Alberta Flood Hazard Identification Program

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Flood Hazard Identification Program
Presentation Outline

- Introduction
- Flood Hazard Identification Program (FHIP)
  - History
  - Objectives
  - Principles
- Flood Hazard Mapping Terminology
  - Design Flood
  - Flood Hazard Area – Floodway and Flood Fringe
  - Program Standards
- Existing Flood Hazard Studies

Flood Hazard Identification Program
Presentation Outline

- **New River Hazard Studies**

  5 New Studies – Upper Bow, Bow and Elbow, Highwood, Sheep, and Peace River Hazard Studies

  - Study Areas
  - Hydrology Assessment
  - Survey & Base Data Collection
  - Hydraulic Modelling
  - Flood Inundation Mapping
  - Flood Hazard Mapping
  - New Study Components

Flood Hazard Identification Program
Introduction

Flooding:

- Can occur along all rivers and streams in Alberta
- Has the potential to cause damage to property, hardship to people and in extreme events, loss of life
- Damages can represent one of the largest expenses for the public, local authorities, and both provincial and federal disaster assistance programs

Identifying and understanding flood hazards is the first step in any program to **reduce flood damages**

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

- 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
- The Government of Alberta has continued to create flood hazard mapping for communities since 1999 with the **Flood Hazard Identification Program** (FHIP)
- Joint Federal-Provincial FDRP focused on urban areas

Flood Hazard Identification Program
Objectives

- Increase public safety and awareness of flood hazards
- Promote appropriate development of flood hazard areas
- Reduce future flood damages and related financial costs

Flood Hazard Identification Program
Principles

- Floods are natural events and severe floods can occur in any year
- We have a responsibility to reduce flood hazards within our areas of jurisdiction, and have a role in managing flood hazard areas through appropriate land-use planning
- Development in flood hazard areas should not result in an unacceptable level of risk to residents, the development, or the environment

Flood hazard studies and maps **identify an existing flood hazard**, they do not create them

Flood Hazard Mapping
Terminology

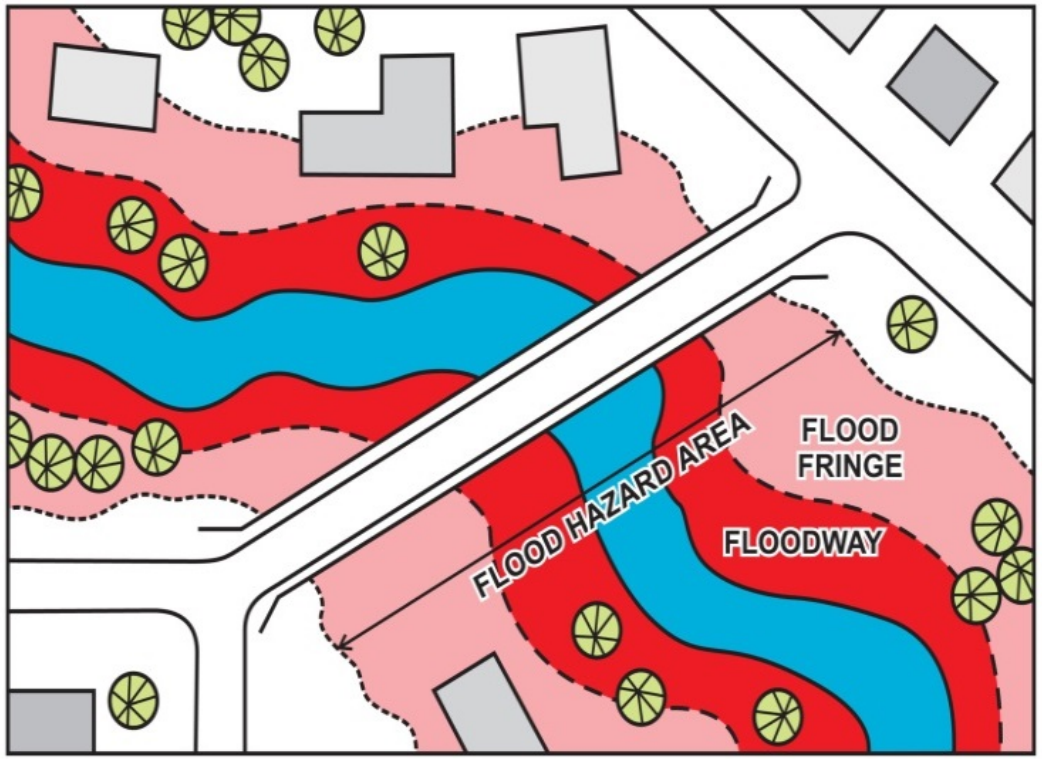
Design Flood

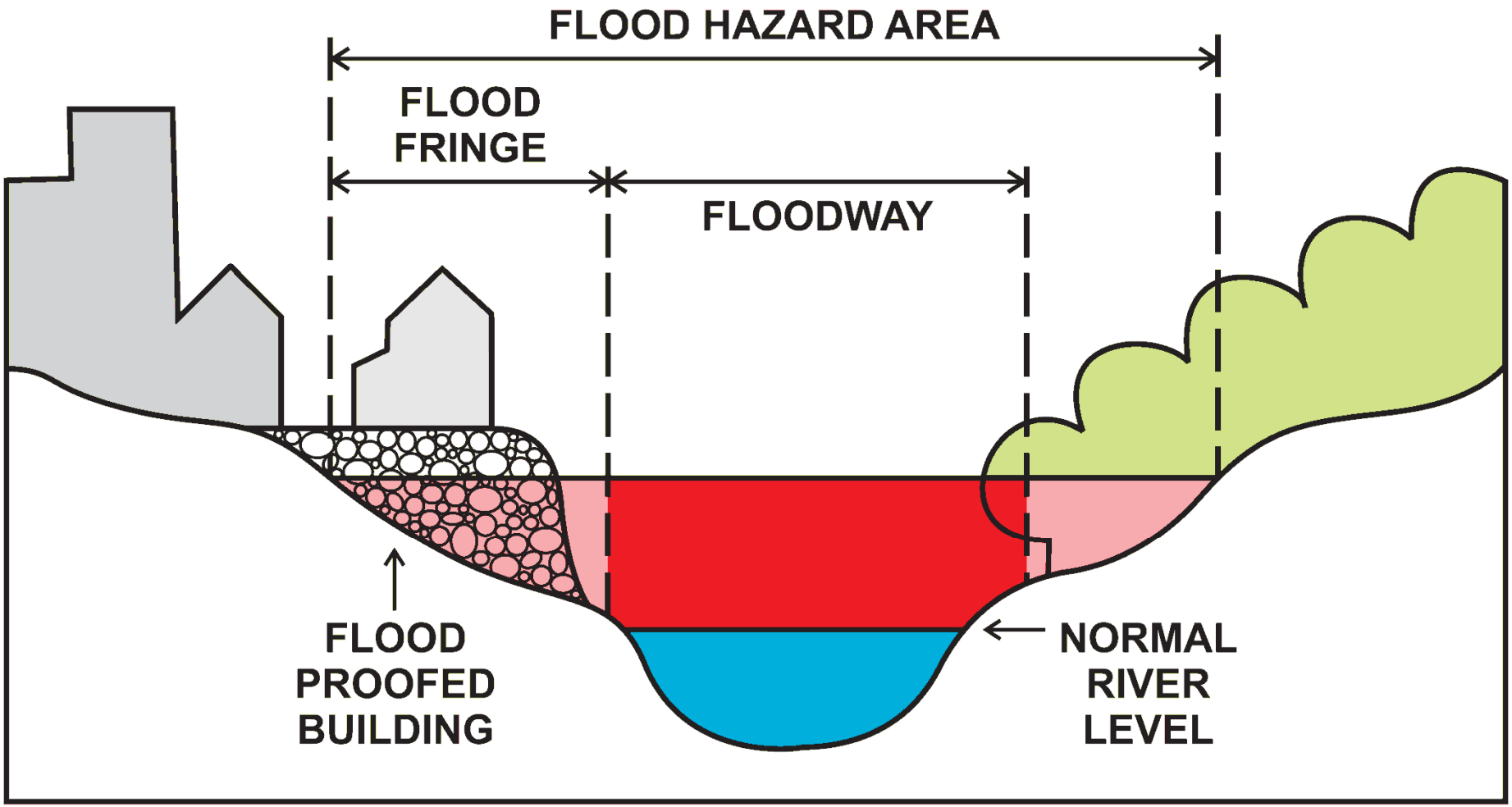
- A flood that has a 1% chance of occurring each year
- Referred to as the 100-year flood, but this does **not** mean that it will only occur once every 100 years
- Can be an open water flood or an ice jam flood
- Determined by hydrologic assessment when a study is conducted

Flood Hazard Mapping
Terminology

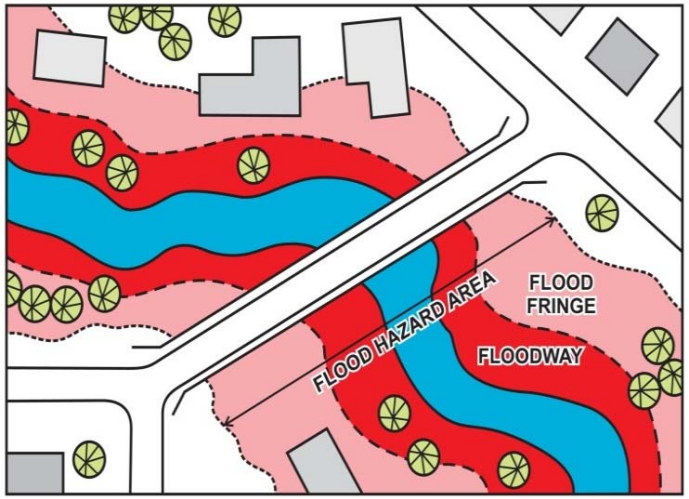
Flood Hazard Area

- Total area inundated by the design flood
- Divided into zones
  - **Floodway**
  - **Flood Fringe**



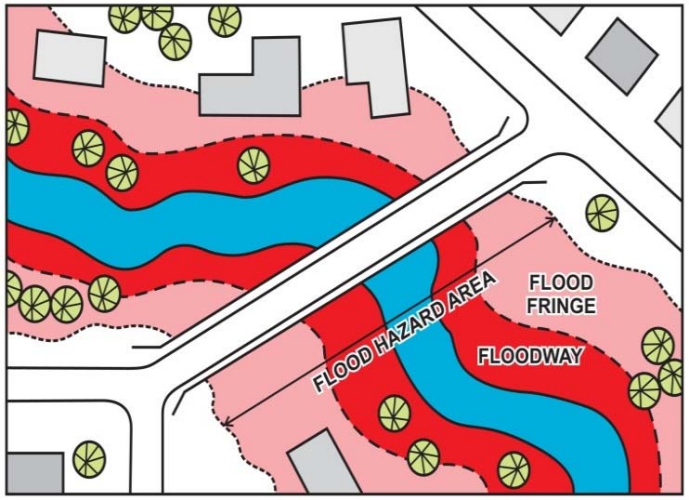

FLOOD HAZARD AREA
FLOOD FRINGE
FLOODWAY
FLOOD PROOFED BUILDING
NORMAL RIVER LEVEL

Flood Hazard Mapping
Defining the Floodway

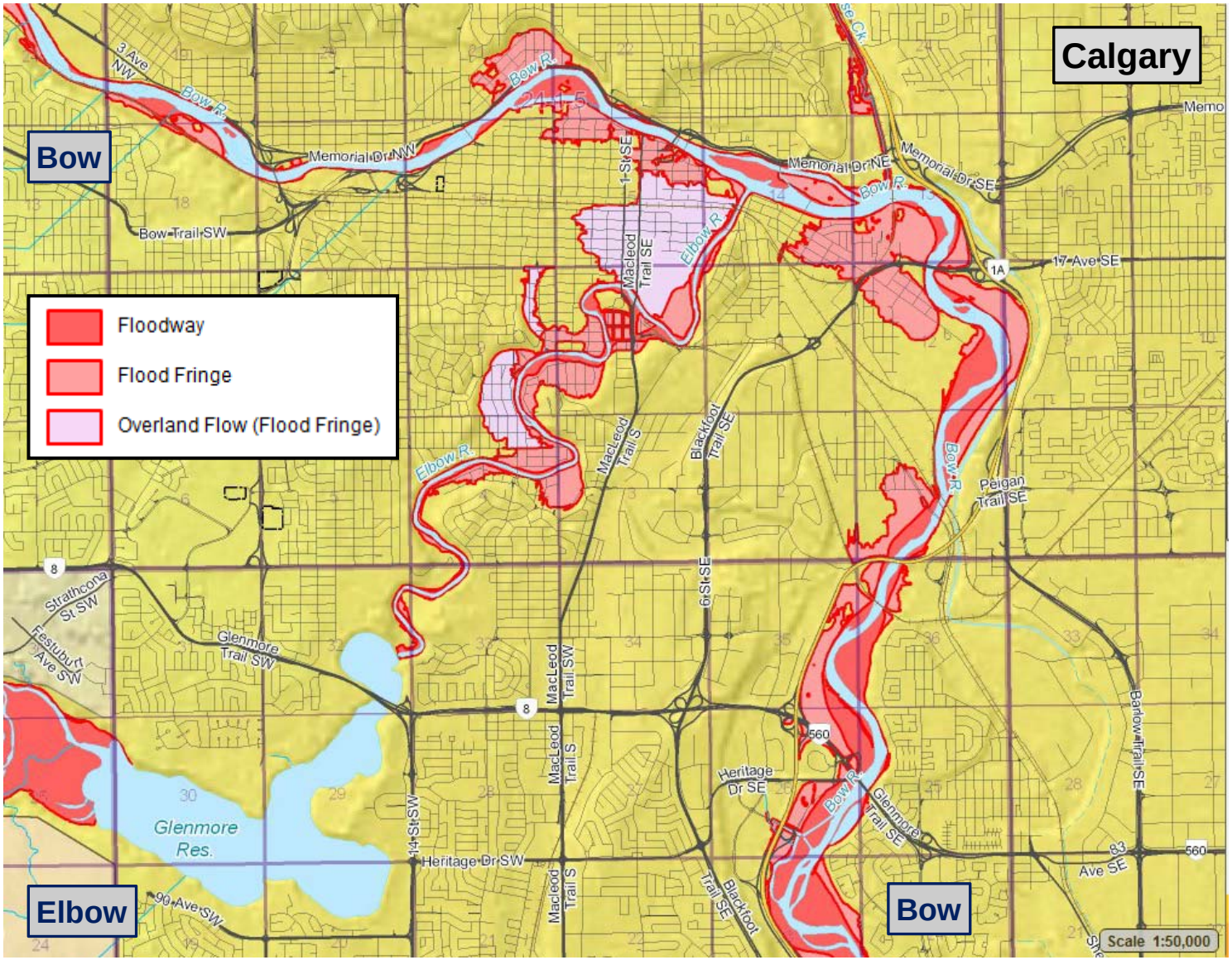


- The portion of the flood hazard area where flows are deepest, fastest and most destructive
- Includes the main channel of a stream and typically a portion of the adjacent floodplain area
- Typically located where design flood waters:
  - are 1 m deep or greater
  - are flowing at 1 m/s velocity or higher

Flood Hazard Mapping
Defining the Flood Fringe



- The portion of the flood hazard area not included in the floodway, but still inundated in design flood event
- Typically has shallower water and lower velocities during the design flood event
- Assumed to be fully developed in the future – development will not increase design flood levels above that calculated and mapped


Calgary
Bow
Elbow
Bow
Floodway
Flood Fringe
Overland Flow (Flood Fringe)
Bow R.
Elbow R.
Memorial Dr NW
Memorial Dr NE
Memorial Dr SE
Bow Trail SW
17 Ave SE
1A
1 St SE
Macleod Trail SE
Macleod Trail S
Blackfoot Trail SE
Peigan Trail SE
6 St SE
Strathcona St SW
Festubert Ave SW
Glenmore Trail SW
Macleod Trail SW
14 St SW
Heritage Dr SW
Heritage Dr SE
Glenmore Trail SE
Barlow Trail SE
83 Ave SE
90 Ave SW
Glenmore Res.
560
8
Scale 1:50,000

Flood Hazard Mapping
Current Program Standards

Mapping and regulation to floodway levels

- **Design flood levels –encroached floodway levels – are applied to entire flood hazard area**
  - Incorporates potential future development impact
  - Recommend no new obstruction of floodway
  - Future floodway development regulations
- **Flood-proofing recommended to design flood level plus a locally-set freeboard**
  - Freeboard not directly incorporated into mapping

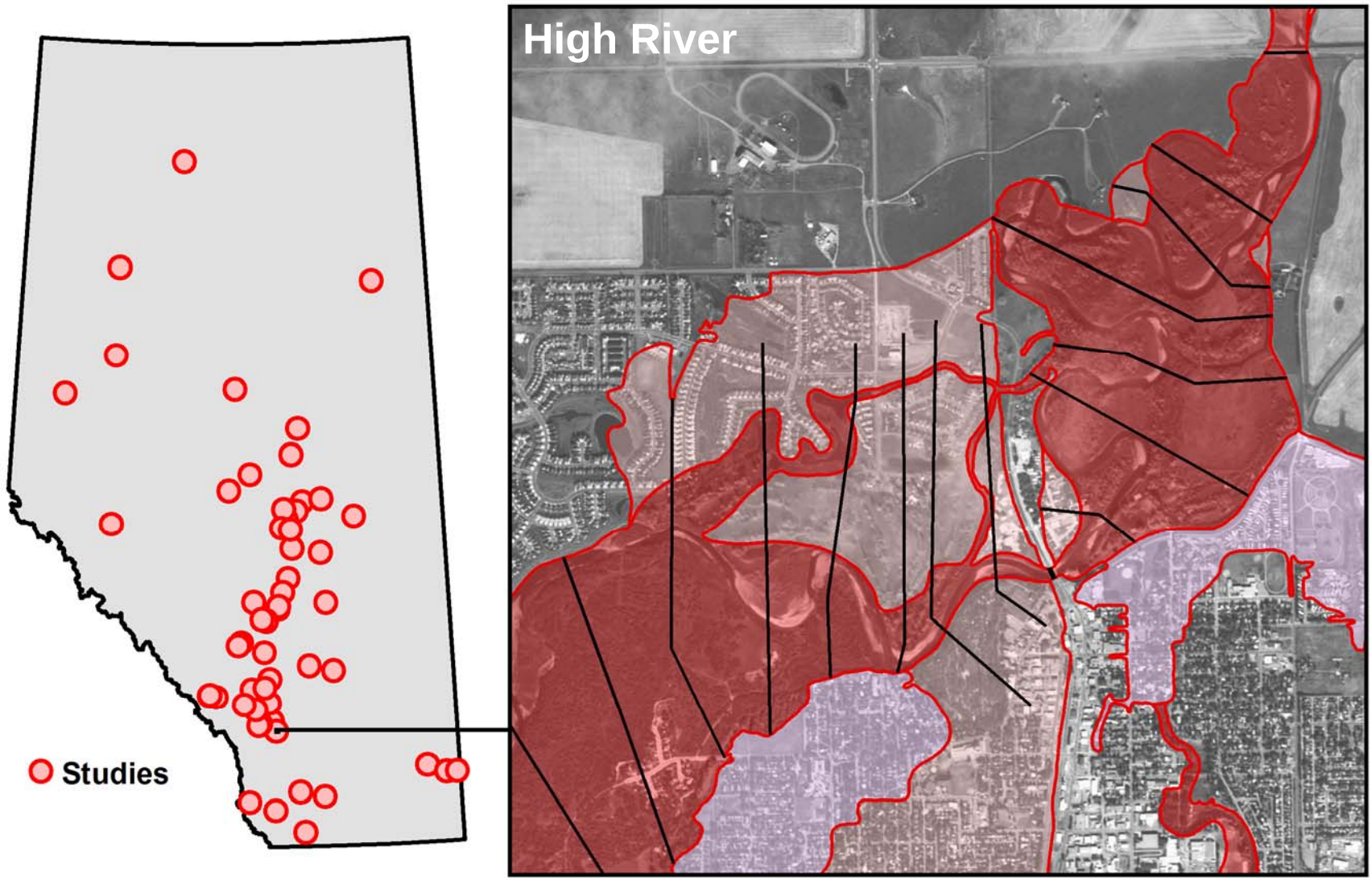
Flood Hazard Mapping
Current Program Standards

Dykes considered functionally ineffective

- **FHIP Guidelines:**

  "When delineating a flood hazard area, any dyking present is assumed to be ineffective and the flooded area behind the dyke would be considered floodway or flood fringe. This is a conservative assumption but it reflects the potential flood hazard if the dykes were to fail."
- **Dykes mitigate risk but do not eliminate hazard**
- **No dyke certification program**

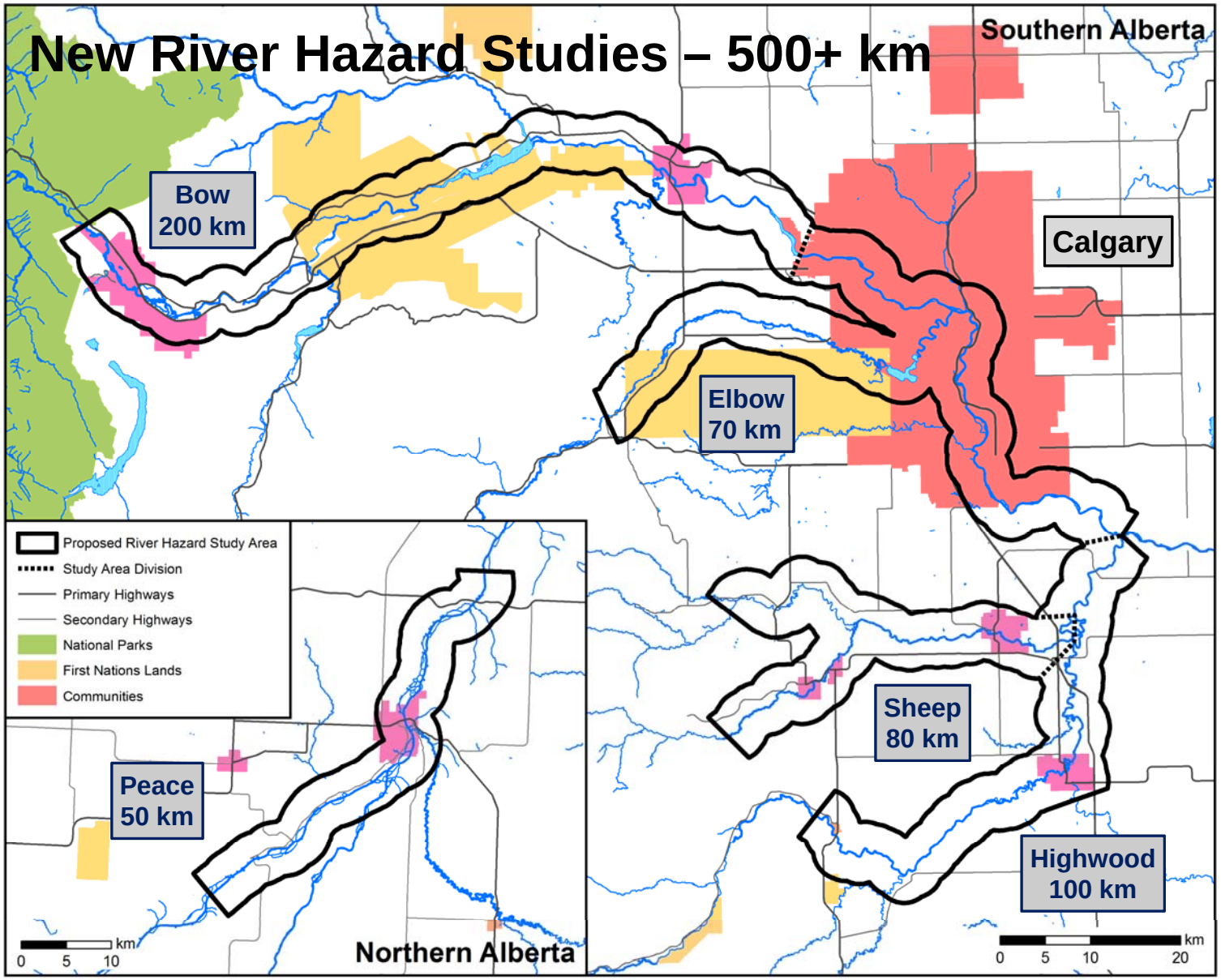

Naturalized design discharge
Oldman Dam, 1995


High River
Studies

Flood Hazard Mapping
Existing Flood Hazard Studies

- **Black Diamond and Turner Valley** – Sheep River – 1992
- **Bragg Creek** – Elbow River and Bragg Creek – 1992
- **Canmore** – Bow River and Policeman Creek – 1993
- **Calgary** – Bow and Elbow Rivers – 1983, revised 1996 and 2012
- **Cochrane** – Bow River, Bighill and Jumpingpound Creeks – 1986, revised 1990
- **High River** – Highwood River, Baker Creek and Little Bow River – 1992
- **MD of Bighorn and Exshaw** – Bow River and Exshaw Creek – 1996
- **Okotoks** – Sheep River – 1996, revised 2013
- **Rocky View County** - Elbow River and Lott Creek – 1996, revised 1998

Flood mapping for these studies will be replaced.

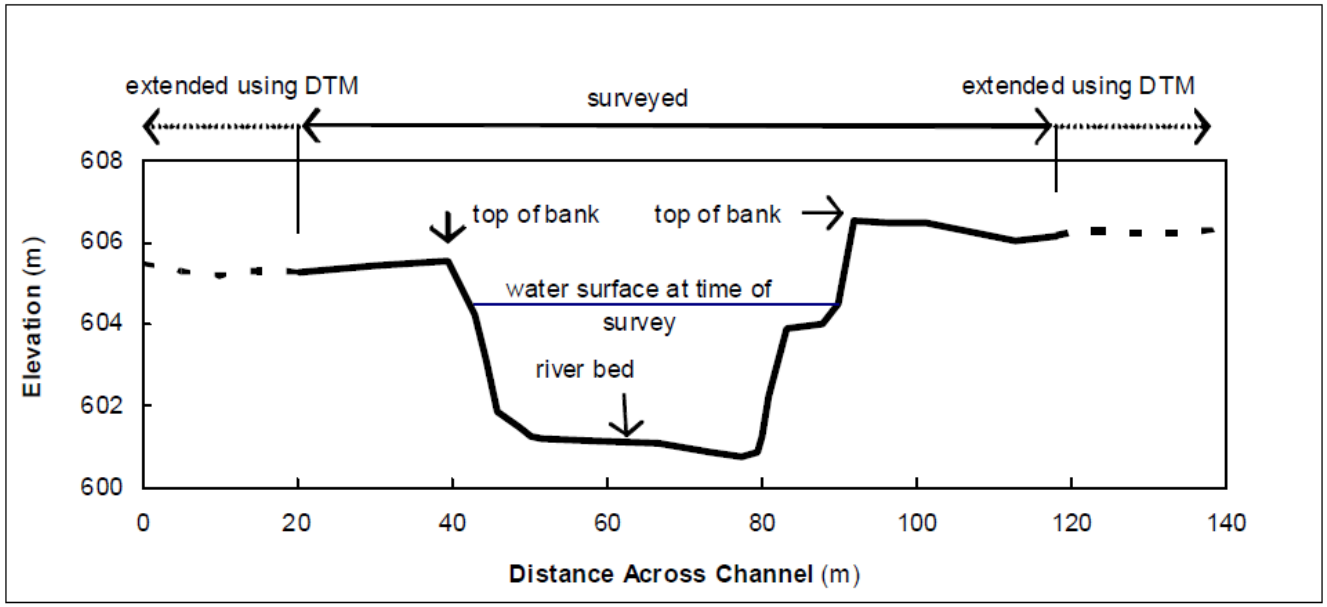

New River Hazard Studies – 500+ km
Southern Alberta
Bow
200 km
Calgary
Elbow
70 km
Sheep
80 km
Highwood
100 km
Peace
50 km
Northern Alberta
Proposed River Hazard Study Area
Study Area Division
Primary Highways
Secondary Highways
National Parks
First Nations Lands
Communities
km
0 5 10
km
0 5 10 20

New River Hazard Studies
Hydrology Assessment

- Basin-wide hydrology assessments in a parallel study
  - Assessing over 85 locations in new river hazard study areas as well as upstream and downstream
  - Including tributaries not part of current mapping plan
  - Including 2013 flood flows and 2014/2015 data in the new analysis, with option to add 2016 flows
- Naturalized and regulated flow scenarios
  - Flow frequency estimates stripping out man-made regulation and including current regulation by dams

New River Hazard Studies
Survey and Base Data Collection

- River and Ground Data Collection
  - Surveyed River Cross Sections
  - Digital Terrain Model (DTM), typically based on LiDAR



New River Hazard Studies
Survey and Base Data Collection

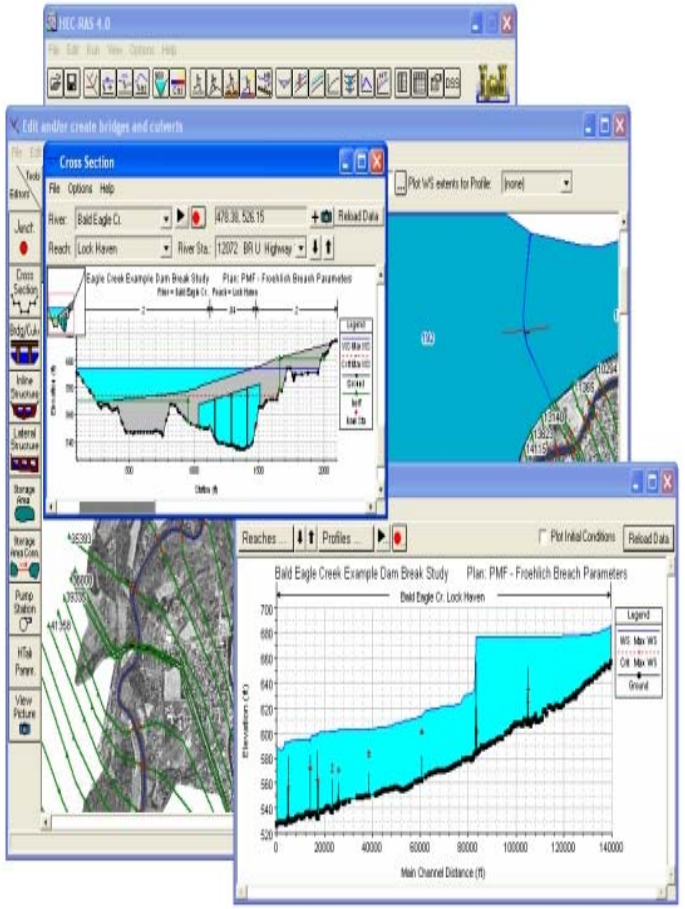
- Hydraulic & Flood Control Structure Data Collection
  - Bridges & Culverts
  - Berms & Dykes
- Aerial Imagery Acquisition
- Highwater Mark Surveys

Inglewood Flood Wall, Calgary - 2013

Red Deer River - 2013

New River Hazard Studies
Hydraulic Modelling

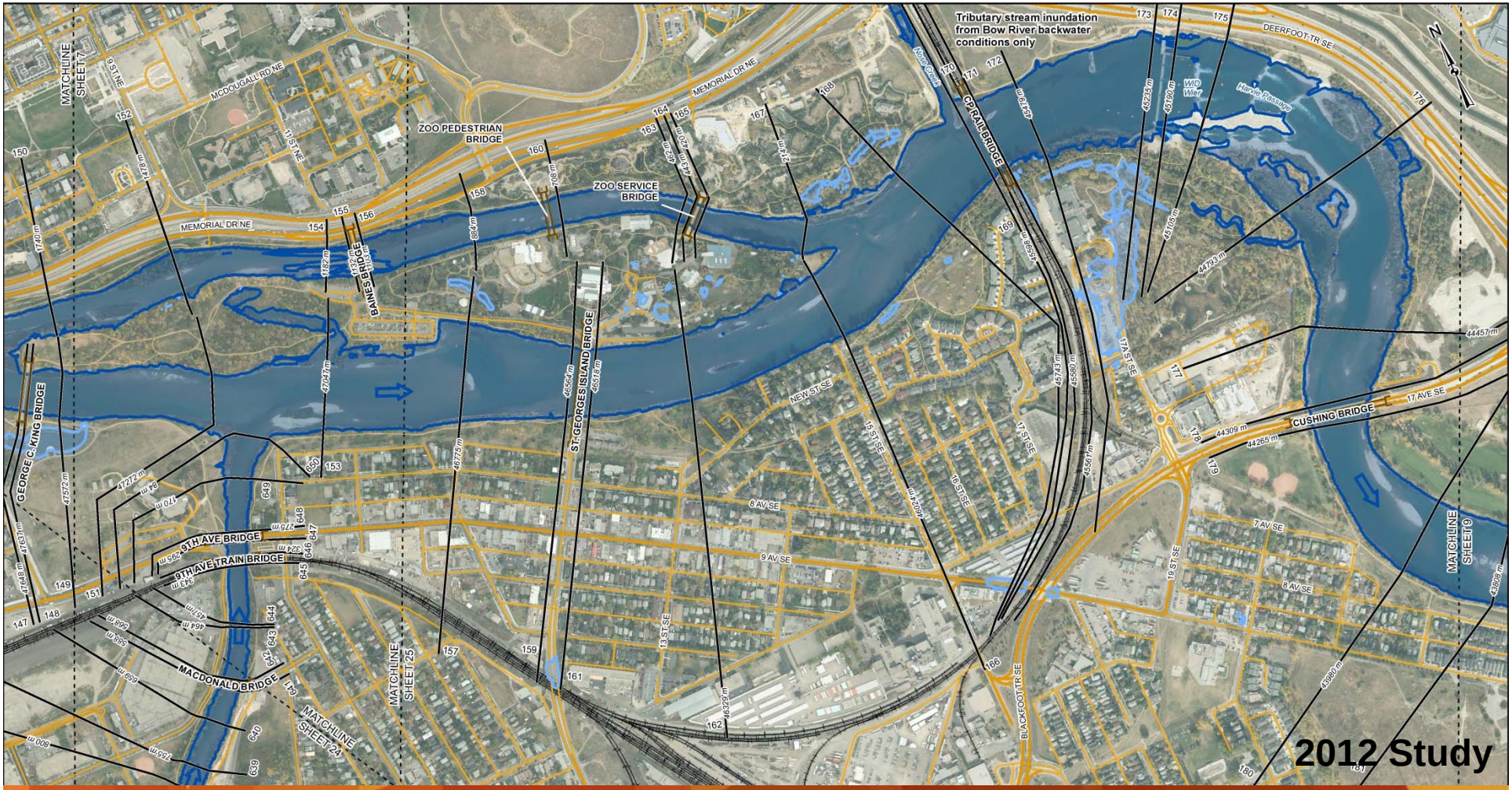
- Create a computer hydraulic model (HEC-RAS) representing the river
  - Survey Data
  - Digital Terrain Model
- Hydraulic models calibrated using historic highwater marks
- 2D modelling to inform the 1D models will be completed in parts of Calgary and High River
- Models calculate water levels for different floods, including the **design flood**



New River Hazard Studies
Flood Inundation Mapping

- Flood levels computed by hydraulic model are transferred to base mapping to delineate areas at risk from flooding
  - Previous Flood Hazard Studies mapped 10-, 50-, 100-year floods
  - New River Hazard Studies will map 2-, 5-, 10-, 20-, 35- 50-, 75-, 100-, 200-, 350-, 500-, 750-, and 1000-year open water floods
- Maps show the inundated extent for 13 flood scenarios
- Primarily used by stakeholders in emergency response planning and preparation
- Based on flood inundation mapping completed as part of Alberta-Calgary partnership projects in 2012 and 2015

Inundation – 5-Year Flood

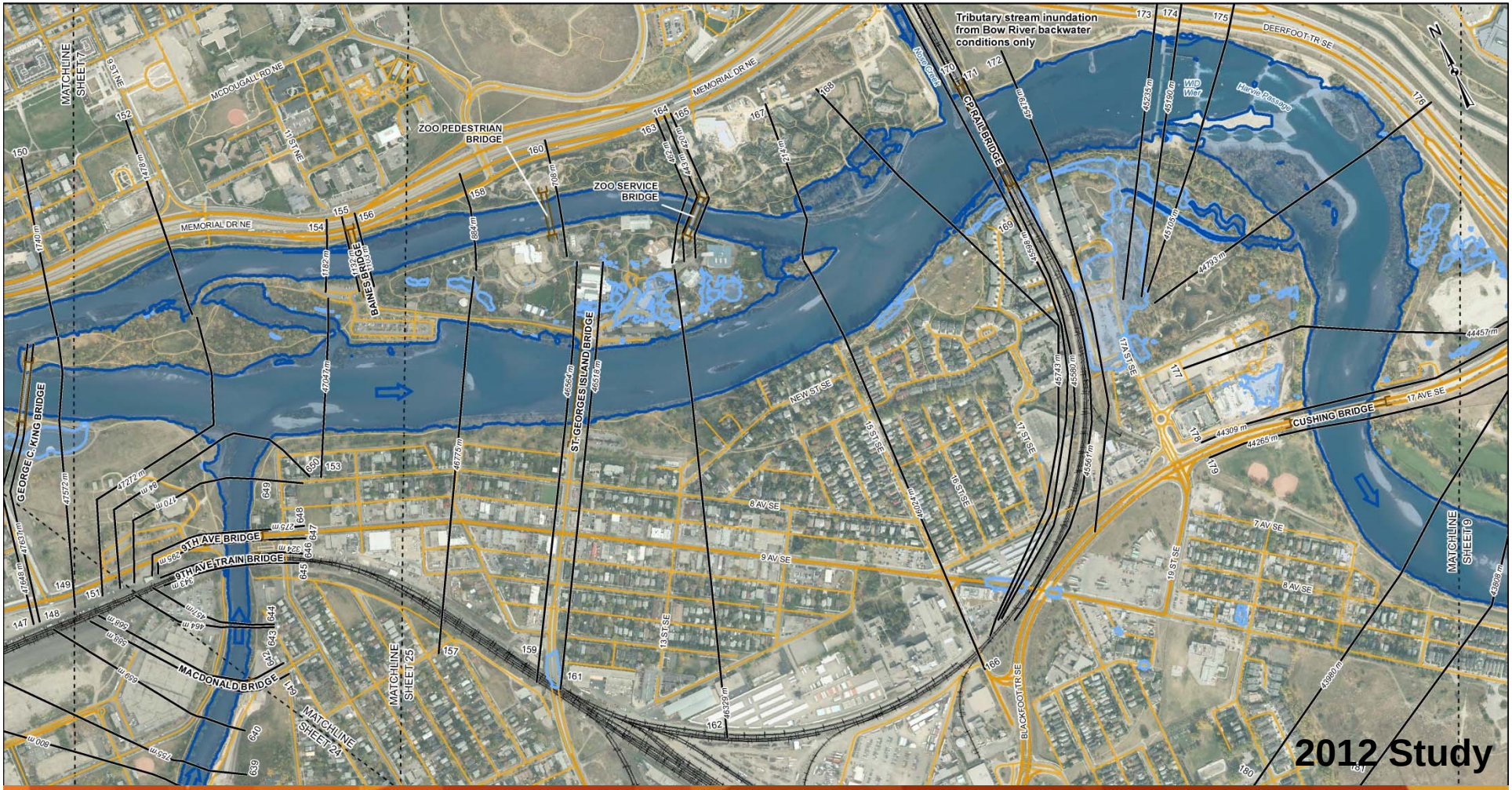


Alberta

FLOOD INUNDATION EXTENT

- FLOOD EXTENT
- FLOOD EXTENT (ISOLATED AREA)
- FLOOD EXTENT (FLOOD CONTROL STRUCTURE FAILURE)

Inundation – 10-Year Flood

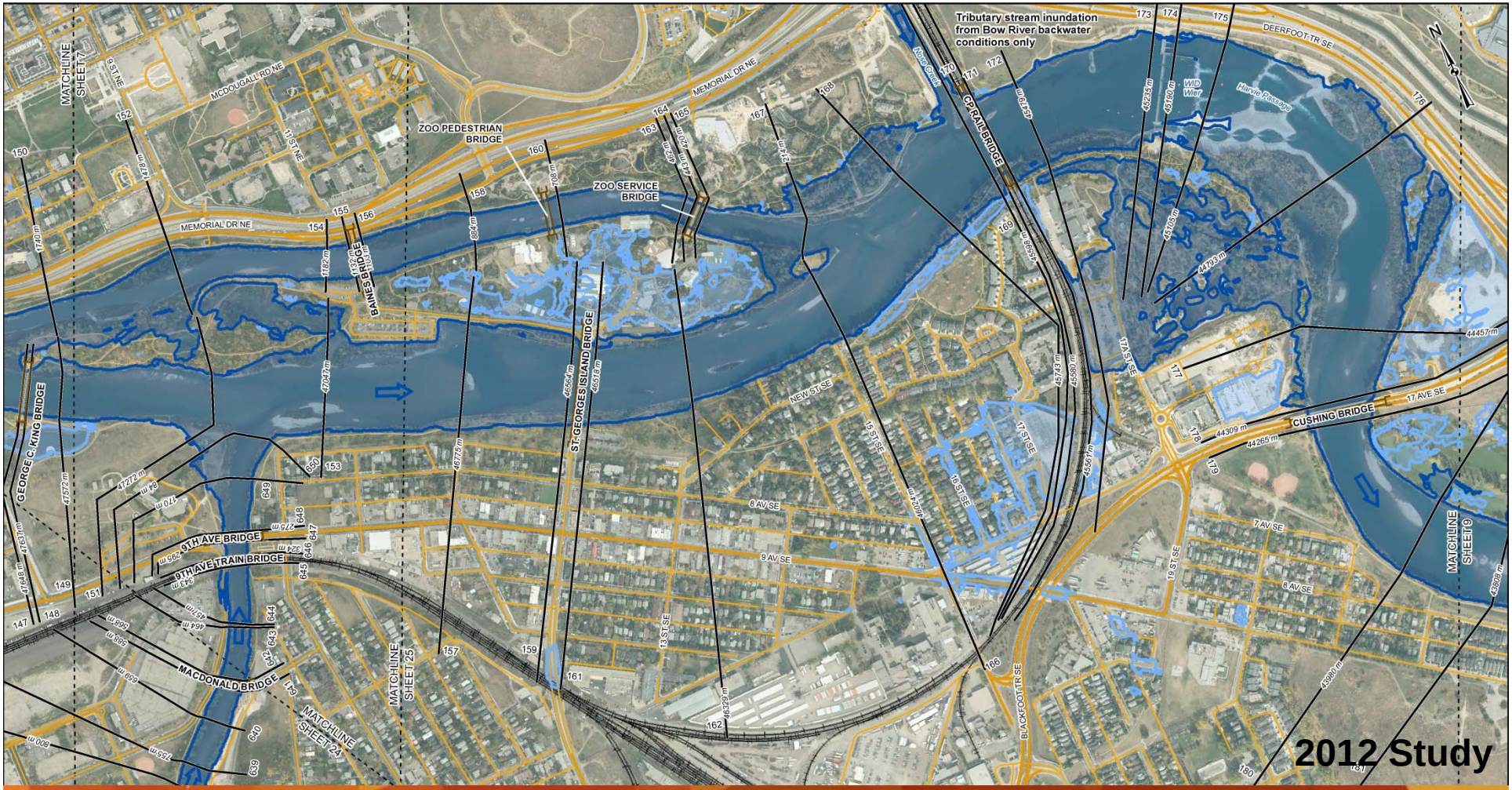


Alberta

FLOOD INUNDATION EXTENT

- FLOOD EXTENT
- FLOOD EXTENT (ISOLATED AREA)
- FLOOD EXTENT (FLOOD CONTROL STRUCTURE FAILURE)

Inundation – 20-Year Flood



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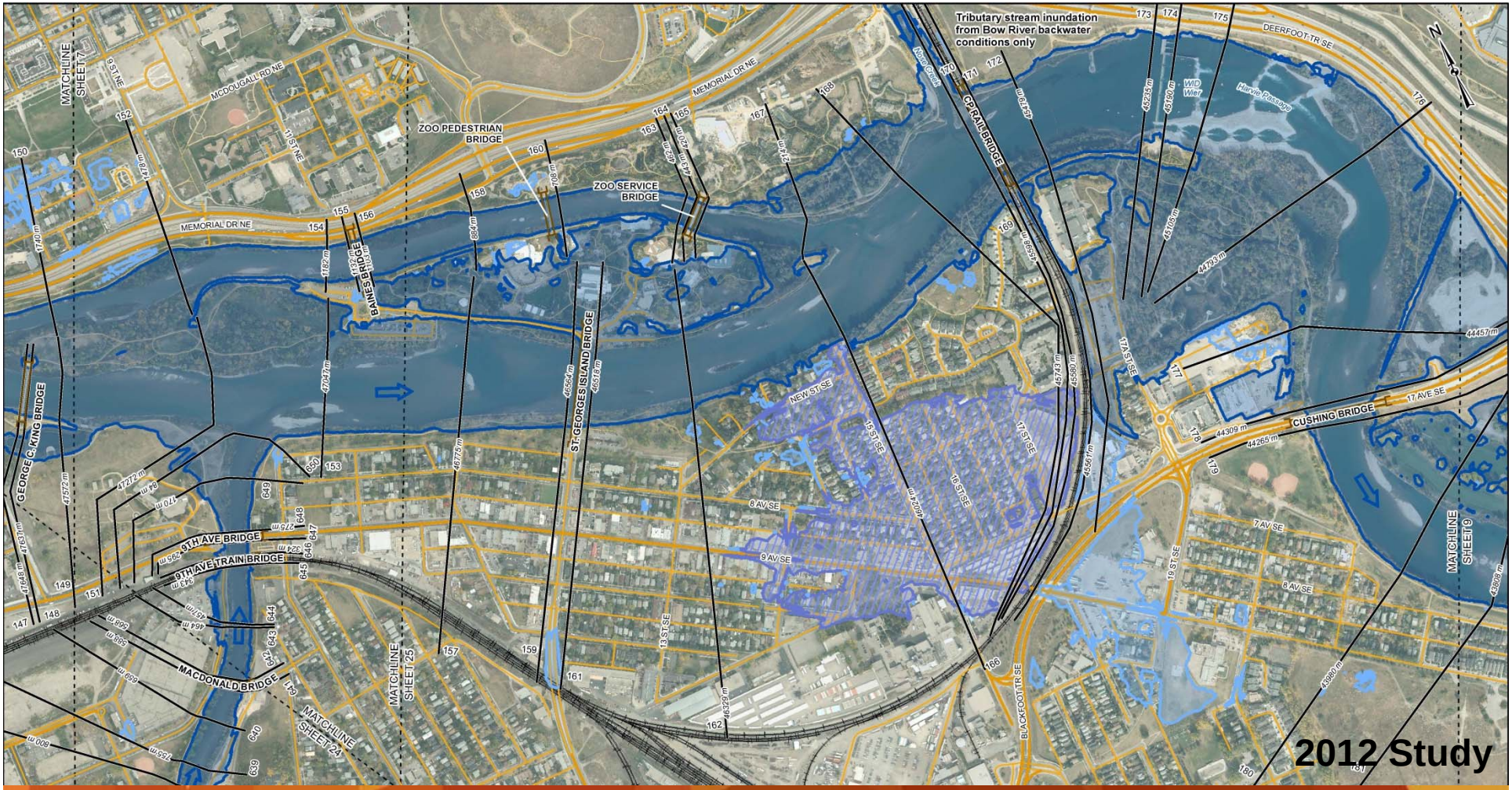
Inundation – 50-Year Flood



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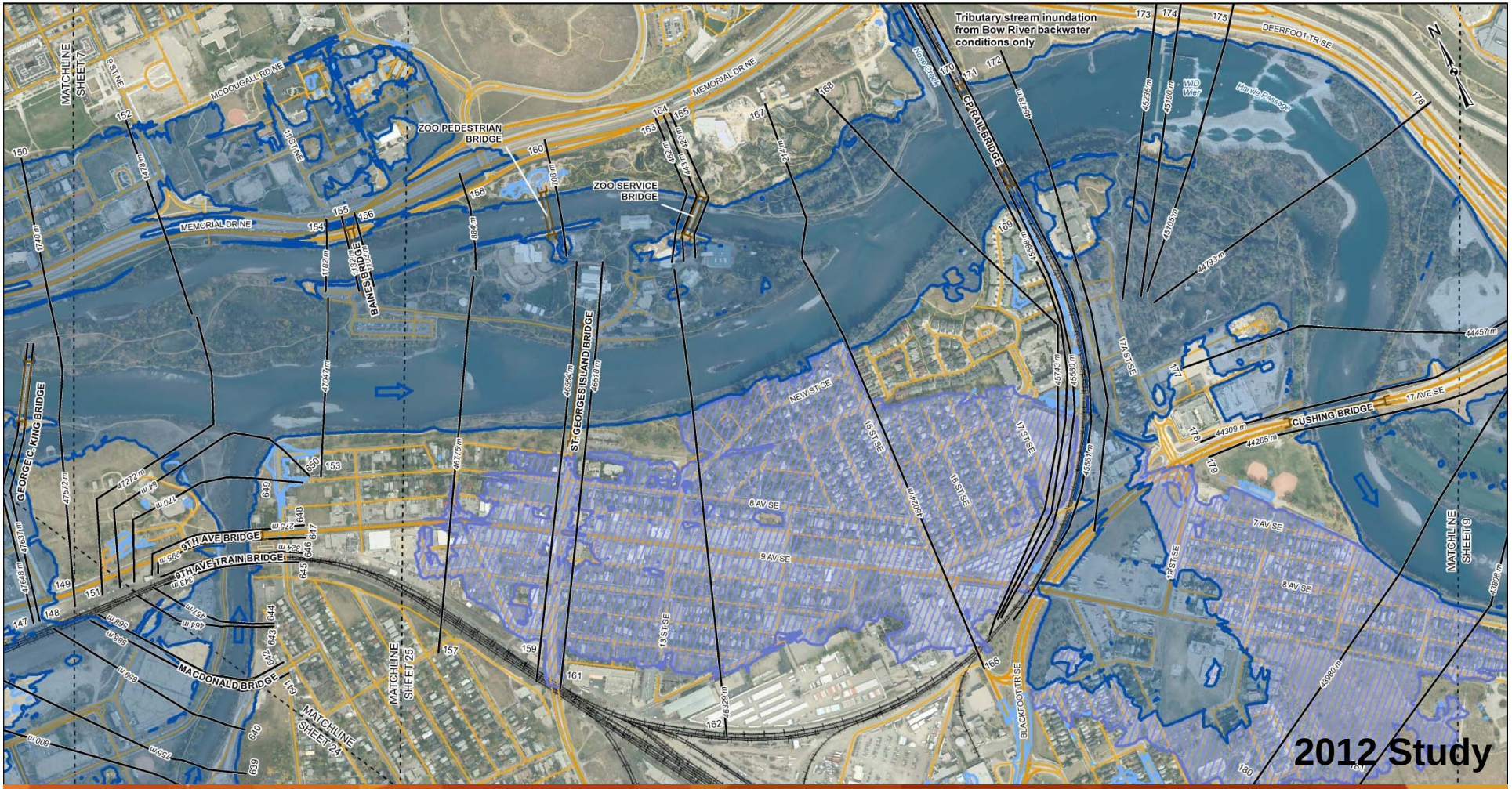
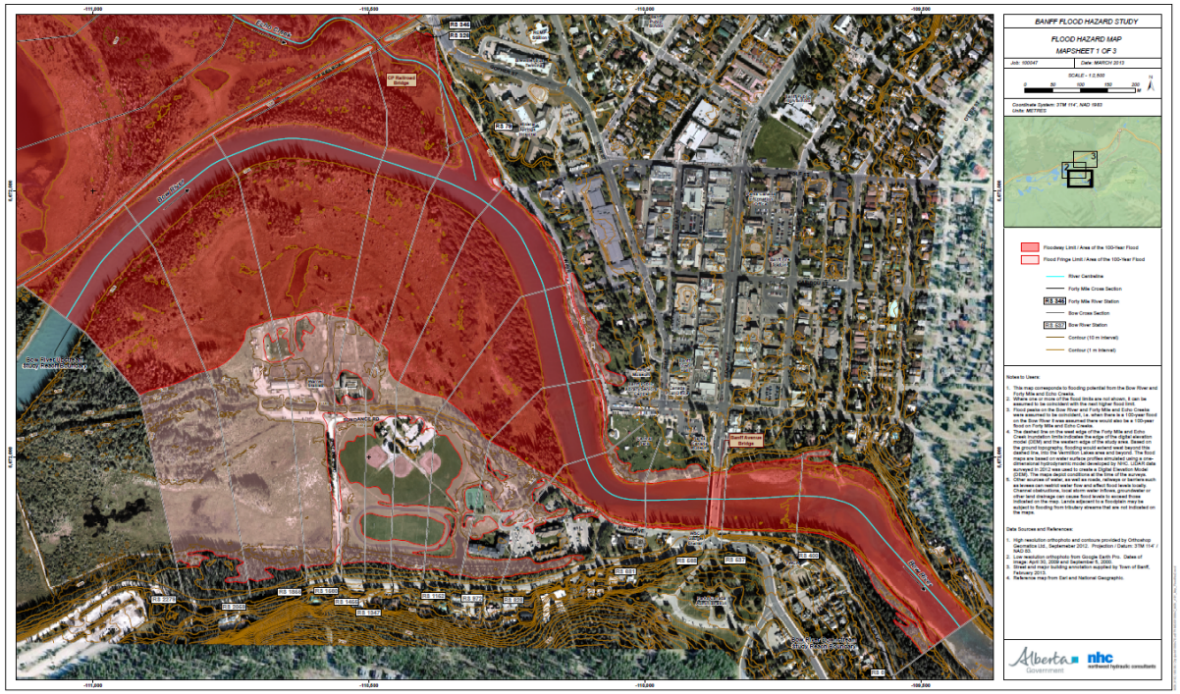
Inundation – 100-Year Flood



Alberta

New River Hazard Studies
Flood Hazard Mapping

- Hydraulic model determines design flood water levels
  - Design flood based on the naturalized 100-year flood
- Maps the flood hazard area, the area flooded by the design flood
  - Divided into **Floodway** and **Flood Fringe** using current standards



New River Hazard Studies
New Study Components

- Flood Risk Assessment & Inventory
  - Inventory of land parcels, buildings, infrastructure, and population in floodplain
  - Various flood scenarios will be used to identify infrastructure and population at risk
- Channel Stability Investigation
  - Delineates historical and current channel bank locations
  - Identifies areas where river migration is occurring

Any questions?