Issued by River Forecast Centre

River Basins Currently with Advisories

Information in addition to this advisory may be found at:

http://www.environment.alberta.ca/forecasting/forecasterscomments

http://www.environment.alberta.ca/apps/basins

High Streamflow Advisory - Stream levels are rising or expected to rise rapidly and no major flooding is expected. Minor flooding in low-lying areas is possible. Anyone situated close to the streams affected is advised to be cautious of the rising levels.

Flood Watch - Stream levels are rising and will approach or may exceed bank full. Flooding of areas adjacent to these streams may occur. Anyone situated close to the river is advised to take appropriate precautionary measures.

Flood Warning - Rising stream levels will result in flooding of areas adjacent to the streams affected. Anyone situated close to the river should take appropriate measures to avoid flood damage.

Streamflow Advisory Overview for Alberta

Advisories apply to streams and their tributaries unless otherwise noted.

Rainfall is expected to begin overnight and continues into Friday, bringing 30-60 mm of rain in an area that covers Edson to Peace River and east to the Swan Hills. Severe thunderstorms are also expected with this system.

A High Streamflow Advisory has been issued due to the possibility of large water level changes from the forecasted precipitation, as water levels may rise ~2 m in some locations, however at this time flows are not expected to approach any known flood thresholds. There is the possibility of the thunderstorms creating more rain than currently expected and the thunderstorms do have the potential to cause rapid responses in streams, however the specific locations of these thunderstorms and associated rainfall are not able to be predicted by meteorologists this far in advance. The River Forecasting Section will be monitoring precipitation and river levels throughout the event and will upgrade advisories as required.

Thunderstorms also have the capability to cause overland flooding and ponding of low-lying areas as water makes its way into streams. Flooding of urban areas is also possible when intense rainfall from thunderstorms overwhelm local infrastructure.

Athabasca River Basin

Stream	High Streamflow Advisory	Flood Watch	Flood Warning	Water Level Status	Advisory Status
All streams and their tributaries flowing out of the Swan Hills.	✔			Steady	New

River Engineering and Technical Services Section

Forecasting

- Flood operating procedures for Government owned dams
- Near real-time monitoring and reporting
- Forecasting floods
- Forecasting water supply
- Ice monitoring, ice jam risk evaluation

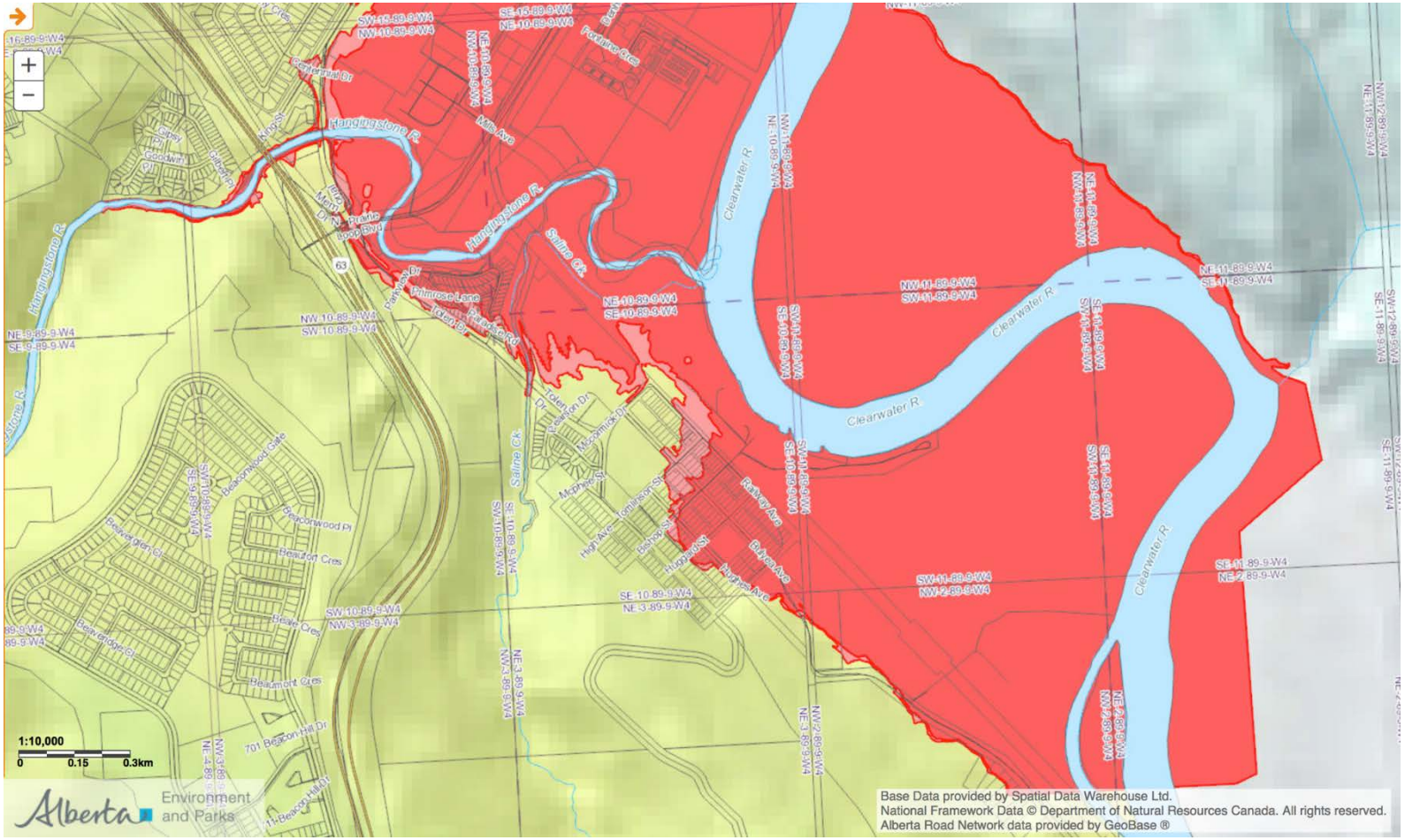
Mapping

- Flood Hazard Identification Program
- River engineering advisory services
- Flood documentation
- Steep Creek and channel migration initiatives

Credit: Calgary Sun

Credit: YouTube/Jason Edmondson

Credit: Canadian Press/NASA Earth Observatory, Joshua Stevens


Hangingstone R.
Clearwater R
Saline Ck
Centennial Dr
Mills Ave
Prairie Loop Blvd
Primrose Lane
Paradise Rd
Toten Dr
Beaconwood Gate
Beaconwood Pl
Beaufort Cres
Beaumont Cres
Beaverdale Cl
Beaverdale Cl
Beaver Cres
701 Beacon Hill Dr
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Bulyea Ave
Railway Ave
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Bishop St
Tomlinson St
McPhee St
McCormick Dr
Pearson Dr
Toten Dr
Fontaine Cres
Loop Blvd
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Clipsy Pl
Colonial Pl
King St
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Menu Dr
Parvey Dr
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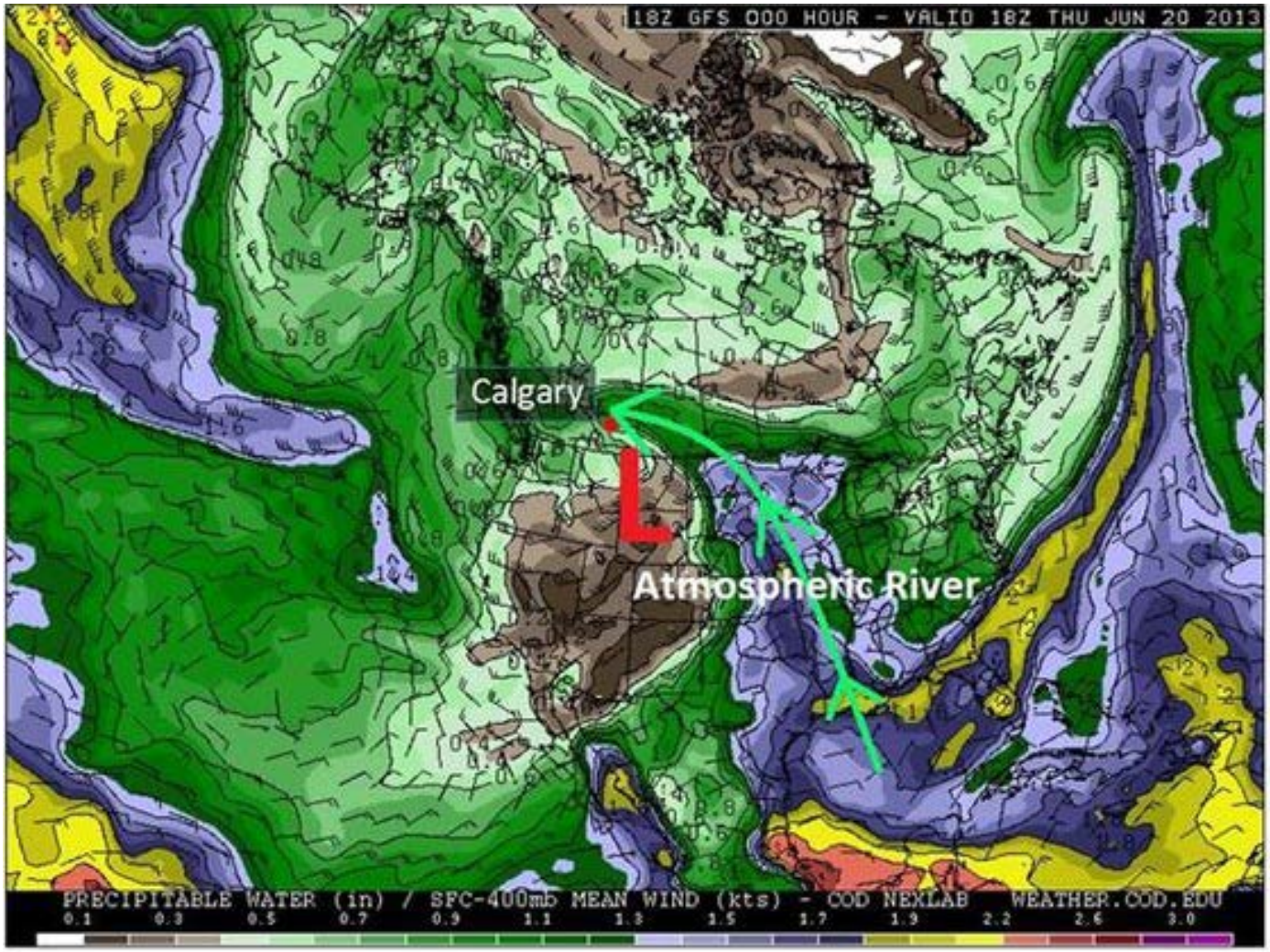
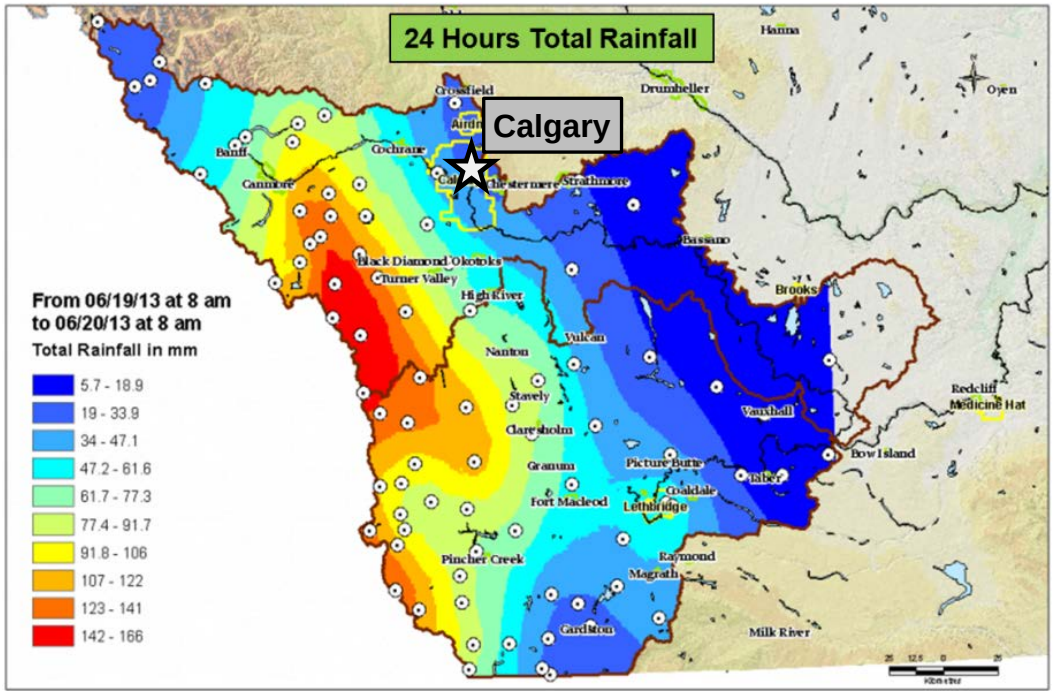
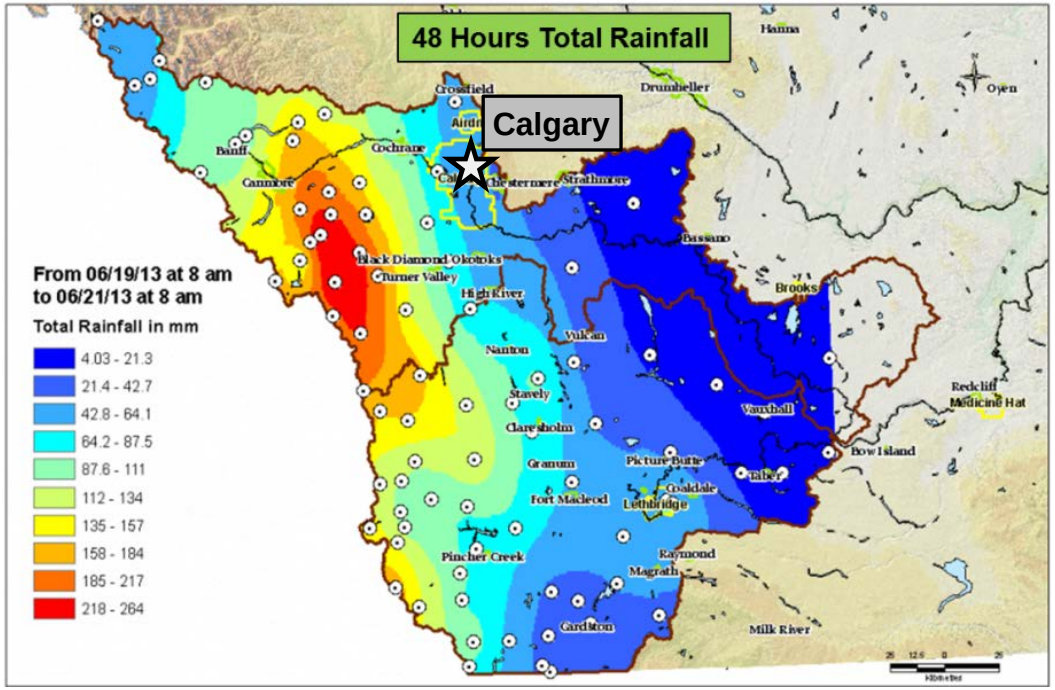
0.3km
Alberta Environment and Parks
Base Data provided by Spatial Data Warehouse Ltd.
National Framework Data © Department of Natural Resources Canada. All rights reserved.
Alberta Road Network data provided by GeoBase ®

2013 Storm – June 18-22, 2013



Source: Alberta Floods: Why is There so Much Rain, Chris Scott


24 Hours Total Rainfall
Calgary
From 06/19/13 at 8 am
to 06/20/13 at 8 am
Total Rainfall in mm
5.7 - 18.9
19 - 33.9
34 - 47.1
47.2 - 61.6
61.7 - 77.3
77.4 - 91.7
91.8 - 106
107 - 122
123 - 141
142 - 166
Hanna
Drumheller
Oyen
Crossfield
Airdrie
Banff
Cochrane
Canmore
Chestermere
Strathmore
Bassano
Black Diamond
Okotoks
Turner Valley
High River
Brooks
Vulcan
Nanton
Stavely
Vauxhall
Redcliff
Medicine Hat
Claresholm
Bow Island
Granum
Picture Butte
Taber
Coaldale
Fort Macleod
Lethbridge
Pincher Creek
Raymond
Magrath
Cardston
Milk River


48 Hours Total Rainfall
Calgary
From 06/19/13 at 8 am
to 06/21/13 at 8 am
Total Rainfall in mm
4.03 - 21.3
21.4 - 42.7
42.8 - 64.1
64.2 - 87.5
87.6 - 111
112 - 134
135 - 157
158 - 184
185 - 217
218 - 264
Hanna
Drumheller
Oyen
Crossfield
Airdrie
Banff
Cochrane
Canmore
Chestermere
Strathmore
Bassano
Black Diamond
Okotoks
Turner Valley
High River
Brooks
Vulcan
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Stavely
Vauxhall
Redcliff
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Claresholm
Bow Island
Granum
Picture Butte
Taber
Coaldale
Fort Macleod
Lethbridge
Pincher Creek
Raymond
Magrath
Cardston
Milk River

Canmore
To Banff
To Calgary

CP/Jonathan Hayward

Calgary Zoo – Lobbi the Hippo

Calgary Herald

High River
© Rob Michaud

Alberta

OVER 14,500
HOMES DAMAGED

80
SCHOOLS DAMAGED

10
HEALTH FACILITIES DAMAGED

30
COMMUNITIES IMPACTED

985 KM
ROADS CLOSED

3,000
BUSINESSES AFFECTED

100,000
PEOPLE EVACUATED

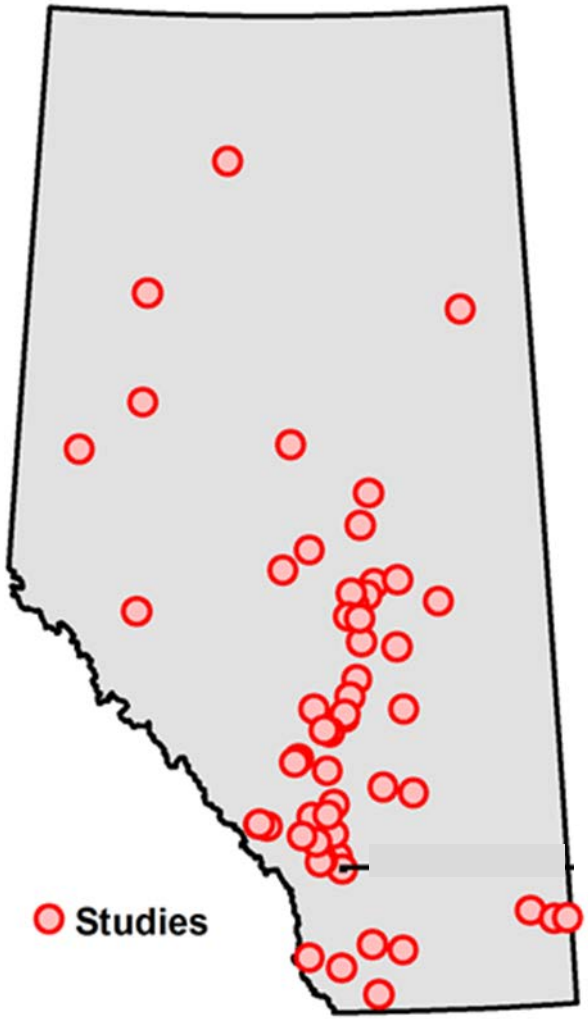
Flood Hazard Identification Program

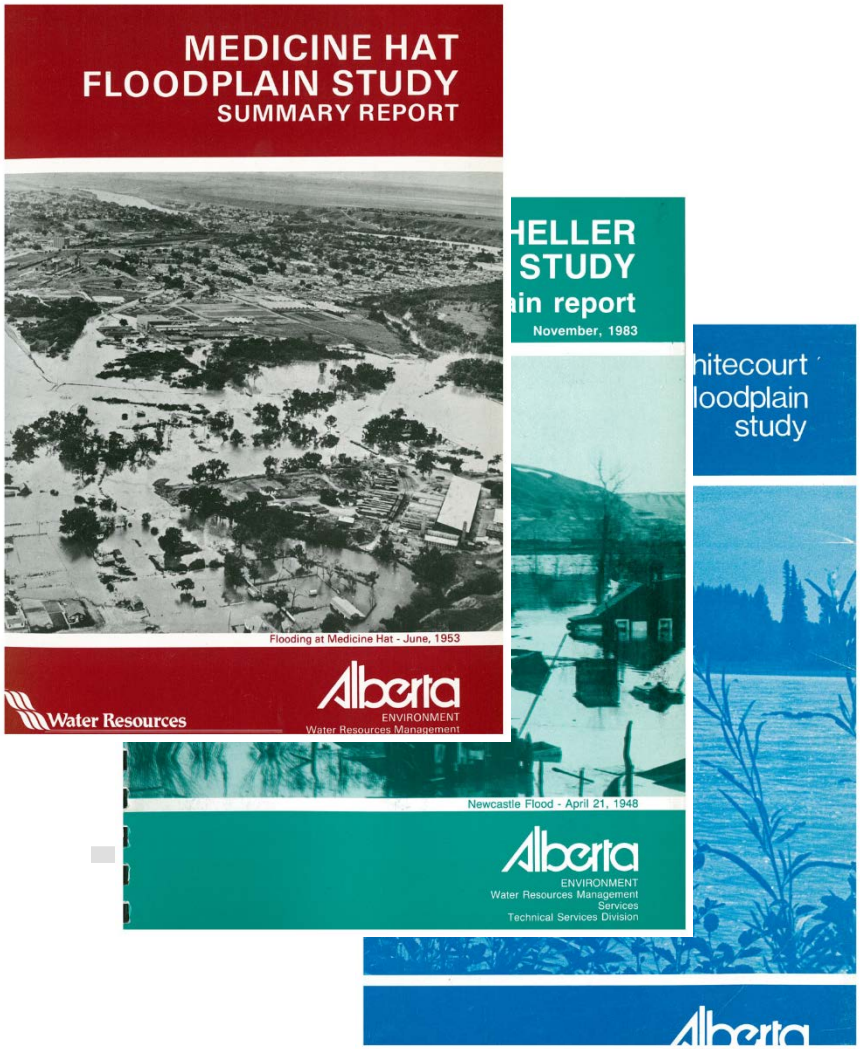
History

- Provincial involvement in flood hazard mapping began in the 1970s
- Canada-Alberta Flood Damage Reduction Program (FDRP) began in 1989 to standardize and cost-share flood hazard mapping studies – a 10 year program
- Alberta continues to create flood hazard mapping for communities since 1999 with the **Flood Hazard Identification Program** (FHIP)
- Canada National Disaster Mitigation Program (NDMP) began in 2015 to reduce the impacts of natural disasters through cost-sharing flood hazard studies

Flood Hazard Identification Program

Study Locations





Flood Hazard Identification Program

Technical

- Current Standard - 1% flood
- DTMs require 15cm vertical accuracy (95%) – typically LiDAR
- Channel cross sections surveyed, overbanks cut from DTM
- Hydrology – Bulletin 17B/17C reference, with additional Alberta specific guidance
- HEC-RAS hydraulic modelling

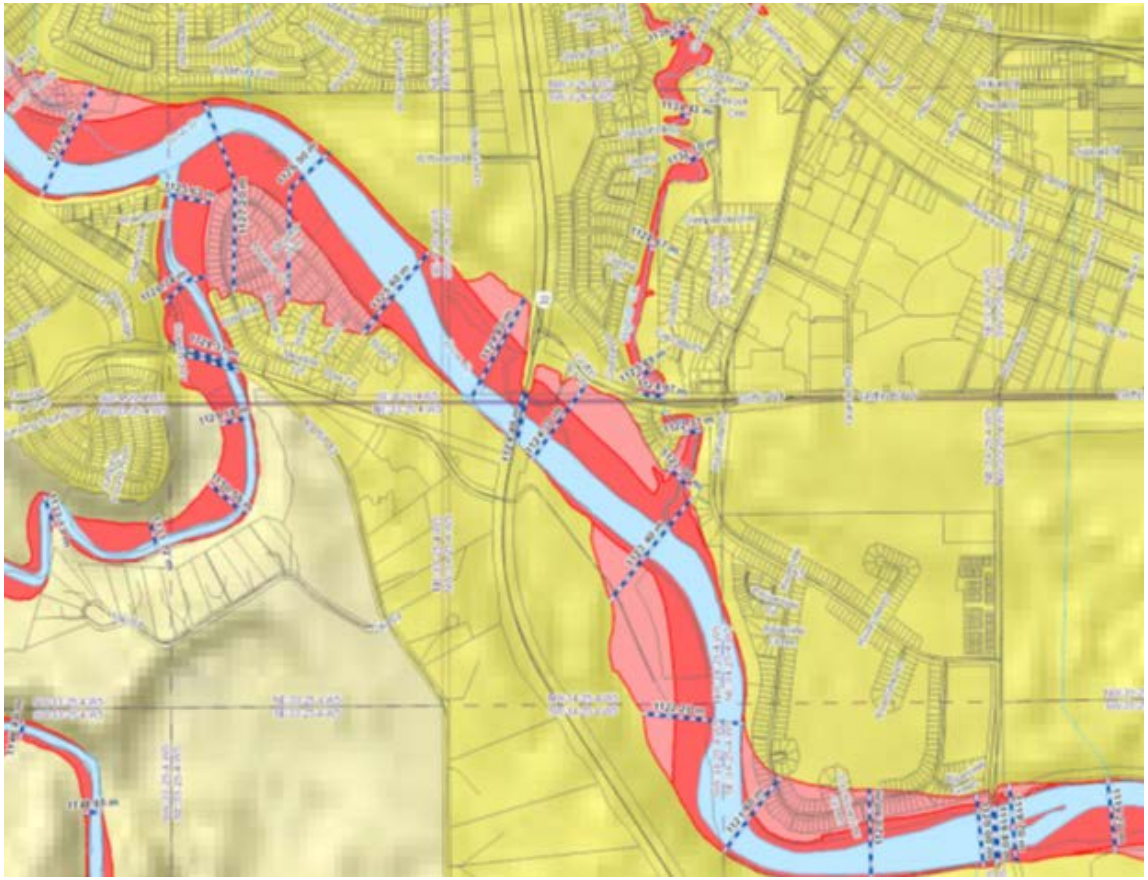
Flood Hazard Identification Program
Products

- “Regulatory” floodplain map
  - In Alberta called “Flood Hazard Map”
- Flood inundation maps
  - 13 scenarios mapped, from 2-year to 1000-year
- Channel migration historical comparison
- Cursory risk assessment
- Intermediate products such as digital terrain models and cross section surveys are also provided to stakeholders, and the public upon request
- Detailed technical report outlining all work, including hydrology assessment

Flood Hazard Identification Program

“Regulatory” Flood Hazard Map

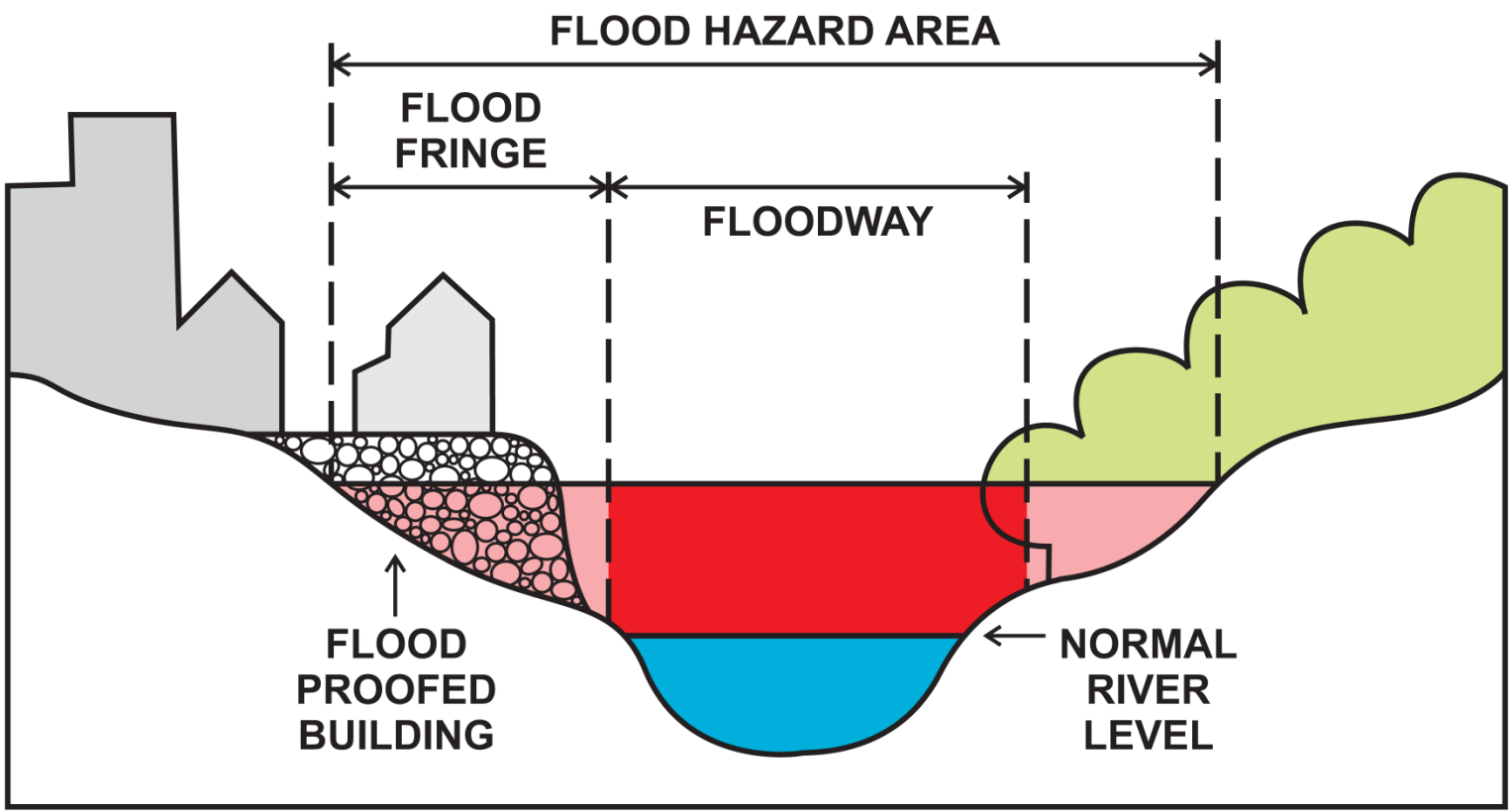
- Typically 2-zone – floodway, flood fringe zones
- Design flood levels use “encroached to floodway” levels



Flood Hazard Identification Program

Floodway Determination Criteria

- 0.3 m (~1 foot) maximum rise threshold (not forced)
- 1 m depth (~3.2 feet) and 1 m/s velocity (~3.2 ft/s)
- No encroachment into the channel



Flood Hazard Identification Program

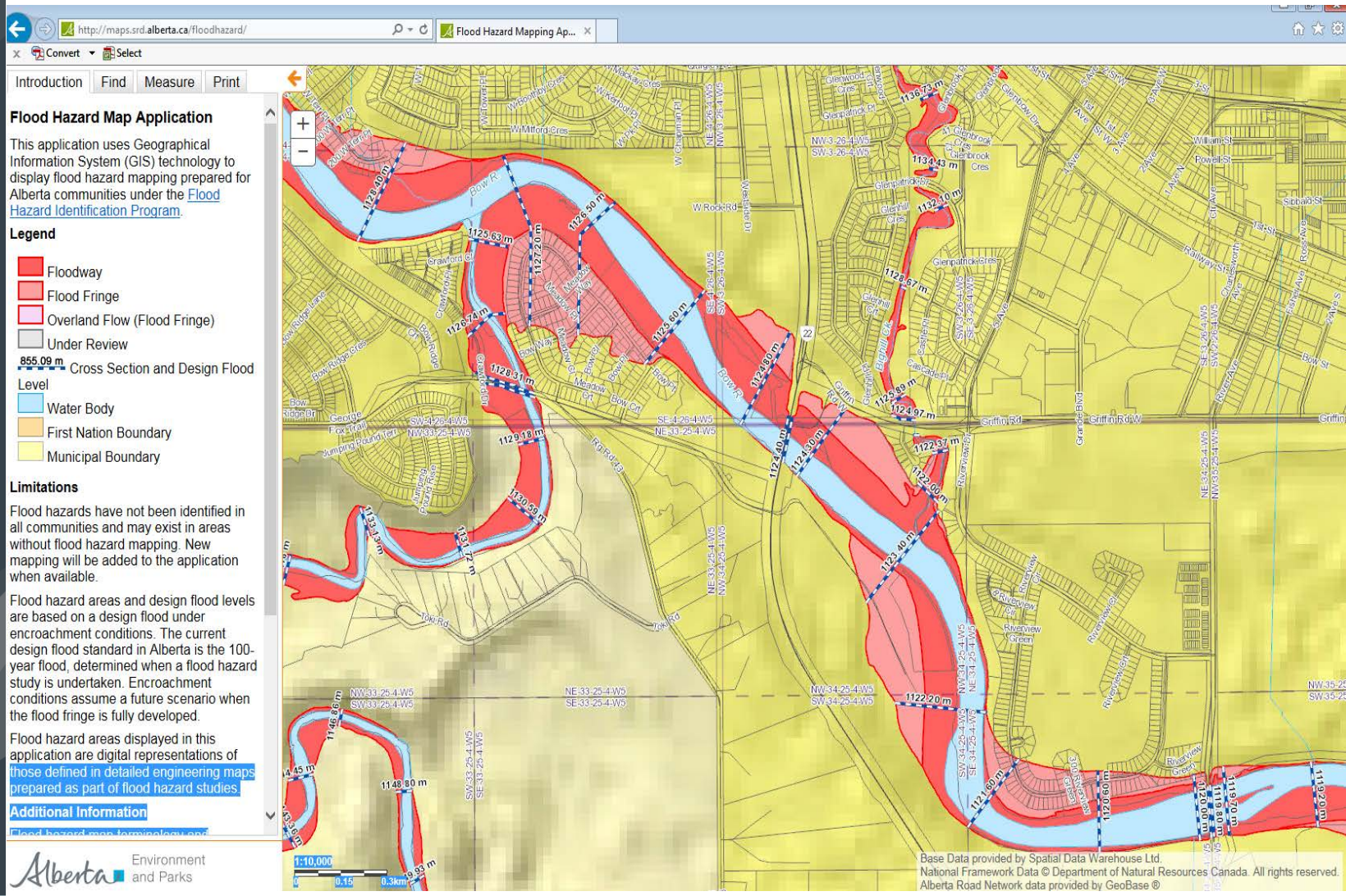
Implementation

- Currently we have over $6 million of mapping studies underway
- Focus on creating strong partnerships with local governments early on
  - Leverage local knowledge when possible
  - Draft products, stakeholder engagement, review process, finalization
  - Local government incorporation into ordinances
- Provincial designation under the Water Act
- Provincial display on website
- Ongoing provincial support and occasional map amendment

Flood Hazard Identification Program

Website

http://maps.srd.alberta.ca/floodhazard/



Montana-Alberta Comparison

Technical

- In general, somewhat similar technical mapping standards with some notable differences
  - Alberta - naturalized flows, typically even downstream of dams
  - Alberta – no levee accreditation, so we assume levees are hydraulically effective but functionally ineffective when modelling
  - Alberta – different way of determining floodway location
  - Alberta – Design flood levels (BFEs) determined assuming future state (no flood fringe conveyance)
  - Alberta – Two-zone map only

Montana-Alberta Comparison

Role of Governments

- No Canadian NFIP equivalent
  - Provincial and federal governments provide disaster assistance
  - Can be viewed like insurance where everyone pays the same premium through their federal and provincial taxes, regardless of individual risk
- Since the $6 billion expense resulting from the 2013 floods, there has been renewed federal interest in
  - National guidelines
  - National flood hazard and risk database
  - Public or private insurance options

Montana-Alberta Comparison

Program Strategies

- Alberta – future looking design levels (BFEs) resulting in longer map life, less required regulation, less required resources but potentially greater cost to governments since they prominently pay for the rebuild due to the absence of any other repayment mechanism
- Alberta - to date local governments have been encouraged but are not yet required to adopt floodplain maps into local ordinances. Adoption is a challenge with some communities
- Alberta - no CRS but are now starting to consider ways to incentivize wise floodplain management. Many good ideas learned in this conference.

Montana-Alberta Comparison

Future Challenges

- Do we have appropriate resources for long term success?
- Do we have effective relationships with our federal and local partners?
- Are we able to utilize current and emerging technologies?
- Are current programs and products effective in meeting desired floodplain management outcomes?

Thank You!
Questions?

http://maps.srd.alberta.ca/floodhazard/