

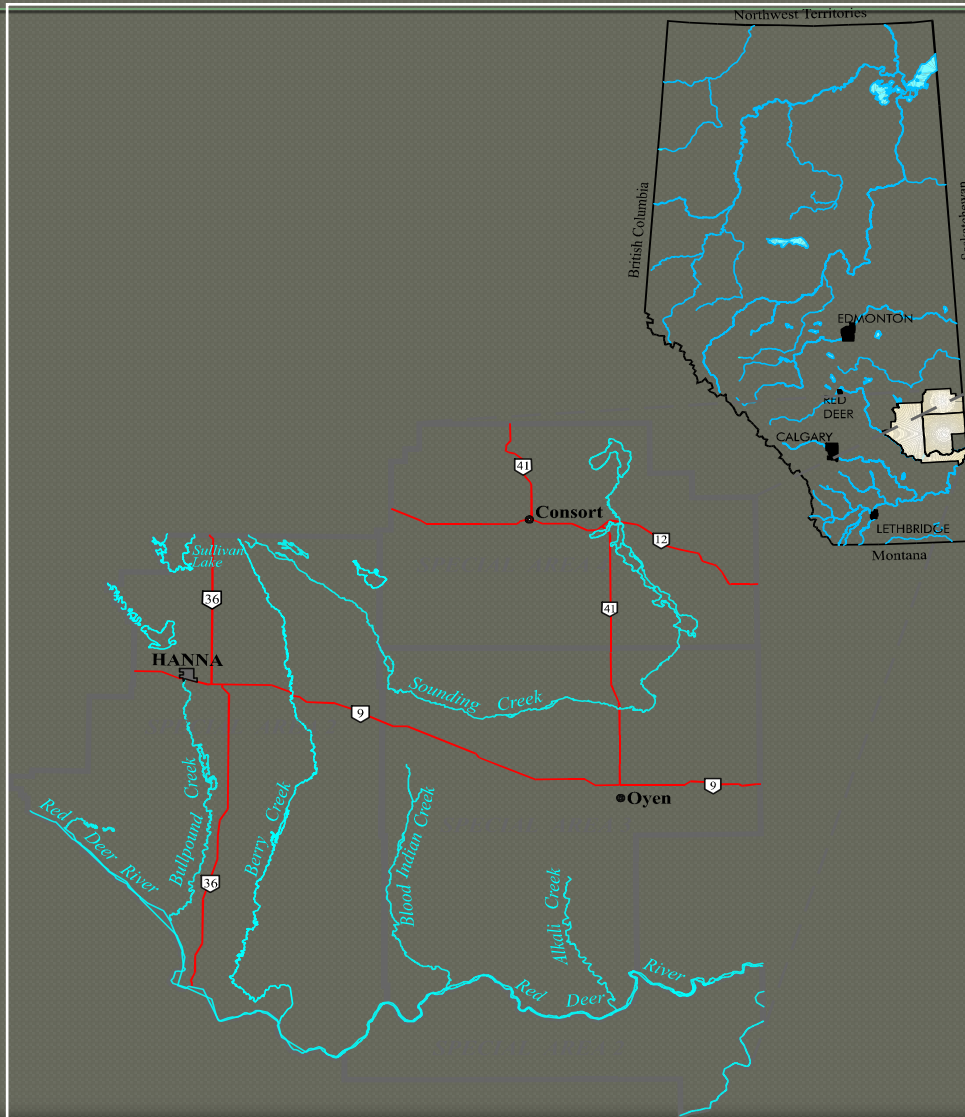
SINS OF THE PAST – HOPE FOR THE FUTURE

CSLA/AAPC Congress 2014



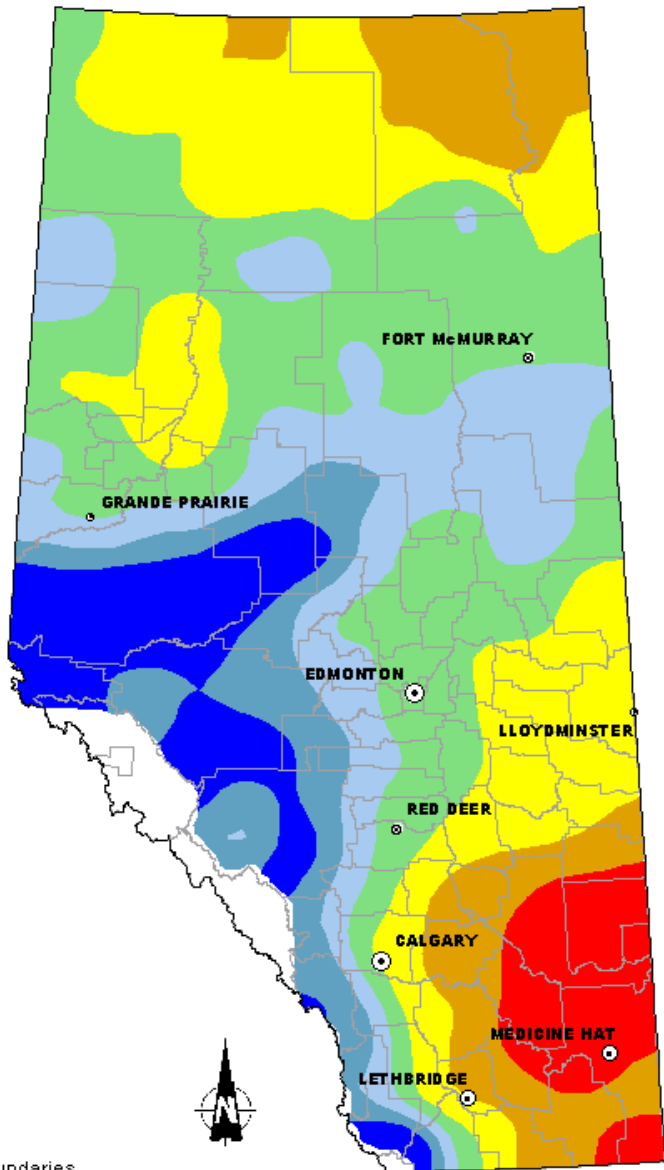
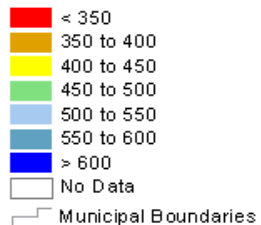
**DROUGHT - The Special
Areas Water Supply project**

Alberta's Special Areas



Annual total precipitation, 1961 to 1990

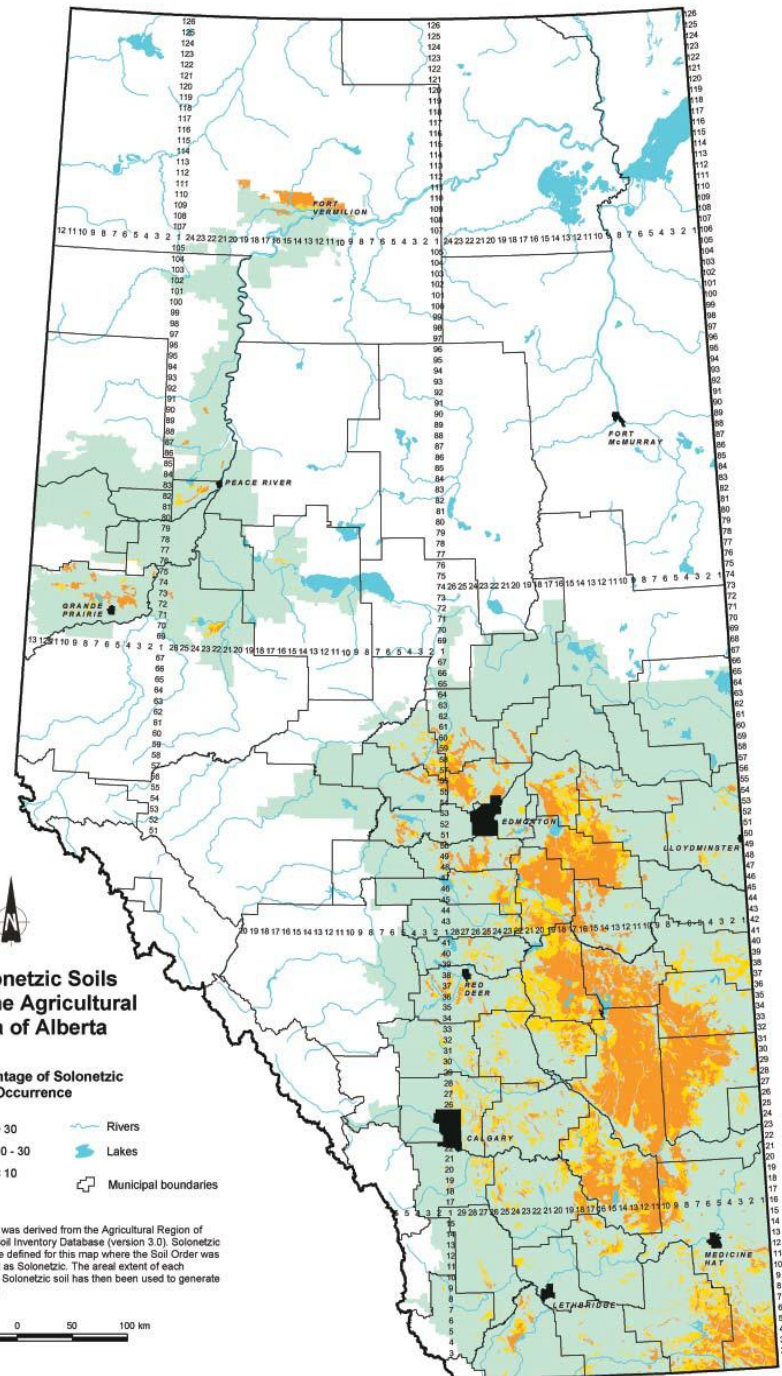
Precipitation (mm)



Based on 1961 to 1990 data from Environment Canada, Alberta Environment and the U.S. National Climate Data Center. Map displayed on Township generalization.

Solonchic Soils of the Agricultural Area of Alberta

Percentage of Solonchic Soils Occurrence



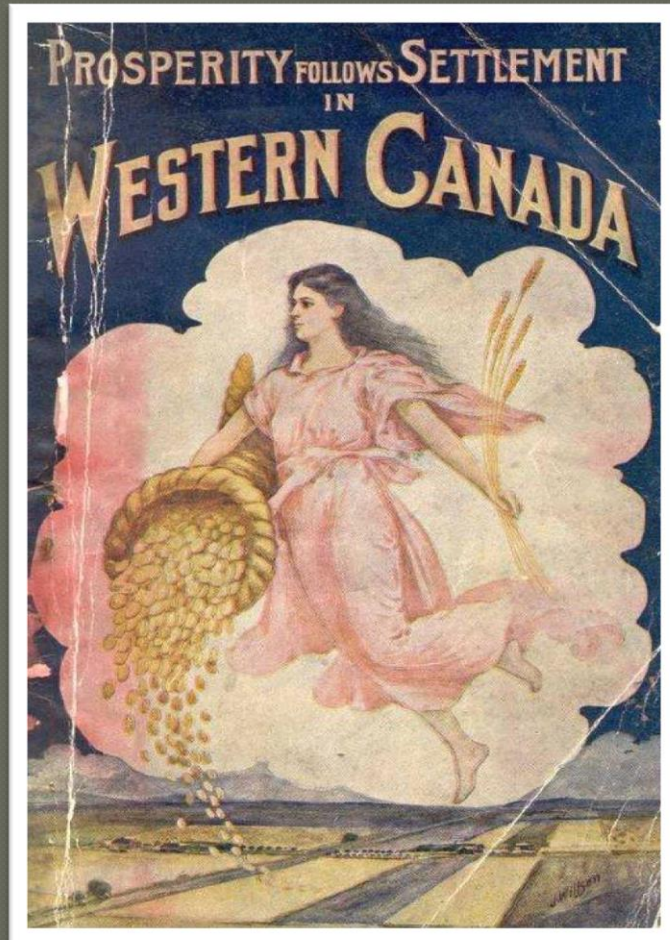
The data was derived from the Agricultural Region of Alberta Soil Inventory Database (version 3.0). Solonchic soils were defined for this map where the Soil Order was classified as Solonchic. The areal extent of each identified Solonchic soil has then been used to generate this map.

50 25 0 50 100 km

A Brief History

- 1860 Palliser expedition – not suitable for farming
- Early cattle ranching until winter of 1906-07 loss of two thirds of cattle herd
- Open for homesteading in 1909 (CPR and Federal Government)
- Population exploded – shift from cattle to wheat

Land of Promise



**Homeseekers
Fares
to
Western
Canada**

Round Trip Tickets
on Sale Every Day

MARCH 1 to SEPT. 30

Via all rail route or via
Monday's steamer from
Owen Sound

Reduced Fares

Return limit 2 Months. Extension of
time limit can be arranged

Stopover privileges Harbort, Ont.,
Dryden, Ont., and intermediate stations,
also at Winnipeg and West

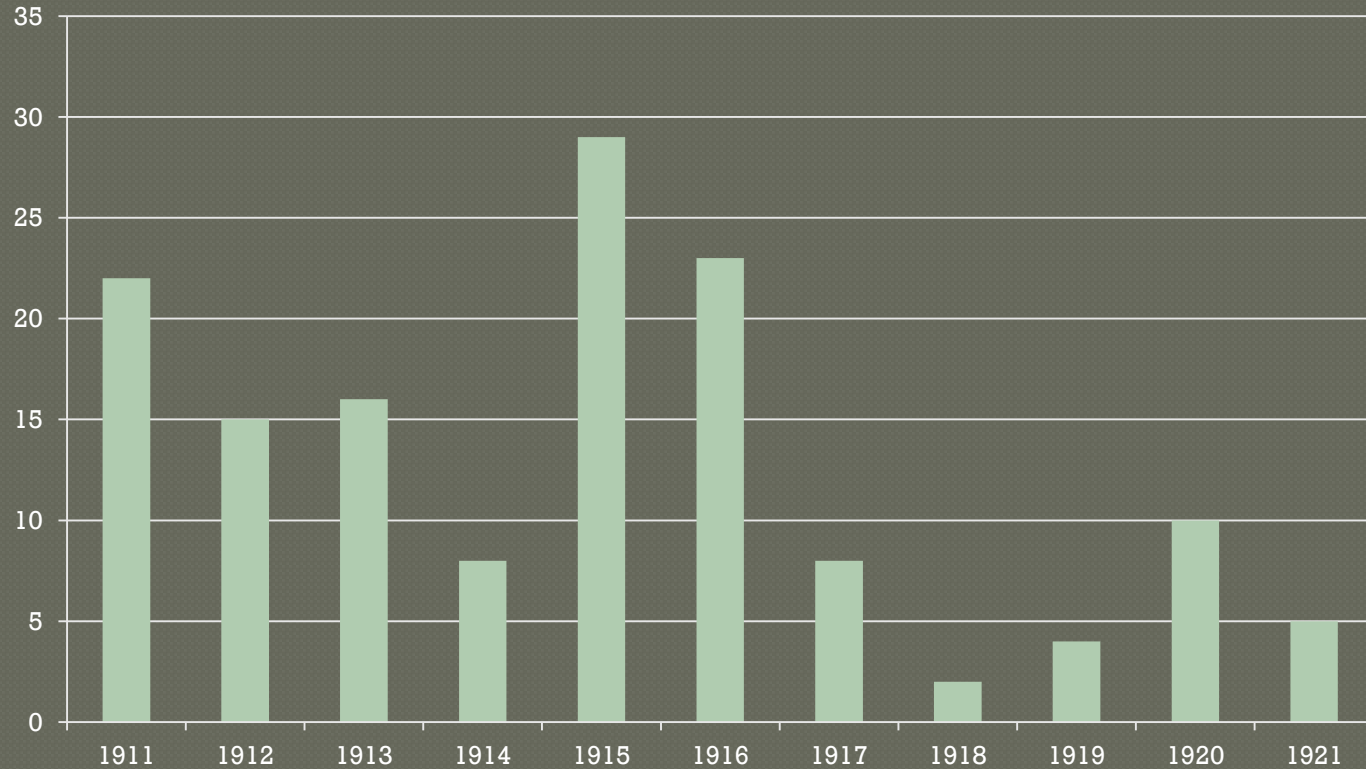
THROUGH TOURIST SLEEPING CARS
For Fares and other particulars apply to any Agent of the

CANADIAN PACIFIC

An advertisement for Canadian Pacific Homeseekers Fares to Western Canada. It features a steamship and a field. The text is arranged in a vertical layout, with the title at the top, followed by the dates and route information, then the fare details and stopover privileges, and finally the Canadian Pacific logo at the bottom.

Deception of Climate Variability

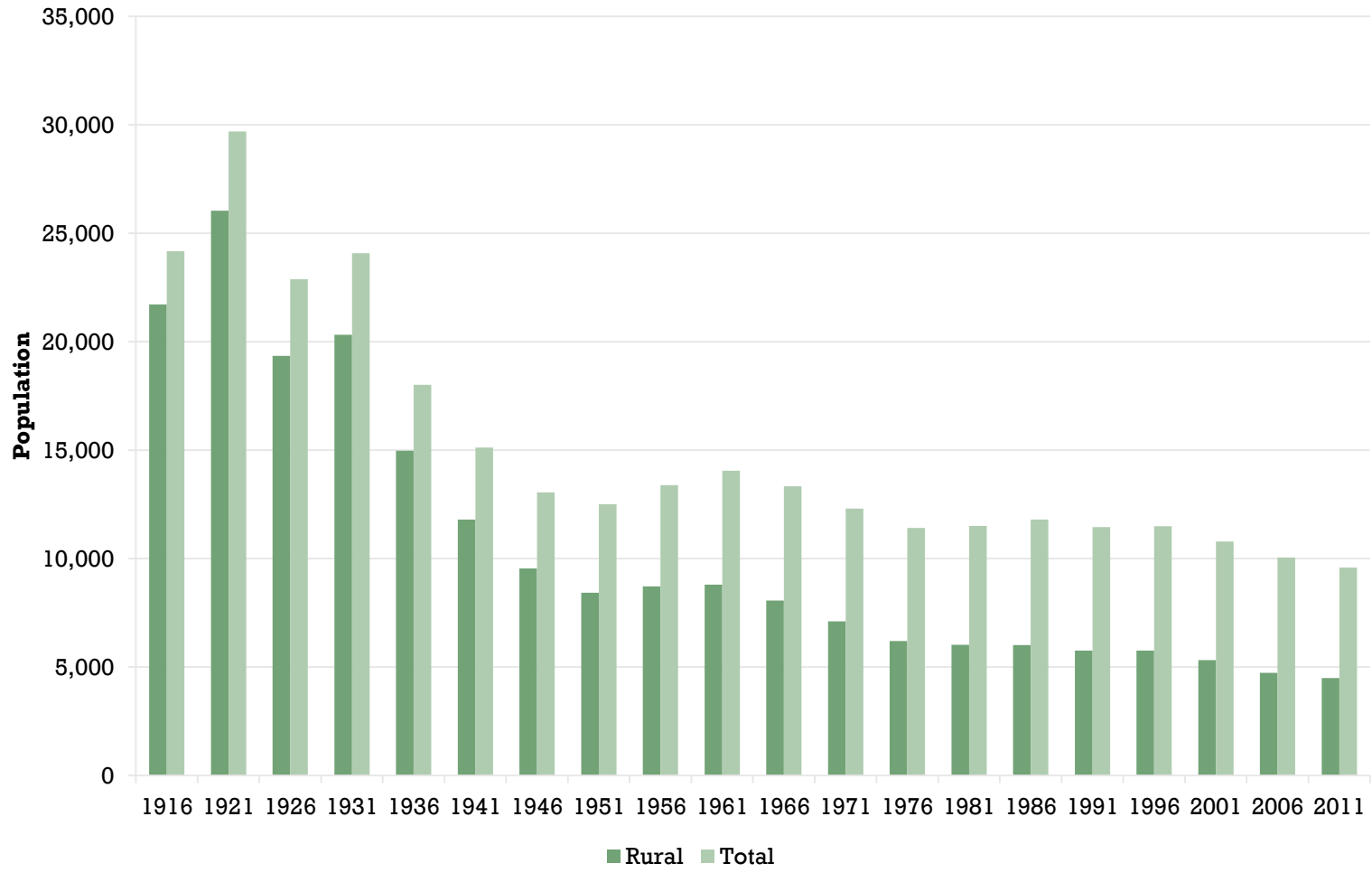
**Crop Yield at Hanna
(bushels per acre)**



The Harsh Reality



Population



Climate Adaptation

A photograph of a weathered, two-story wooden barn in a dry, grassy field. The barn is made of dark, aged wood and has a gabled roof. The ground is covered in dry, yellowish-brown grass. The sky is a clear, bright blue. The barn is the central focus of the image, and the text is overlaid on the left side.

○ Institutional Change

- Creation of Special Areas Board
- Mortgage and tax default lands
- Organized Depopulation and Land Rationalization

○ Research and Outreach

- Dominion Agricultural Research Stations
- Revegetation of degraded land
- Appropriate agriculture

Climate Adaptation (cont.)

◉ Individual Initiative

- Novel equipment and new farming practices

◉ Water Management

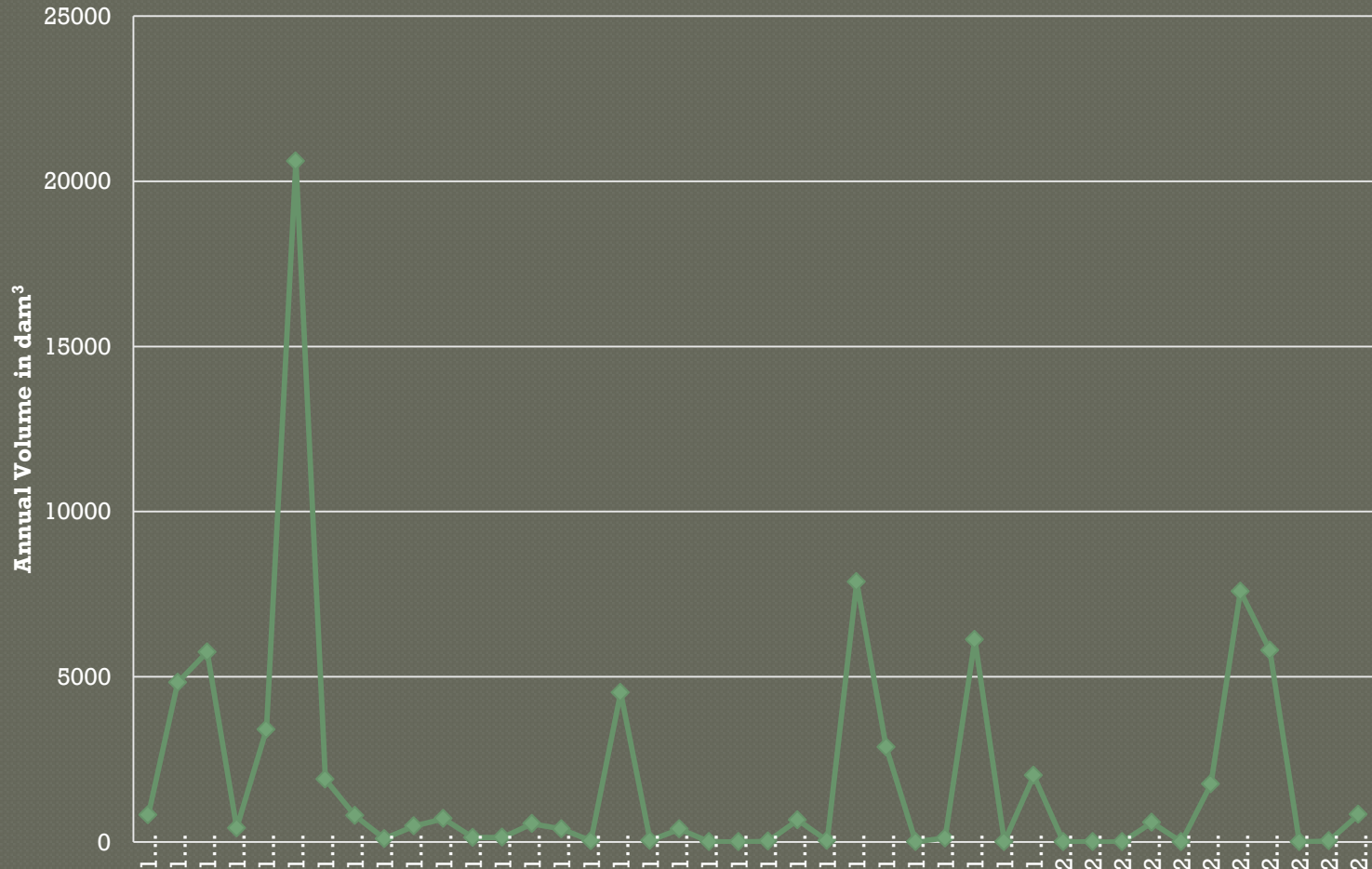
- Prairie Farm Rehabilitation Administration
 - Reservoirs
 - Dugouts
- Ducks Unlimited Canada
 - Reservoirs
 - Managed wetlands

Water Management

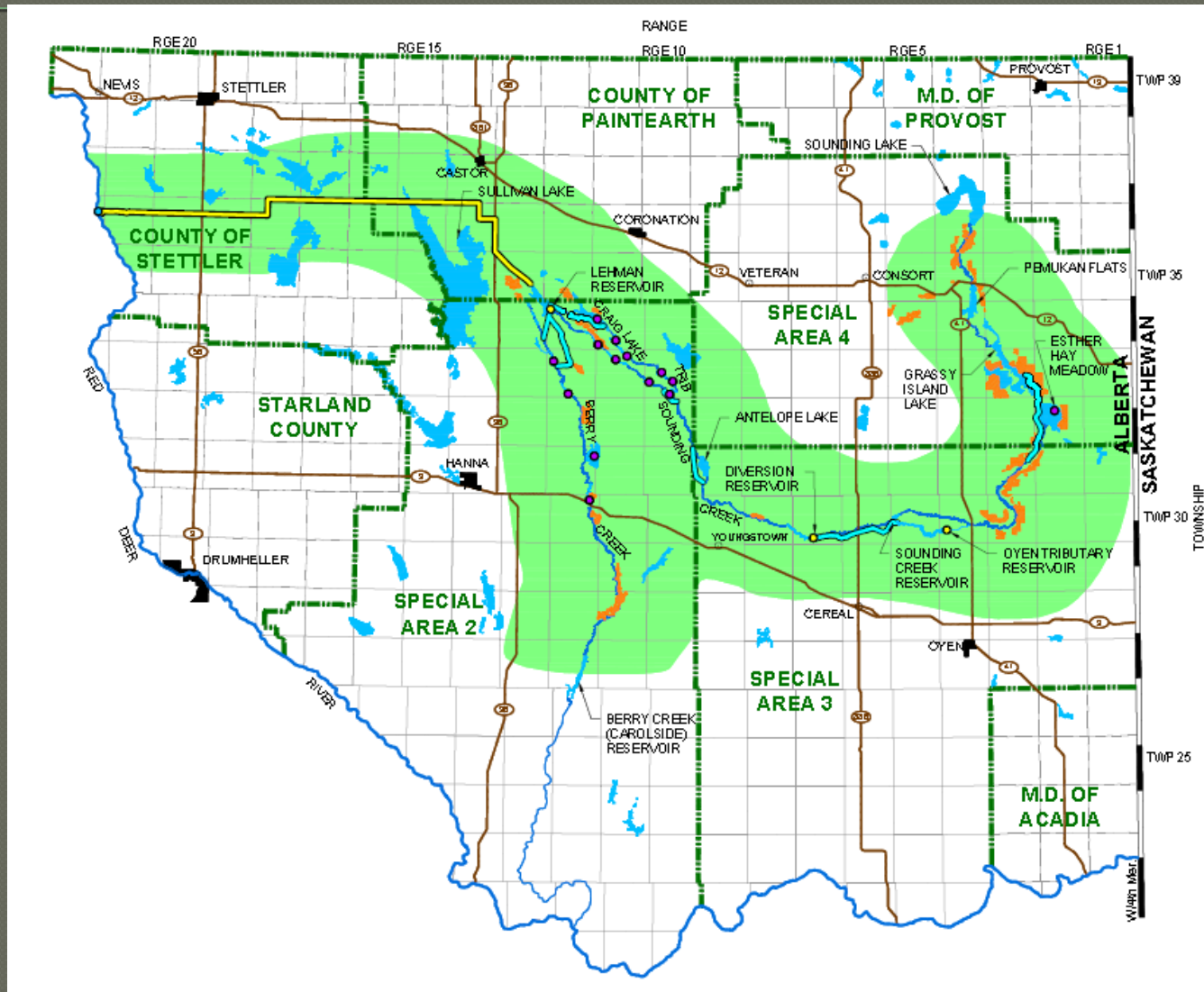


Natural Variability

Sounding Creek at Oyen



Special Areas Water Supply Project



Project Purpose

- ◉ Stock watering allowing improved use of grazing land
- ◉ Multi-use projects providing waterfowl habitat, hay or forage, and stock water
- ◉ Irrigation primarily of hay and forage to complement livestock operations
- ◉ Recreation on new reservoirs
- ◉ Enhanced riparian areas

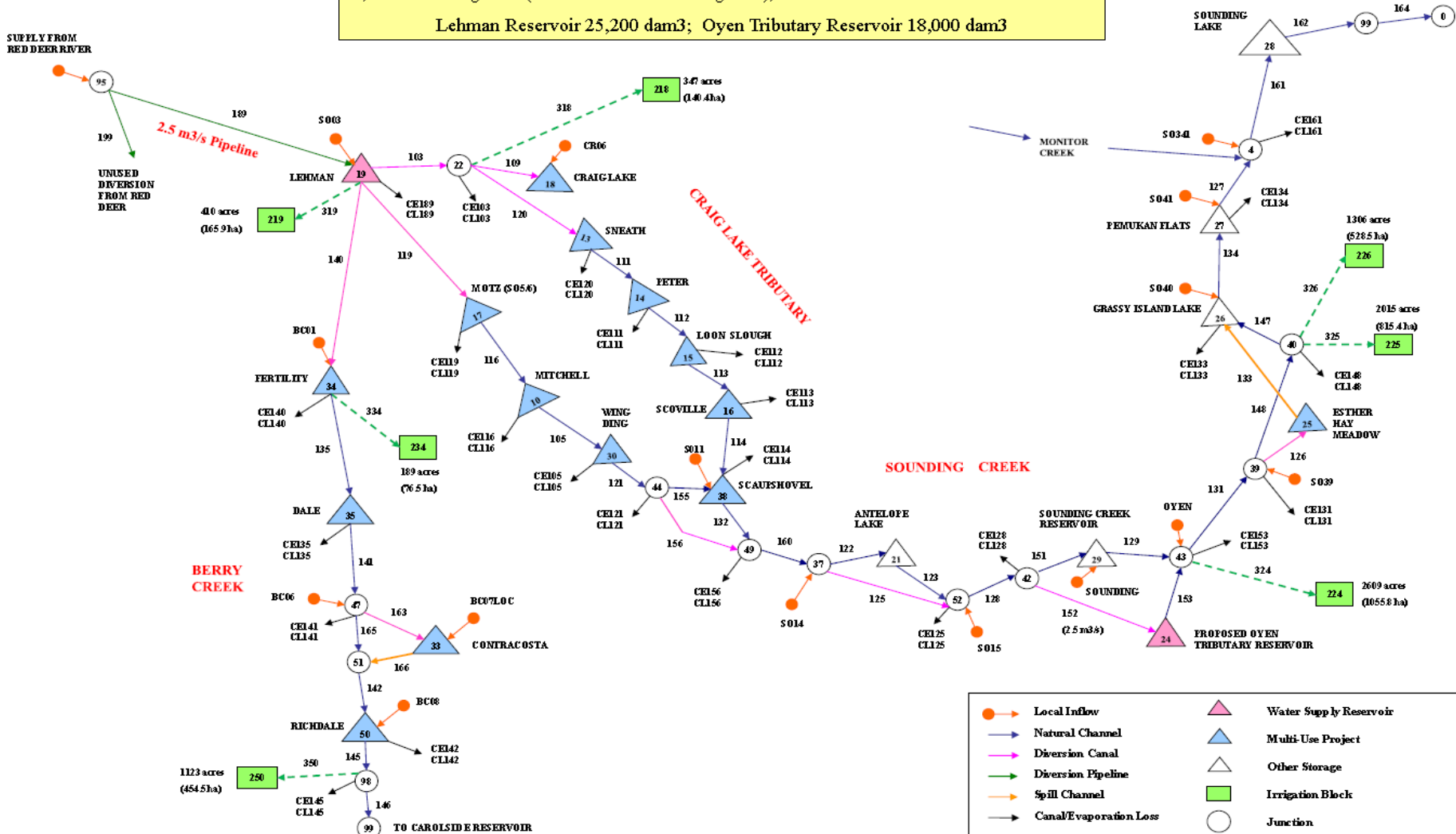
Will it work?

- Water Balance Model Testing
 - What has happened can happen
 - Hydrological period of record
 - What would happen with project in place

Water Balance Model

WRMM MODELLING SCHEMATIC – JultoOct 2013

8,000 acres Irrigation (excludes Backflow Irrigation); 2.5 m³/s Diversion from Red Deer river
 Lehman Reservoir 25,200 dam3; Oyen Tributary Reservoir 18,000 dam3

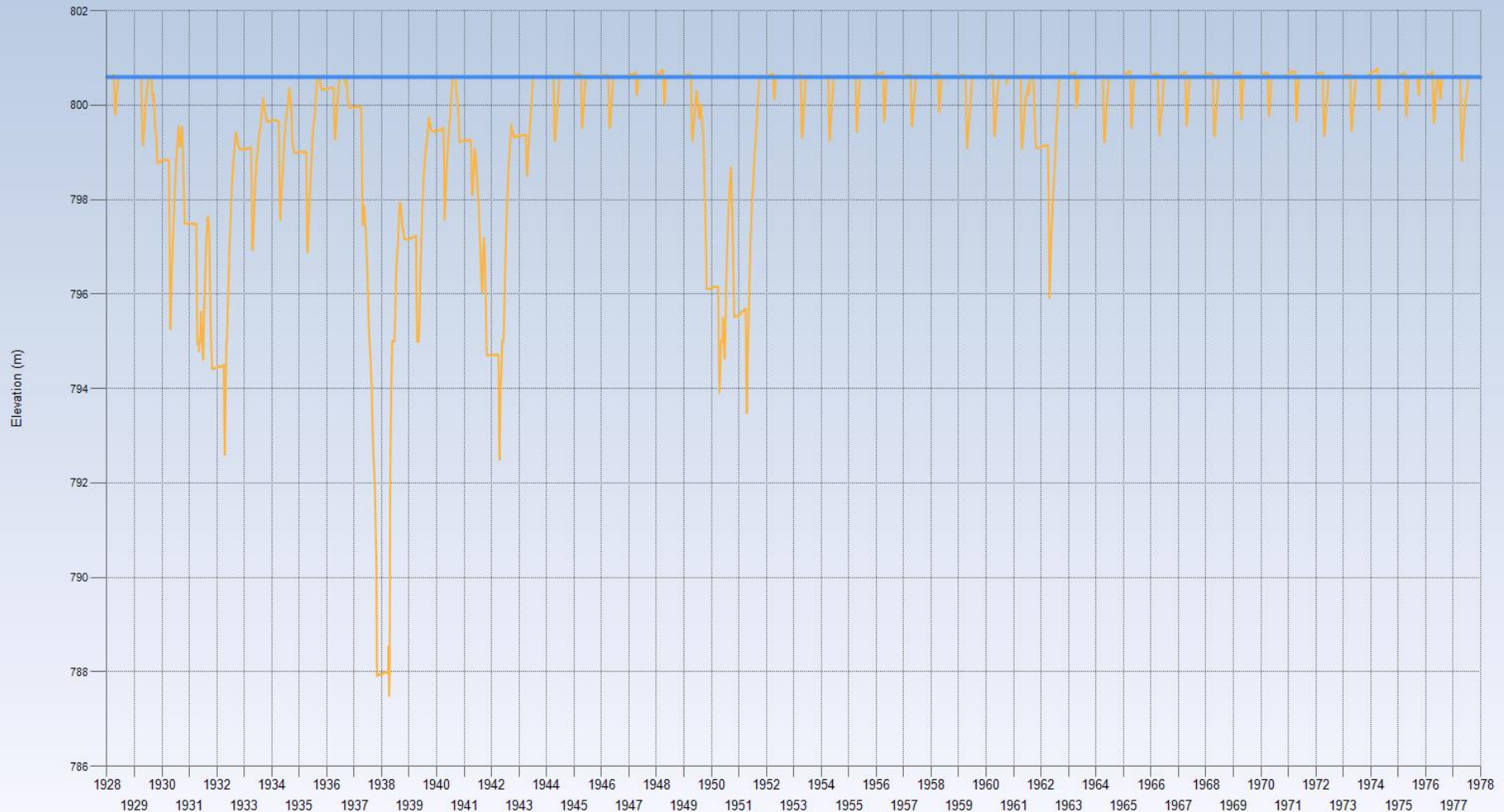


Reservoir Performance

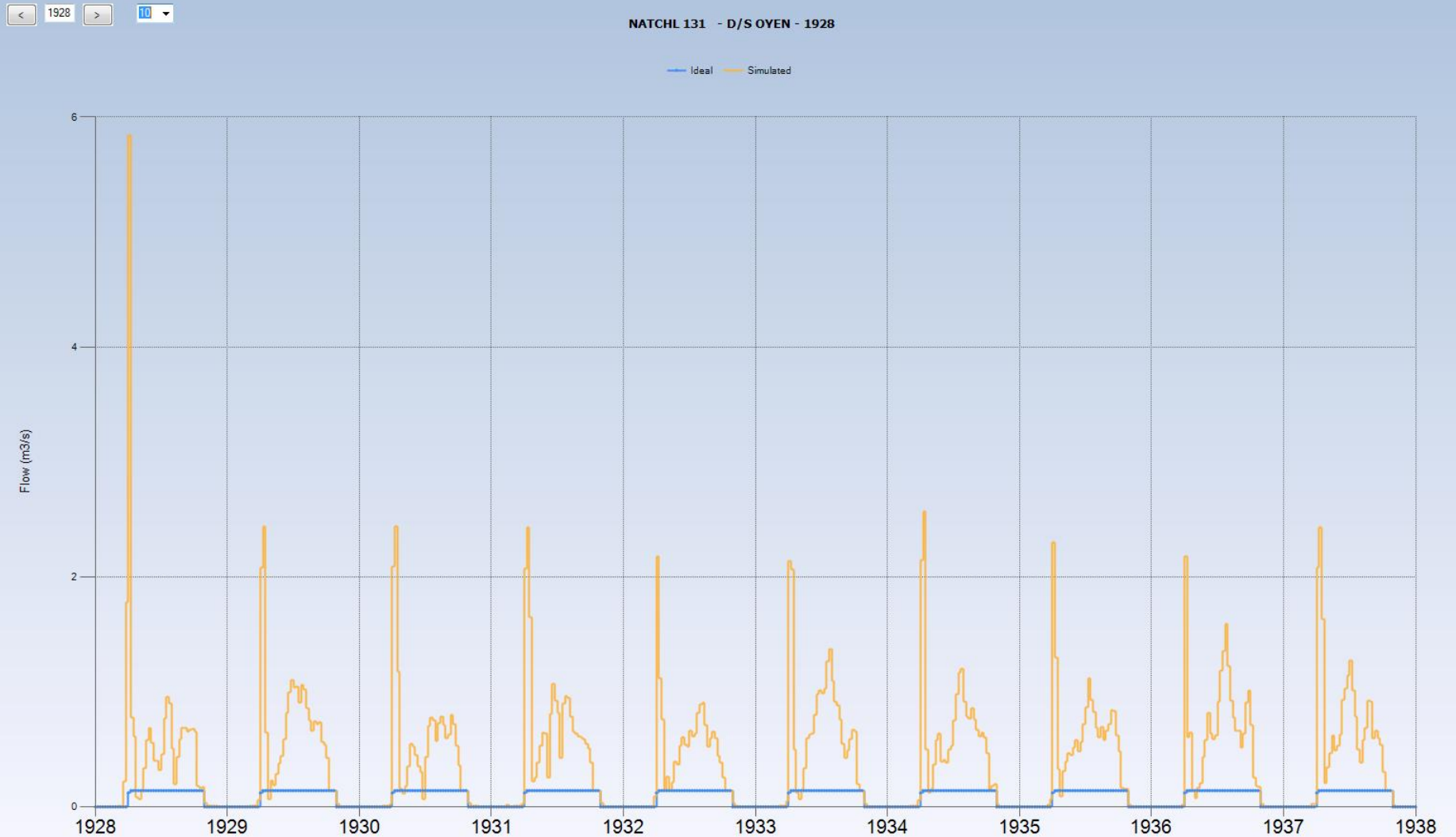
< 1928 > 50 ▾

RESERV 19 - LEHMAN - 1928

— Ideal — Simulated



Stream Flow

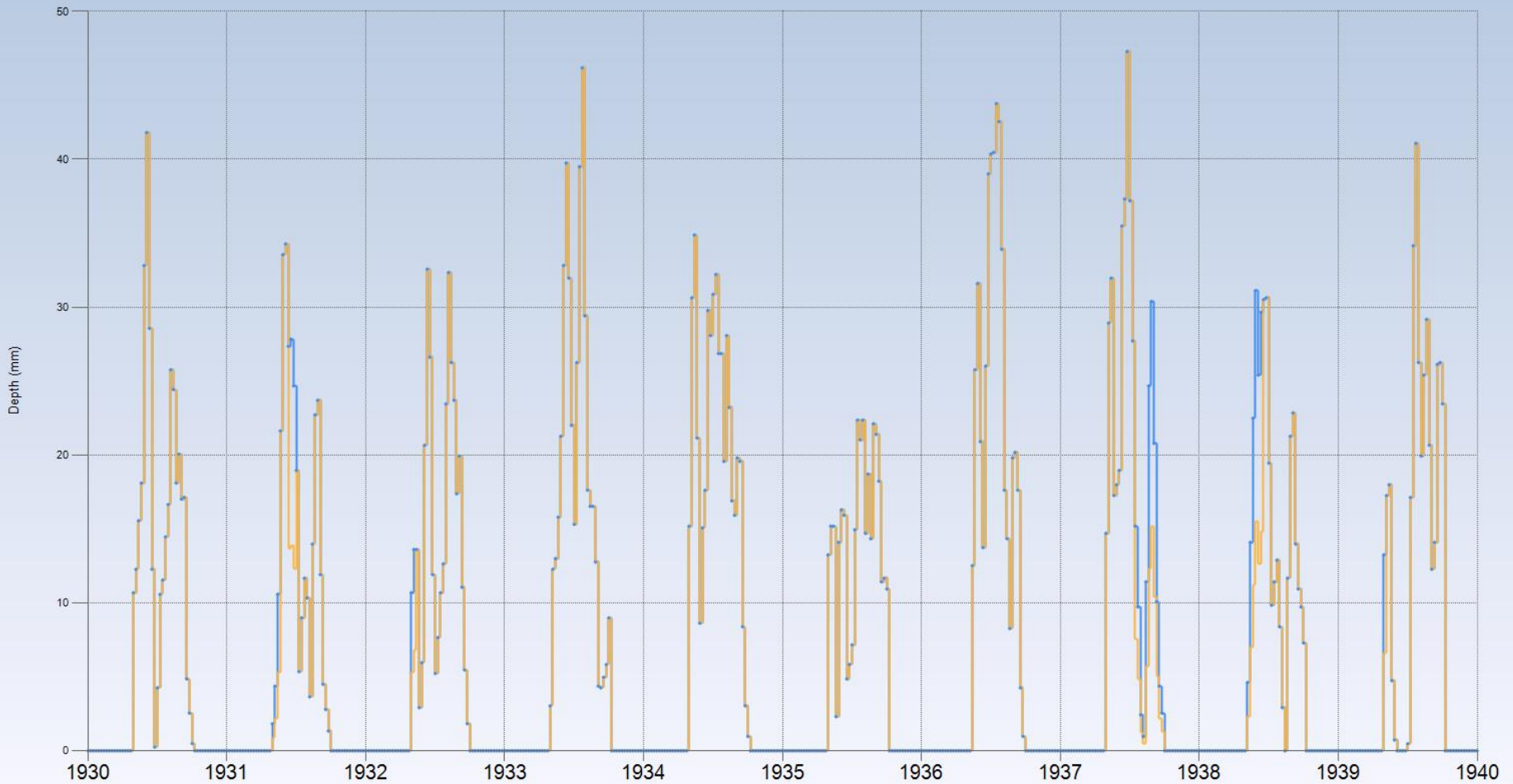


Irrigation Performance

< 1930 > 10 ▾

IRRIGAT 219 - BELOW LEHMAN - 1930

— Ideal — Simulated

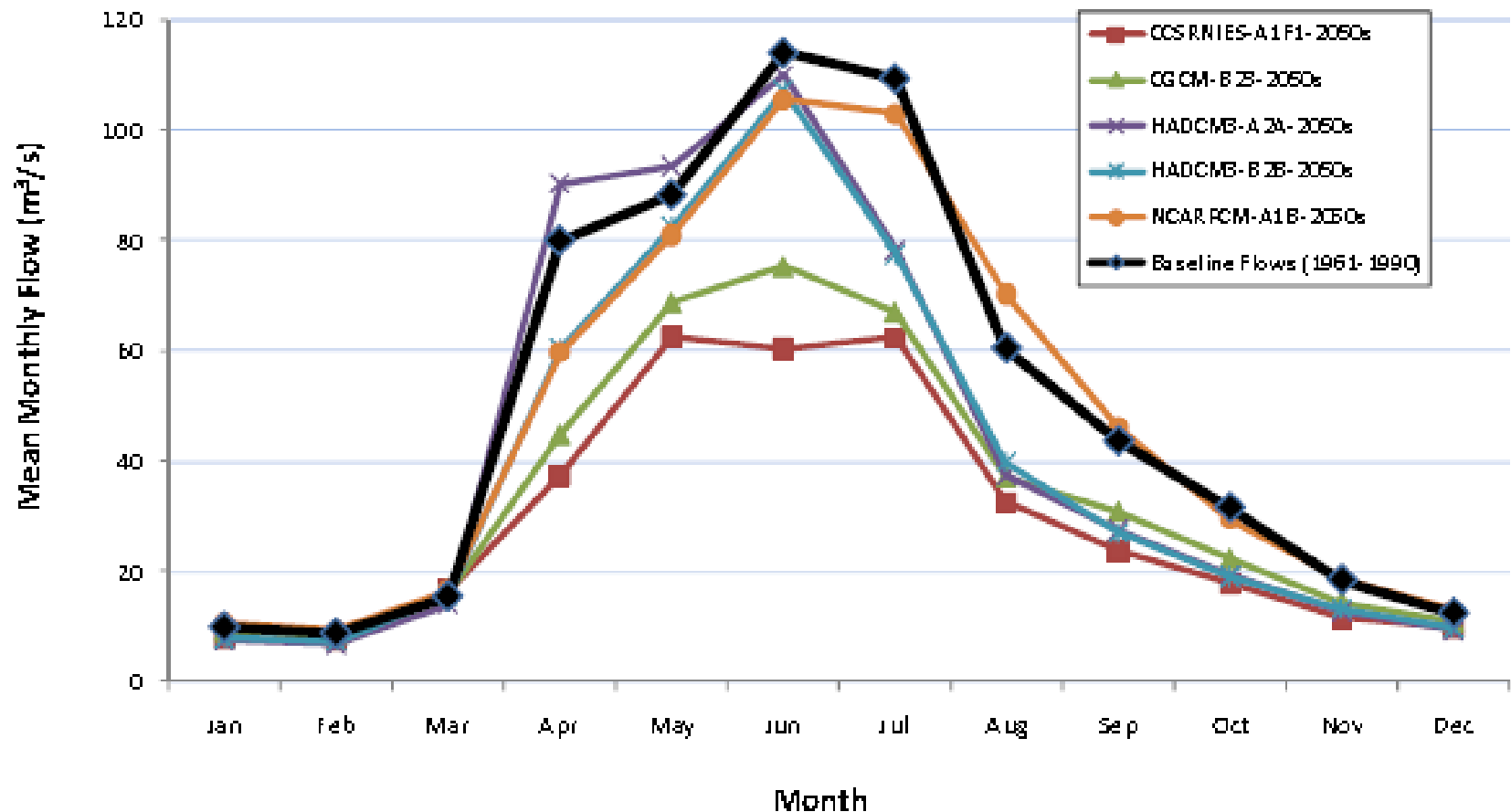


What about future climate change?

- What do we model?
- Common belief in increased variability
- Global models resolve poorly at local levels

Range of Predictions 2050

Forecasted Effects of Climate Change on Flows at Red Deer River near Nevis W5C05C0004
- 2050s



An aerial photograph showing a town in Southern Alberta, Canada, completely inundated with floodwater in 2013. The water is a muddy, brownish color, covering almost all the land. Only the tops of trees and some buildings are visible above the water level. The flooding is extensive, covering the entire town and surrounding areas. The text "Flood – Southern Alberta 2013" is overlaid in green on the center of the image.

Flood – Southern Alberta 2013



Extent of Flood Damage

- Alberta's 2013 floods Canada's most **costly** natural disaster
- Damage to some new ill-advised development
- Most areas of damage have been settled for a long time
- The river valleys have become major amenities inviting adjacent development
- LA's share in the blame for the extent of damage

An aerial photograph showing a large town completely inundated with floodwater. The water is a muddy brown color, covering residential streets, commercial areas, and agricultural fields. In the background, a wide river flows through a valley. The sky is overcast with grey clouds. The text 'Difficult Decisions' is overlaid in a large, light green, serif font at the top center of the image.

Difficult Decisions

- Relocate or protect development
- Value of developed properties versus frequency of flood damage
- Feasibility of flood protection
 - works until it fails – then it makes things worse
 - adverse impacts of flood mitigation measures
- How big was the 2013 flood and how likely is it to occur again? We don't know.

How big was the flood?

- Gauging stations washed out
- Channel erosion and relocation at gauging stations
- Spillage from one basin into another
- Flood flows calculated from secondary sources (e.g. high water marks on bridges)
- Peak flows for 2013 flood still being calculated

What was the flood frequency?

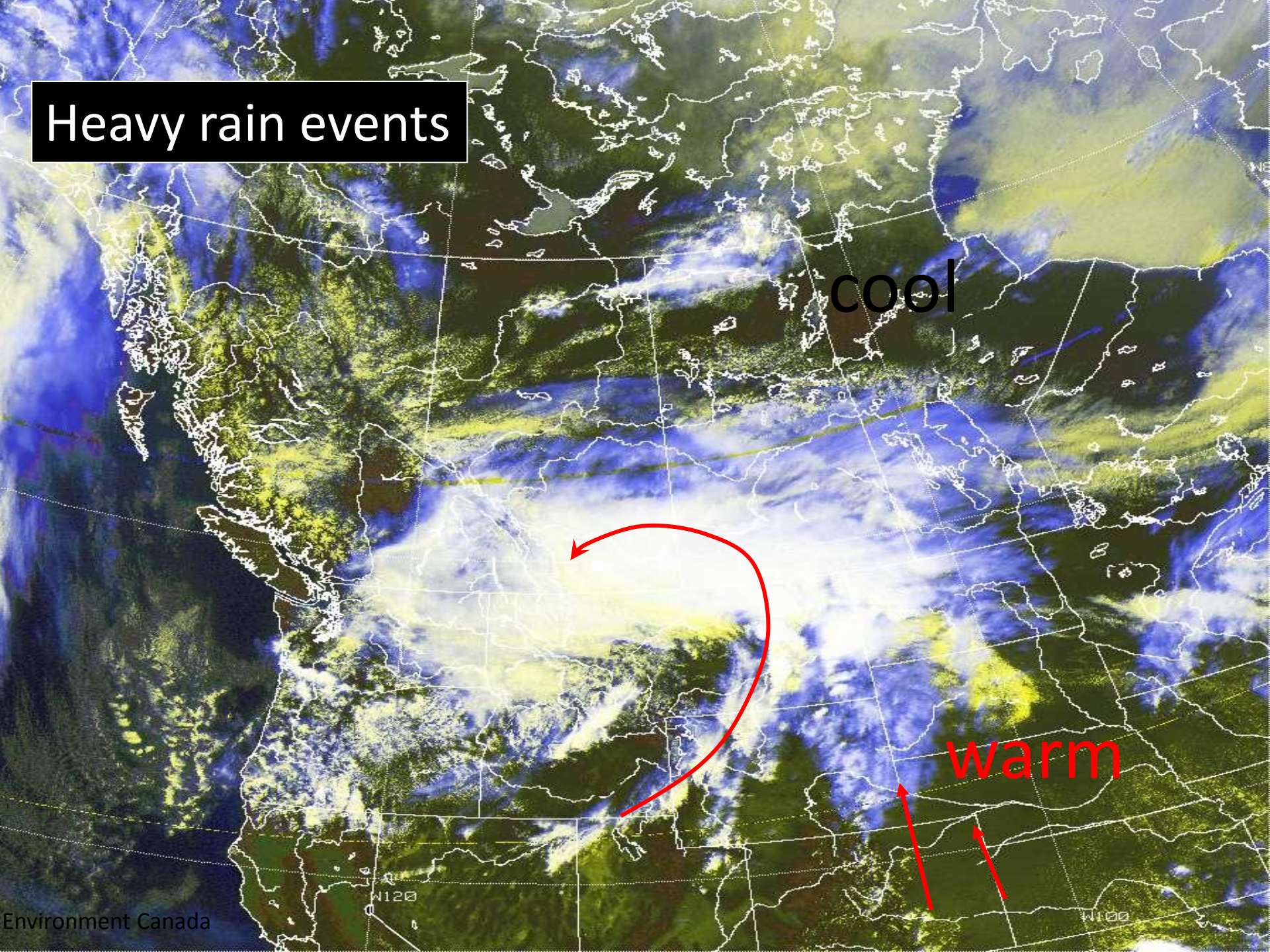
⦿ Limitations of hydrologic record

- many gauging stations have short history
- many gauging stations relocated periodically
- much unreliable data

⦿ Limitations of analysis

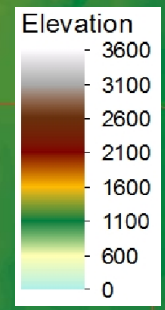
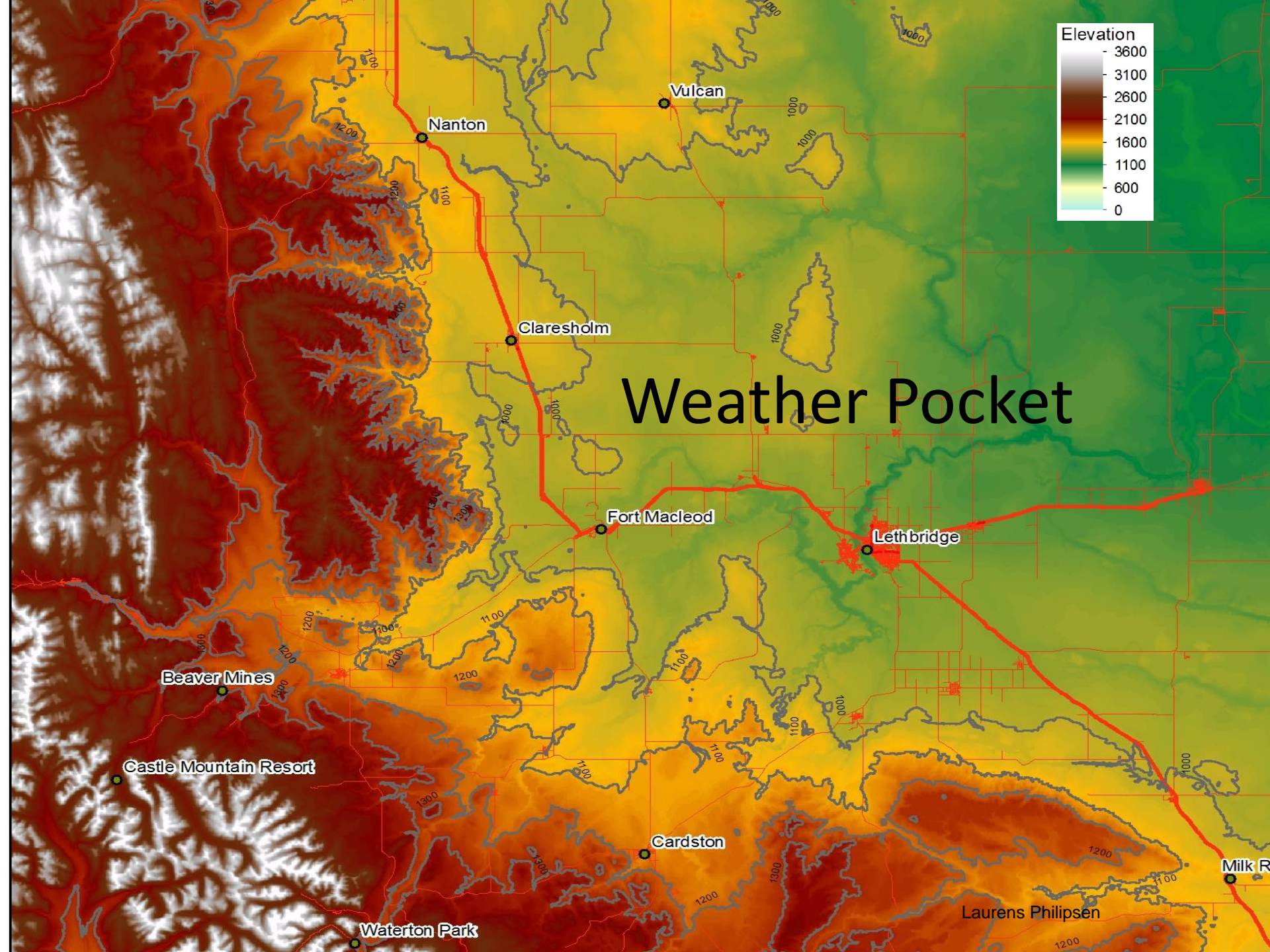
- difficulty of assigning probabilities to infrequent events
- no reliable statistical method of analyzing flood frequency

Heavy rain events



cool

warm



Weather Pocket

Nanton

Vulcan

Claresholm

Fort Macleod

Lethbridge

Beaver Mines

Castle Mountain Resort

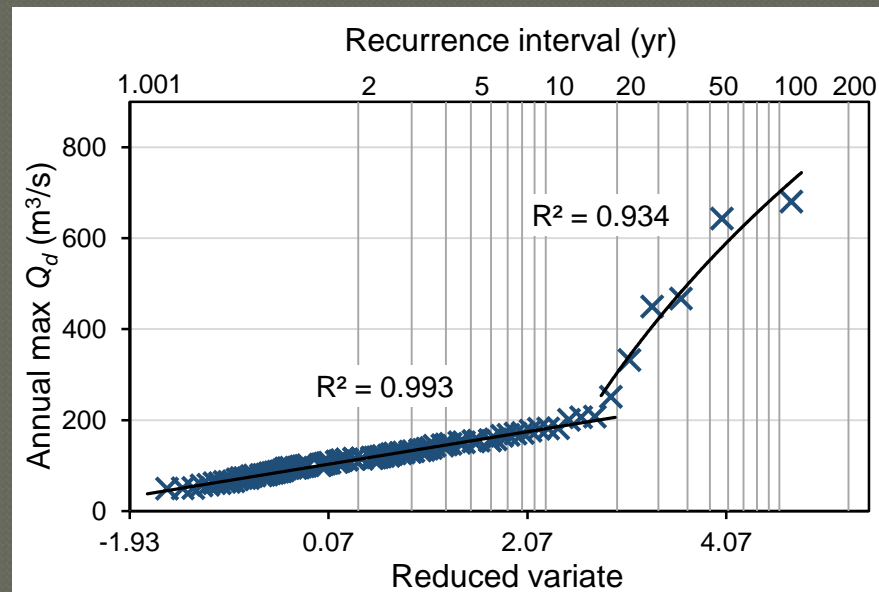
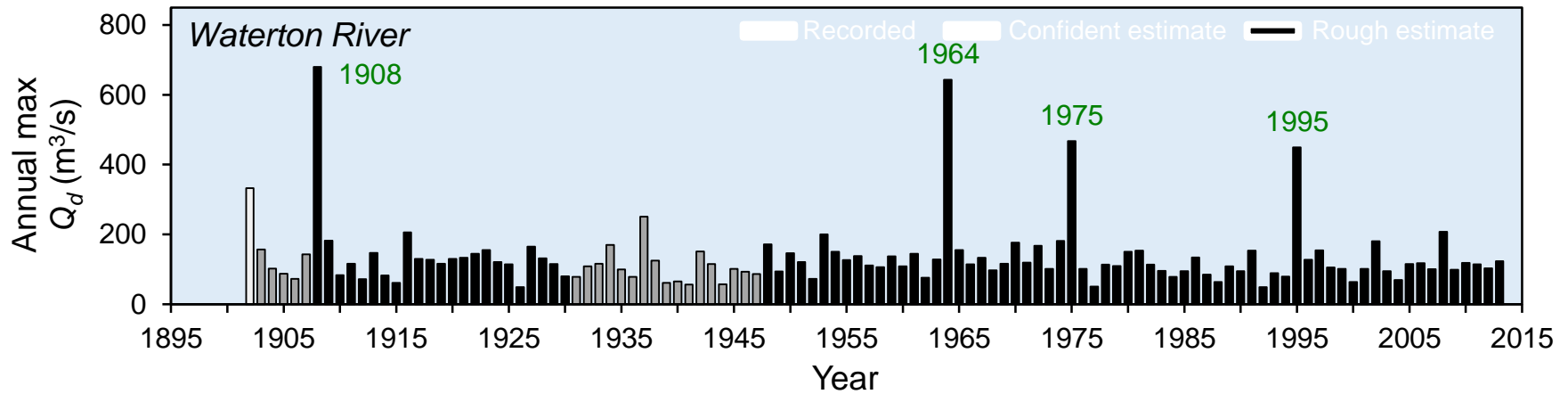
Cardston

Waterton Park

Laurens Philipson

Milk R

Typical Flood Flow Pattern



Key Points

- We don't have a good understanding of historical flood frequency
- An understanding of general climate change in the region will likely not help predict changes in flood frequency
- We need a prediction of frequency of changes in weather patterns
- Understand the certainty of error in probability