

# Water Availability Study

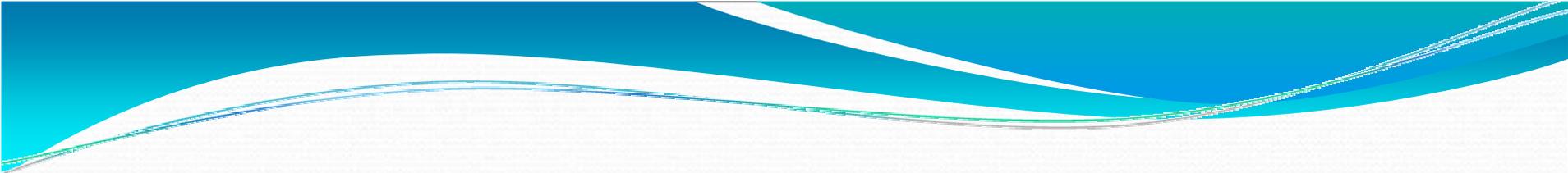
November 18, 2009

Doug Johnson

Director, Basin Operations



Saskatchewan  
Watershed  
Authority



# Water Availability Study

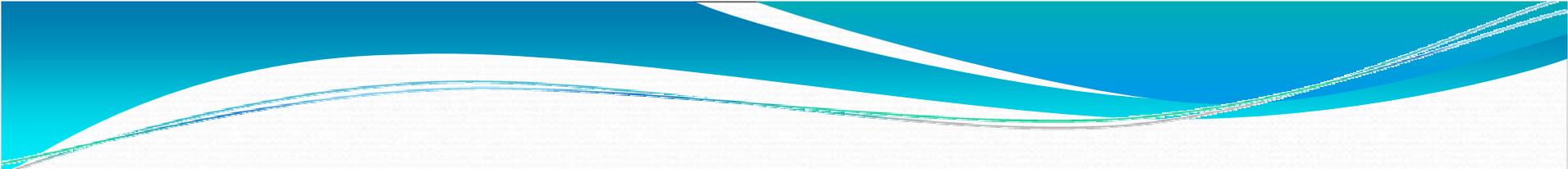
- Saskatchewan Watershed Authority is embarking on a \$7.5 million 4 year study to improve knowledge on the province's water resources.
- Economic development pressures in the province is creating increased demands for water and information on water supplies
- The study will allow us improve support for economic development by providing more accurate and timely information

# Focus of Water Supply Study

1. Assessing existing water use.
2. Mapping the location of ground water sources and defining their water supply potential.
3. Analyzing water supplies in Saskatchewan's major river systems.
4. Establishing in-stream flow requirements to support ecological health.
5. Assessing the limits to the capacity of Saskatchewan's water control infrastructure.
6. Understanding future sensitivities due to climate change.
7. Determining the economic value of water.

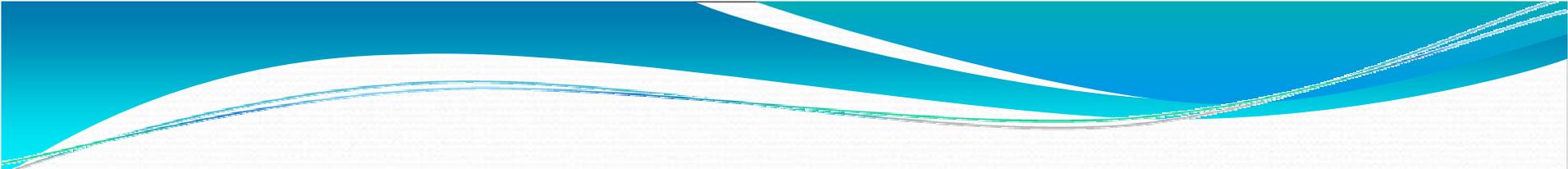
# Water Supply Study

- Components of work underway or will be initiated in this fiscal year
  - Water Use Assessment Project  
(Tim Hrynkiw )
  - Groundwater Availability/Mapping  
(John Fahlman)
  - Surface Water Study Components  
(Bart Oegema/Doug Johnson)



# Water Use Assessment Project

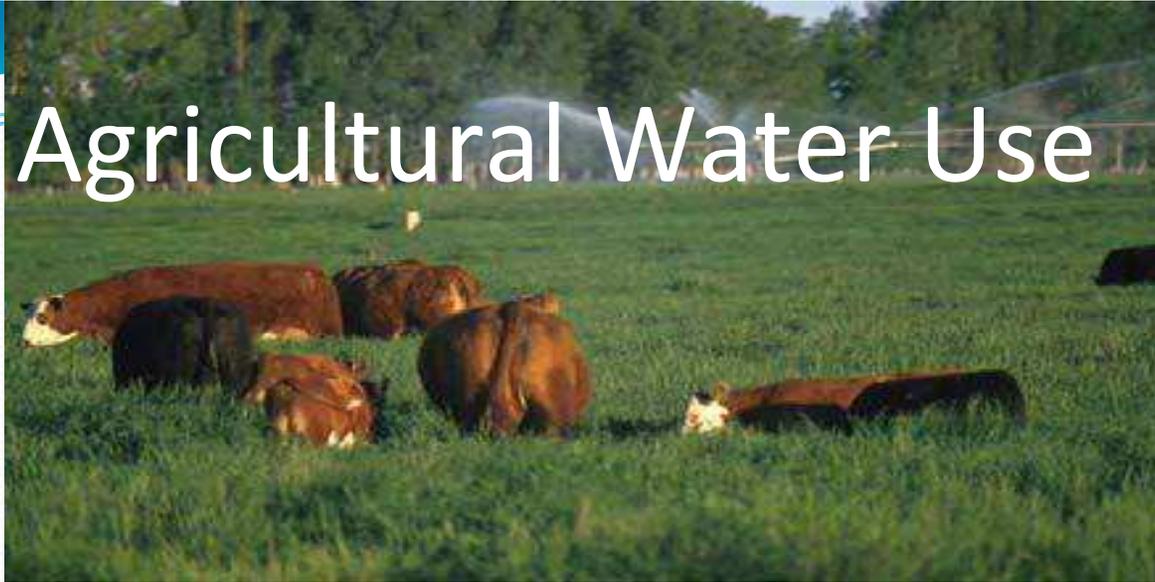
- Goal:
  - To develop and implement a system for the ongoing quantification, collection and reporting of water use data for various surface and ground water projects in Saskatchewan.



# Water Use Licenses

- Municipal Water Use Projects
- Industrial Water Use Projects
- Agricultural Water Use Licenses
- Other Water Use Projects including
  - recreation,
  - flood control,
  - wildlife and
  - environmental flows (also referred to as instream flow needs).

# Agricultural Water Use



- Includes all agricultural uses such as rural pipelines, stock watering dams, mechanical irrigation, backflood irrigation and flood irrigation systems.
- Additional data will be collected from other agencies (e.g. Ministry of Agriculture, Saskatchewan Irrigation Producers Association, Agriculture and Agri-Food Canada) and individual clients.
- The majority of the work involved in this project (80% to 90%) will be directed to this sector.

# Water Use : Techniques for Quantification

- Direct and indirect measurement (metering)
  - Expensive and resource intensive
  - Hard to implement on some projects
- Estimated Water Use
  - Optimal accuracy if properly done and documented
- Water Use Coefficients
  - Typically based on previous use, production values or other characteristics
- Apply the BATNEEC principle

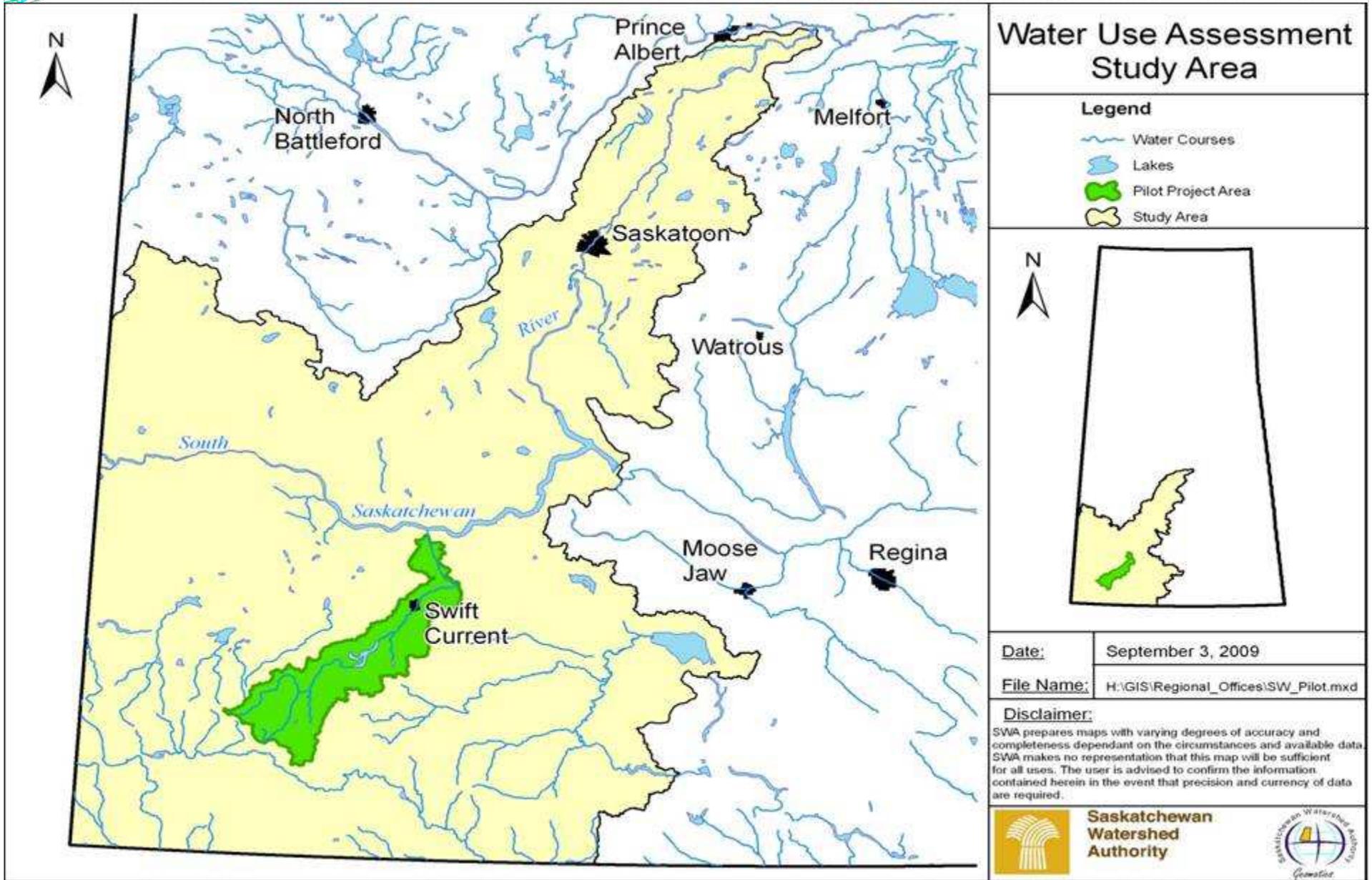
# Project Constraints and Limitations

- Regulatory database and project status accuracy
- Budget ( $\approx$  \$450,000 over first two years)
  - Pilot Project estimate is \$150,000
- Scope
  - Initially southwest region to entire province
- Water use dependant on hydrological conditions
  - Backflood and spring flood irrigation projects
  - Year to year variances (study becomes a snapshot in time)

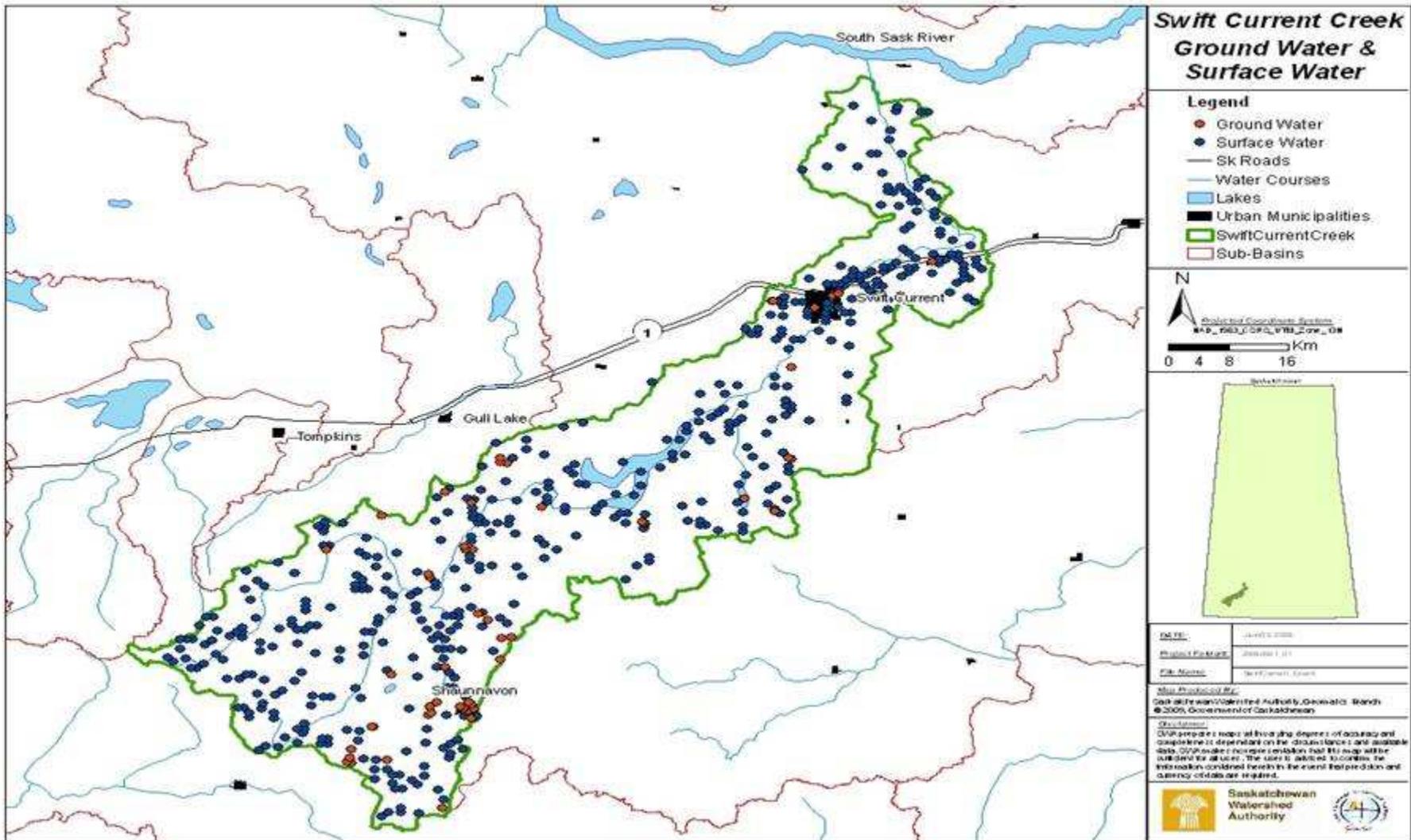
# Approach

- Review of information on regional water use assessment strategies and programs
- Discussions with SWA Regional Operations, MoA and WAS Management Committee to develop scope and work plan
- Pilot Project approach selected
  - Expression of Interest advertised
  - ToR developed and Request for Proposal issued
  - RFP submissions from qualified consultants
  - Clifton Associates Ltd. selected to conduct pilot project (June 30, 2009)

# Water Use Assessment Study Area



# Water Use Assessment Pilot Project Study Area



# Pilot Project Methodology

- Planning, ToR and selection of consultant;
- Verification of project status and water usage;
  - file review
  - review of air photo and geospatial imagery
  - personal contact by questionnaire, phone or in person to discuss/verify project status and water use
  - ground truthing and field inspection (focus on irrigation projects)
- Assimilation of all usage data into total water use by sector, purpose, type, system, operation, sub-basin and/or hydrogeologic formation;
- Final Report

# Pilot Project Final Report

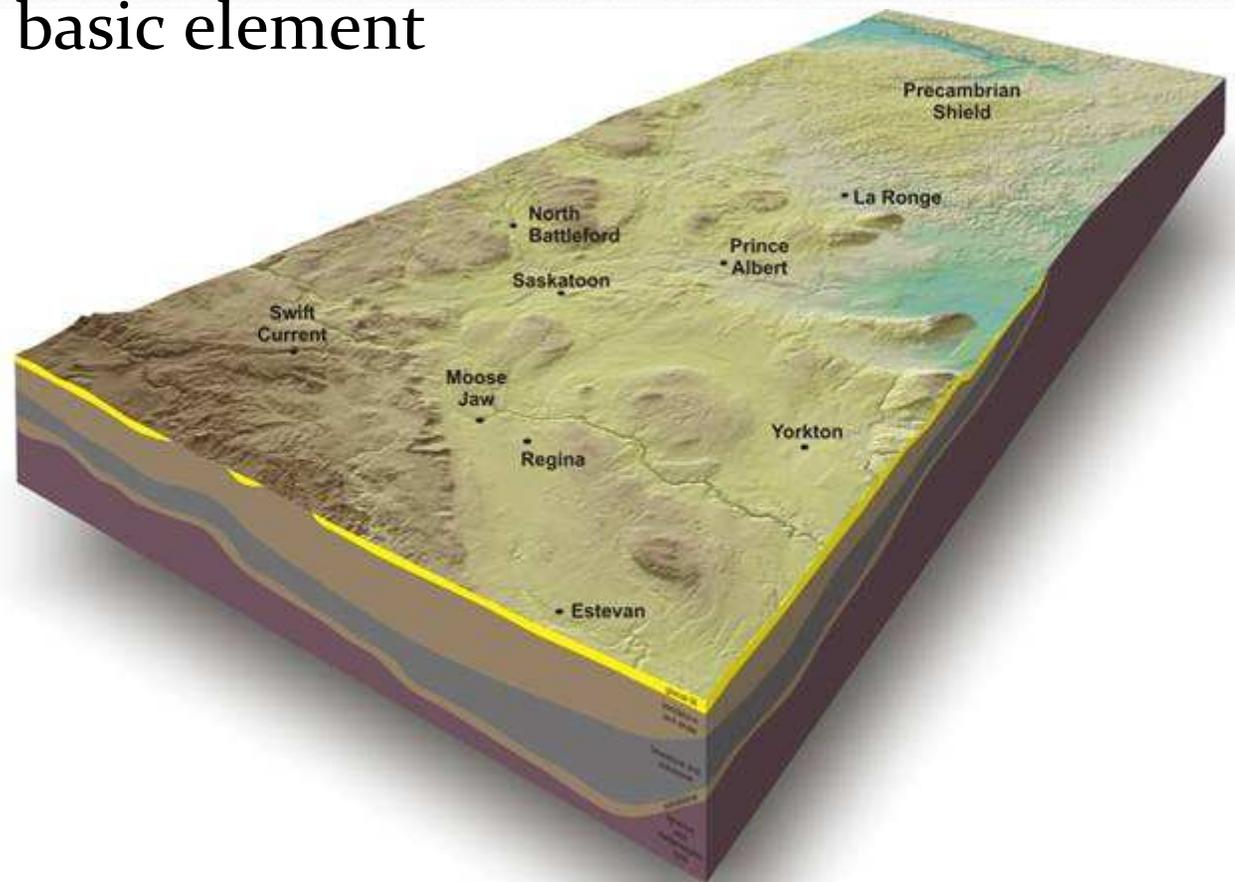
- presentation of final water use results by project, sector, purpose, type, system, operation, source of supply, sub-basin/basin, hydrogeologic formation.
- comparison of various estimation techniques and other pertinent information and results.
- documentation of the results of the pilot project, recommended methodology and protocol for water use assessments that may be used for the rest of the province.

# Tentative Schedule

<b>Milestone</b>	<b>Completion Date</b> (dd/mm/yyyy)	<b>Deliverables</b>
Pilot Project Completion	31/12/2009	Regional water use assessment protocol
Milestone 1	28/02/2010	Determination of provincial methodology
Milestone 2	31/03/2010	Terms of Reference & RFP
Milestone 3	30/04/2010	Award Contract
Milestone 4	15/05/2010	Project kickoff
Project Completion	31/08/2012	Draft Report
Project Conclusion	30/09/2012	Final Report

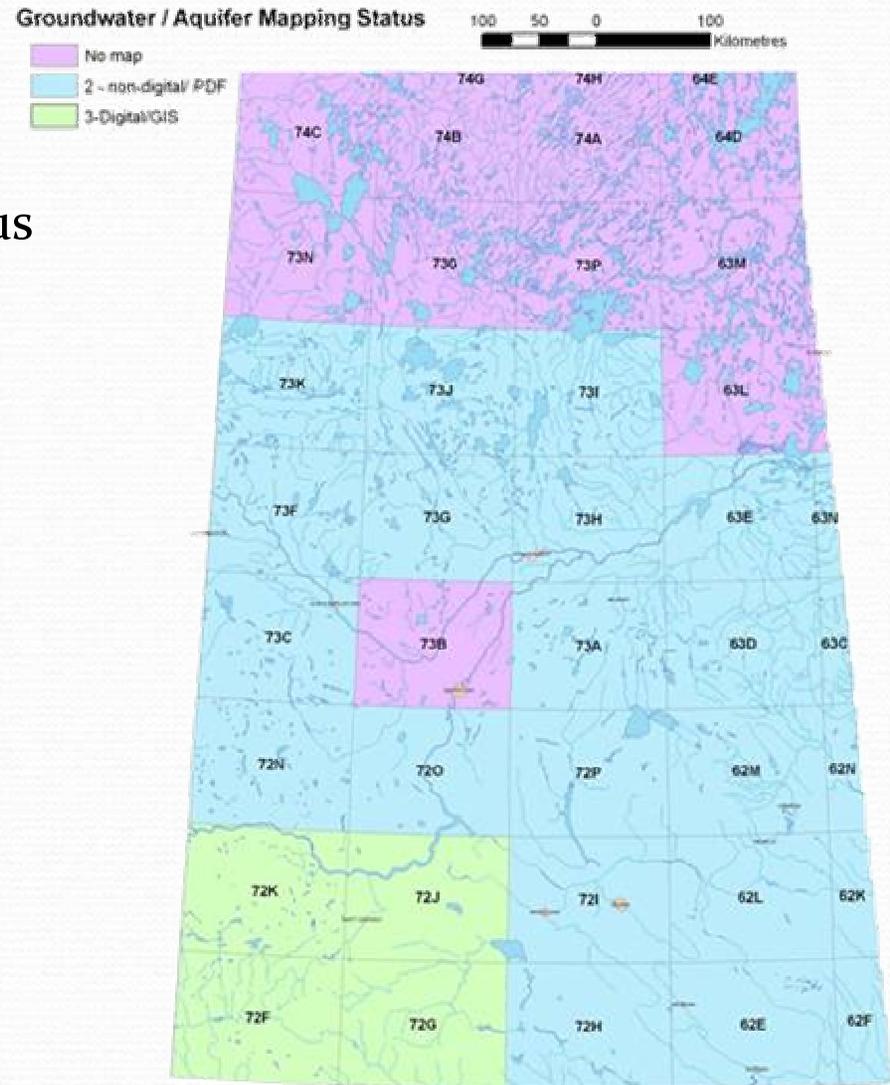
# Groundwater Availability

- fn (aquifer geometry, recharge characteristics)
- Regional mapping – basic element



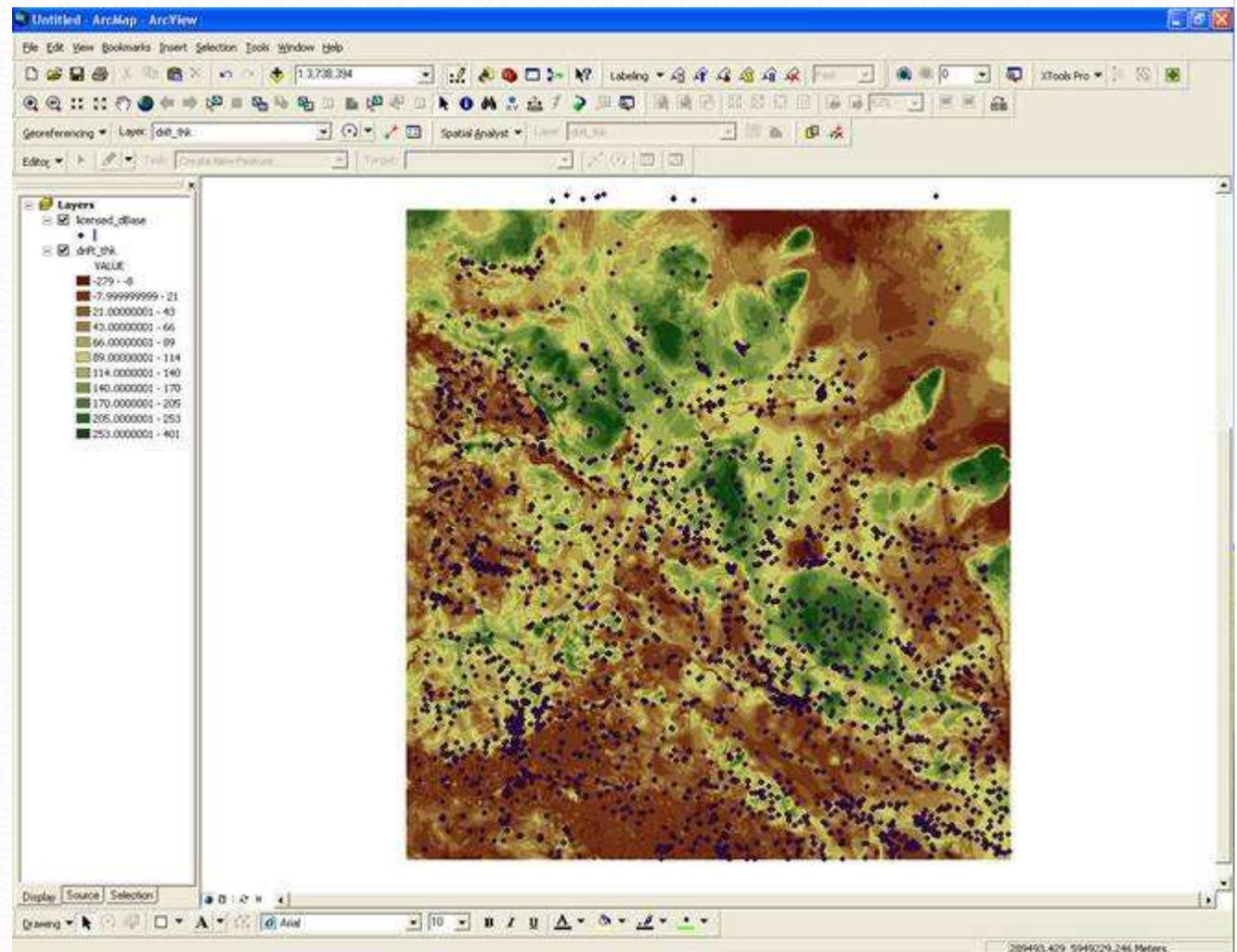
## Mapping Opportunities:

- Move to Applied vs. Research focus
- Address Discontiguous mapping
  - Generations, “border faults”
- Add hydrogeology
  - Hydrostratigraphy
  - Hydraulics
  - Water quality
  - Availability
- Update formats and convenience
  - GIS



# Year 1 Work

- Mapping
  - New standard
  - Sanctioned model
- Data Management
  - Cleansing
  - X-reference
  - Capture/population
- Availability
  - Raw data
  - Information
  - Knowledge



# Project Progression



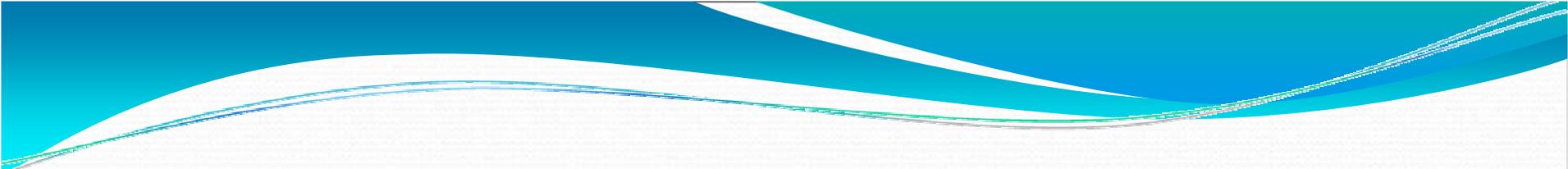
## Project Life

- Apply mapping standard to rest of Ag. Sask.
- Capture of relevant GW data / population of databases
- Long term – ongoing maintenance



# Surface Water Availability

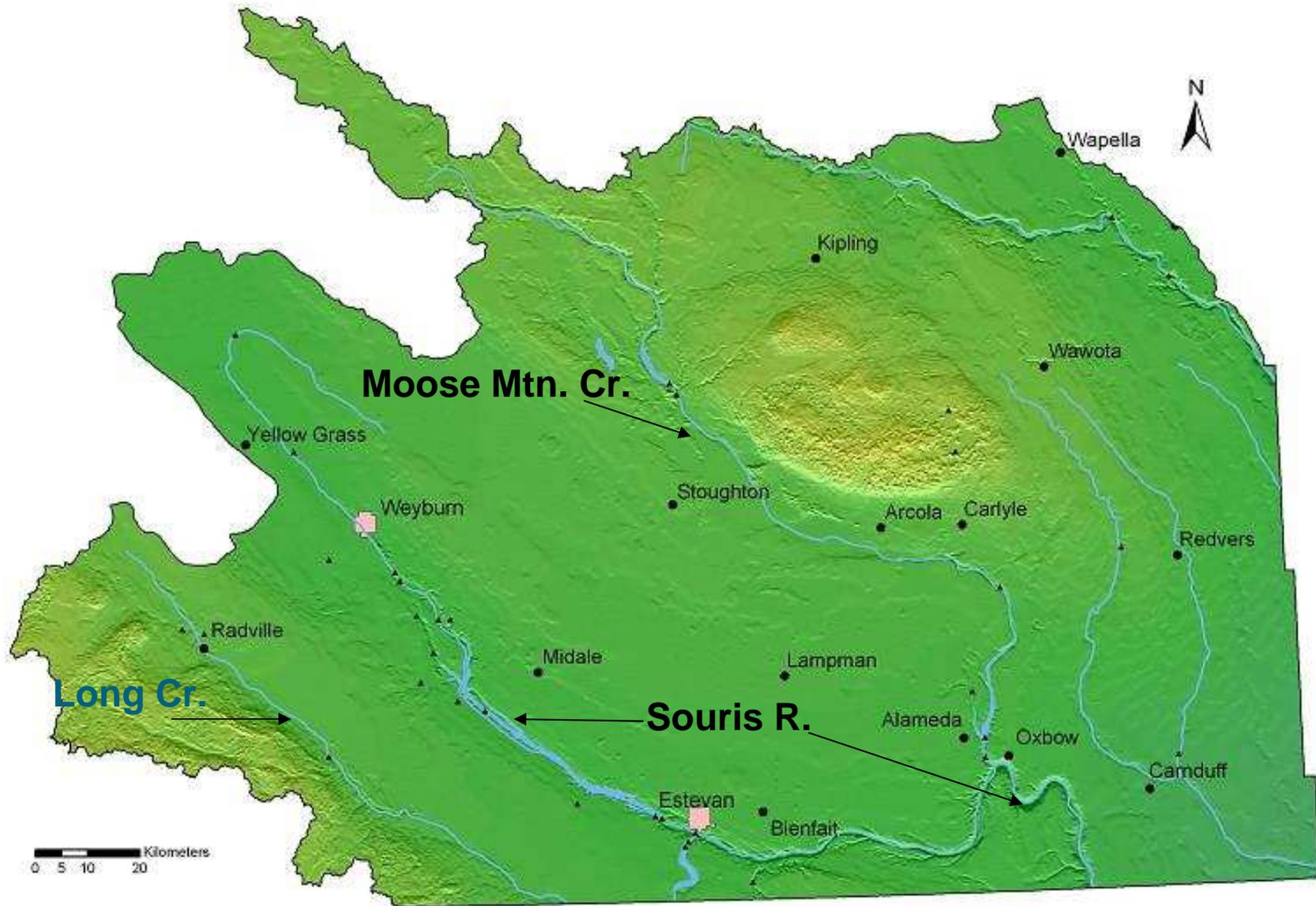
1. Saskatchewan Hydro-Climate Trend Analysis
2. Saskatchewan Natural Flow Trend Analysis
3. Water Supply and Availability in the Major Saskatchewan Systems



# Surface Water Availability

- An example of why we need to do work on relationships between precipitation and runoff

# Souris River Basin

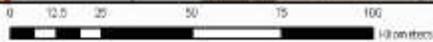


# Rafferty and Alameda Dams

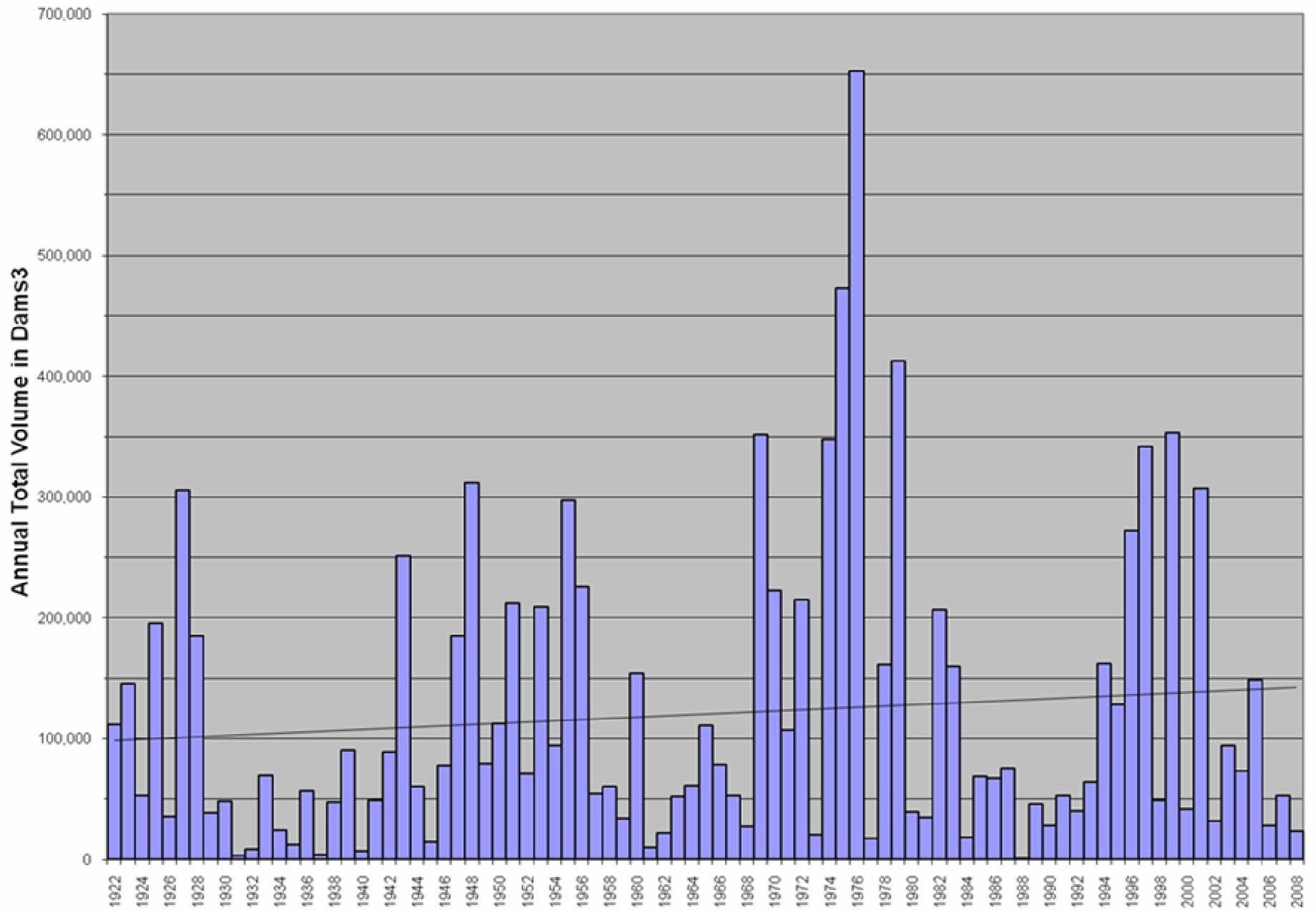


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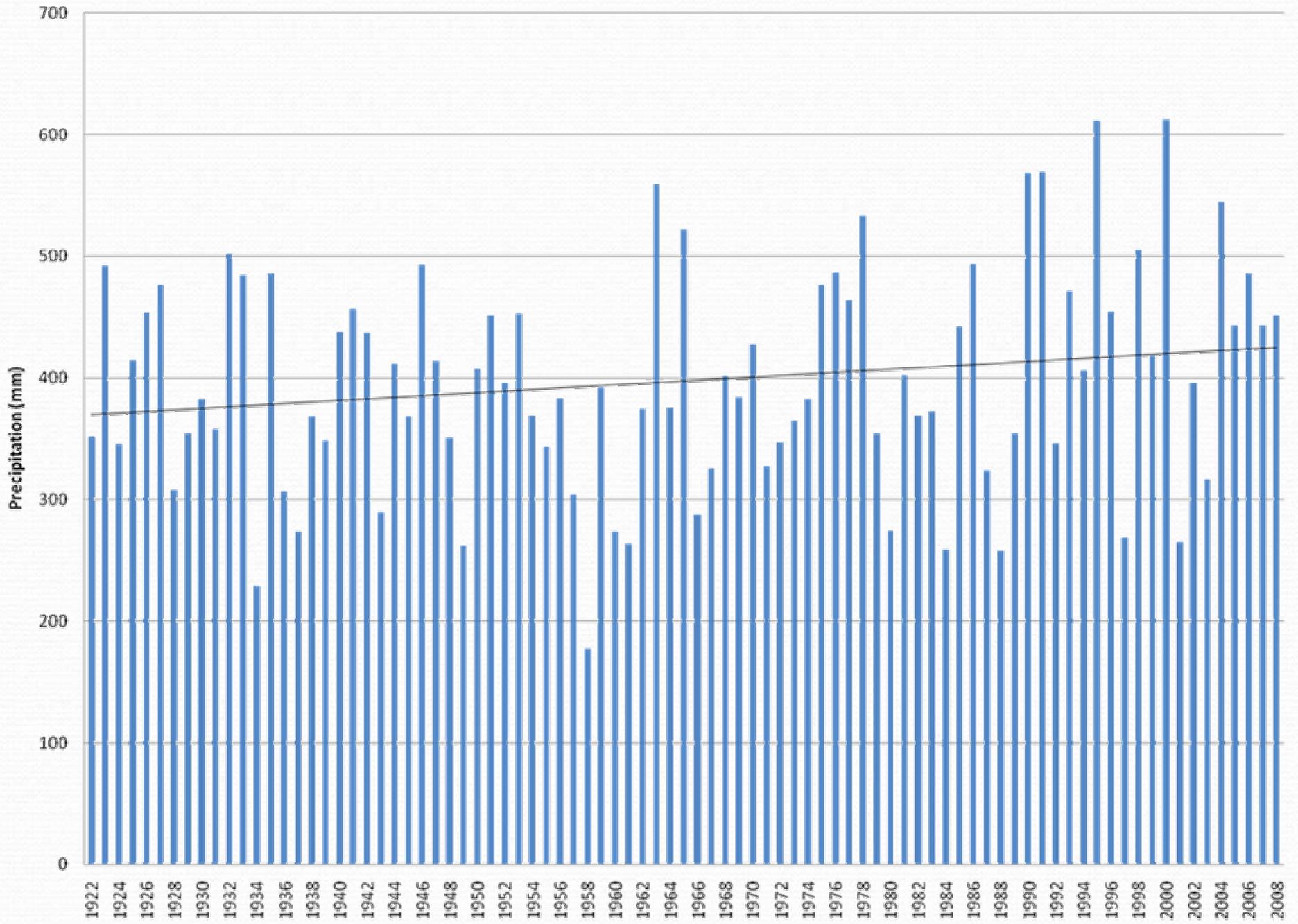
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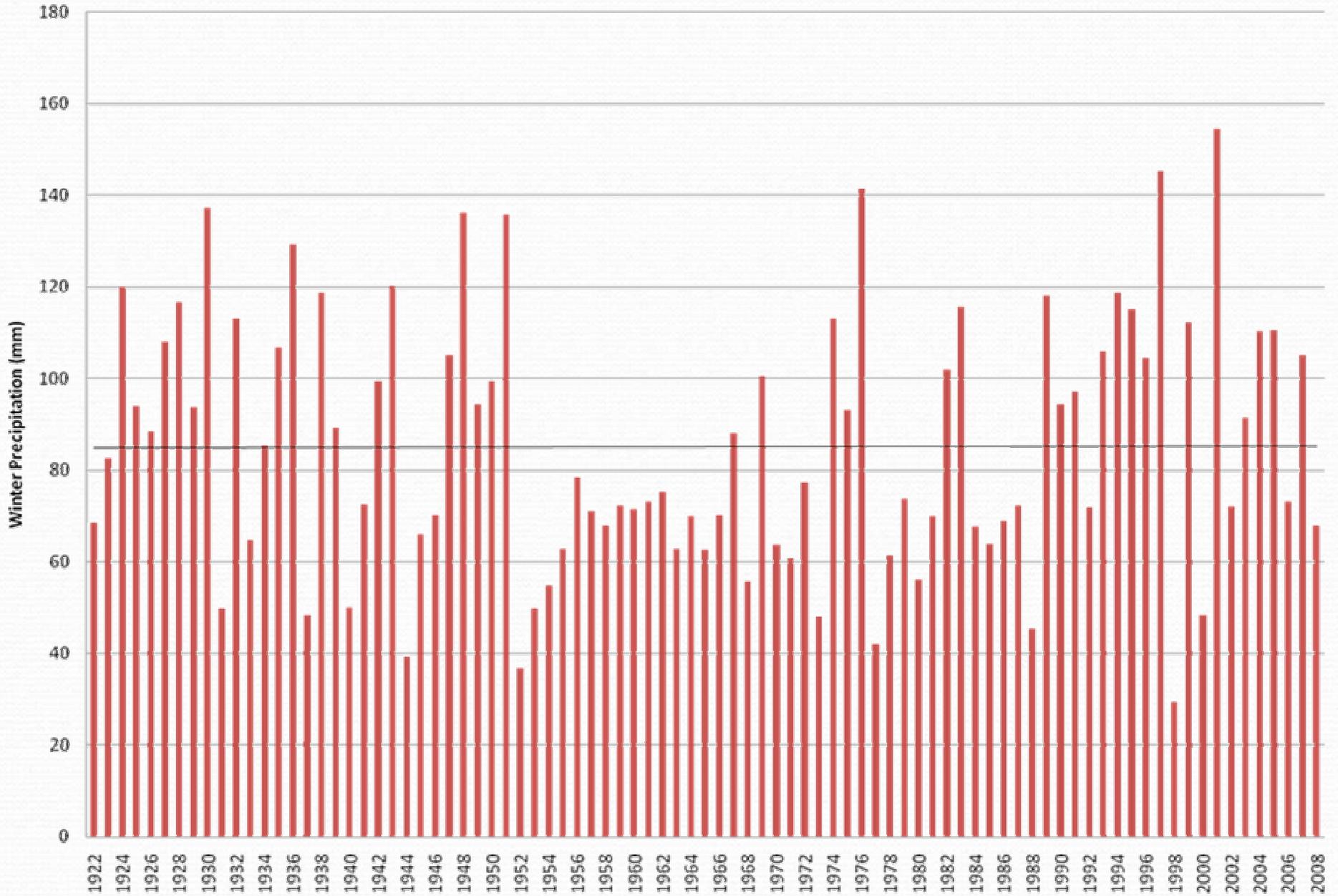
# Naturalized Annual Volumes, Souris River at the International Boundary



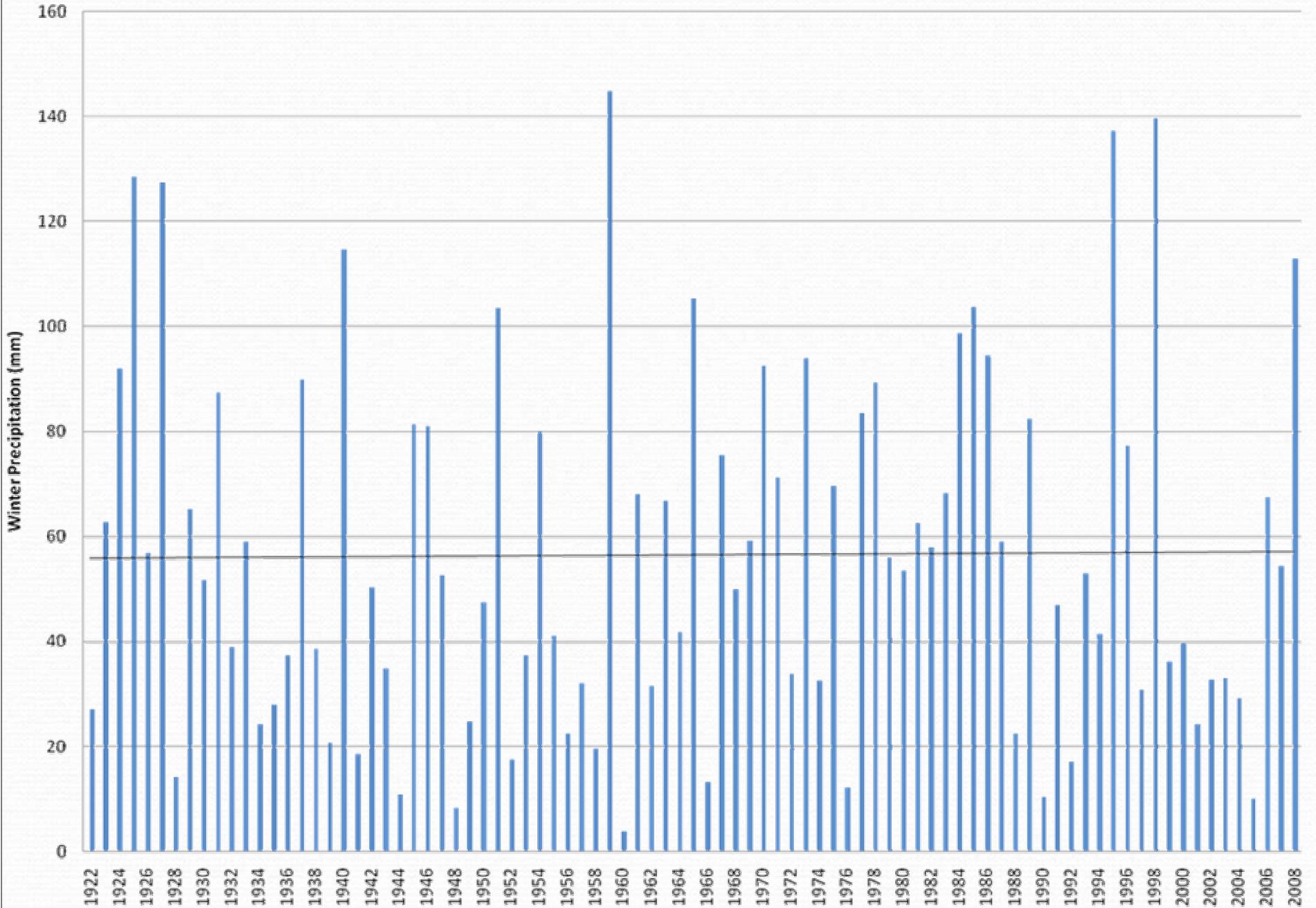
# Weyburn Annual Precipitation



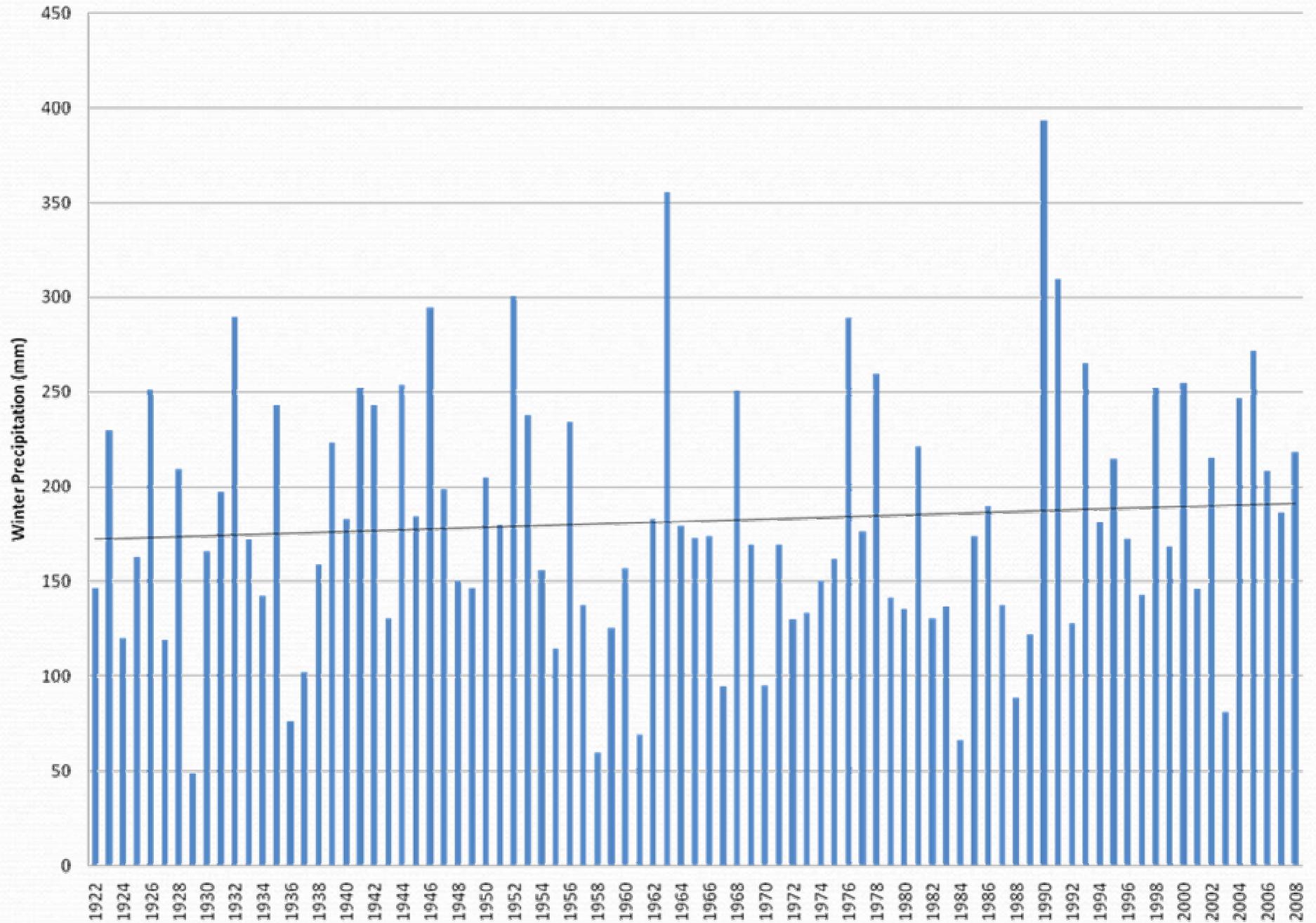
# Weyburn Winter Precipitation



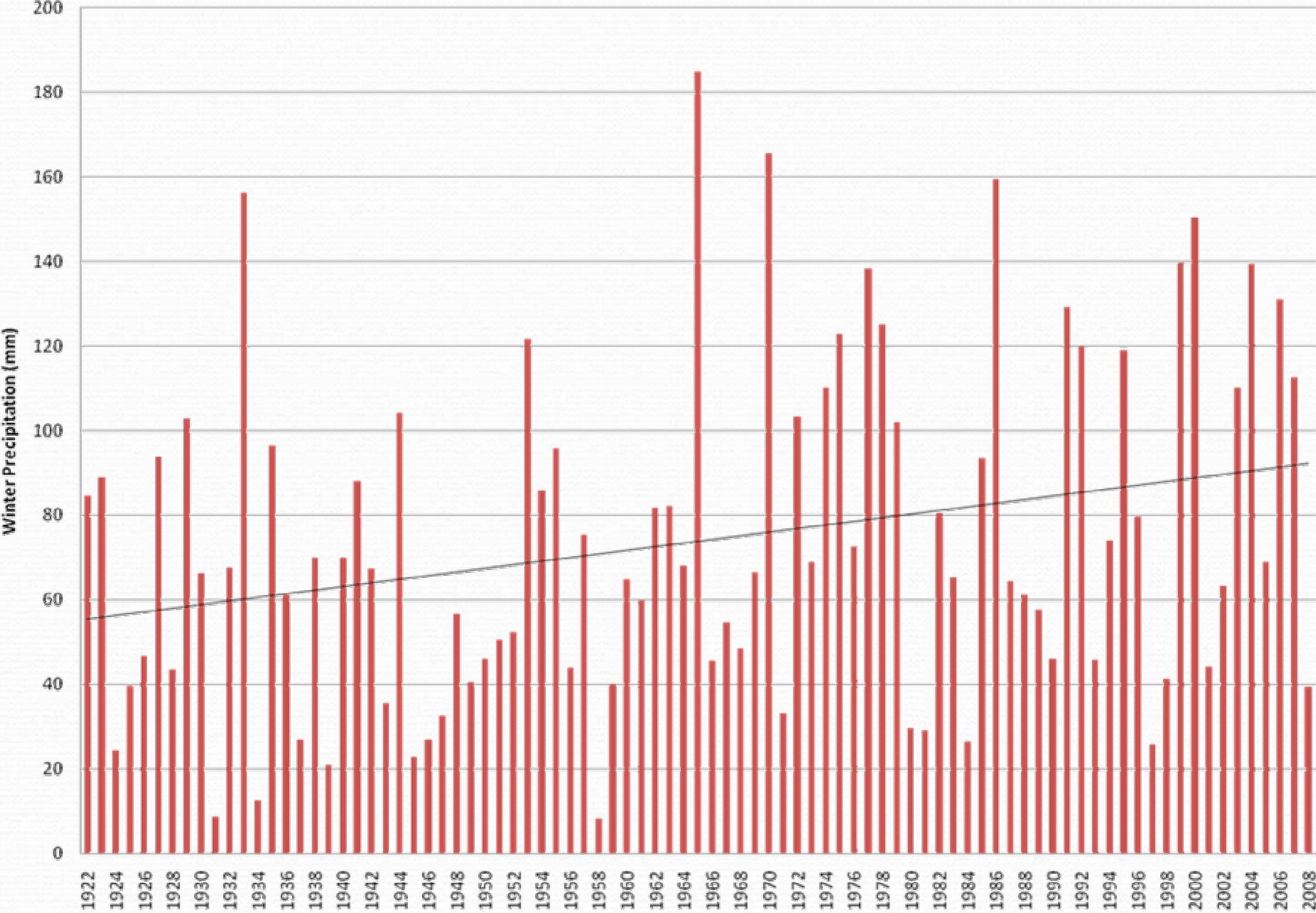
# Weyburn September and October Precipitation



# Weyburn June, July and August Precipitation



# Weyburn April and May Precipitation



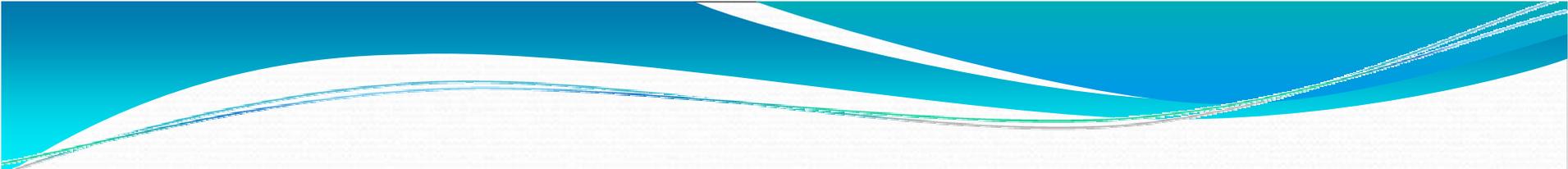
# Hydro-Climate Trend Analysis

Management of water supplies and determination of availability relies observed and calculated meteorological parameters including :

- Annual, seasonal and monthly precipitation,
  - Annual snowfall
  - Ratio of snow/rainfall,
  - Open water evaporation
  - Snow water equivalent
  - And Snow cover duration
- The objective is better understand whether there are trends in hydro-climatology and the magnitude of these trends

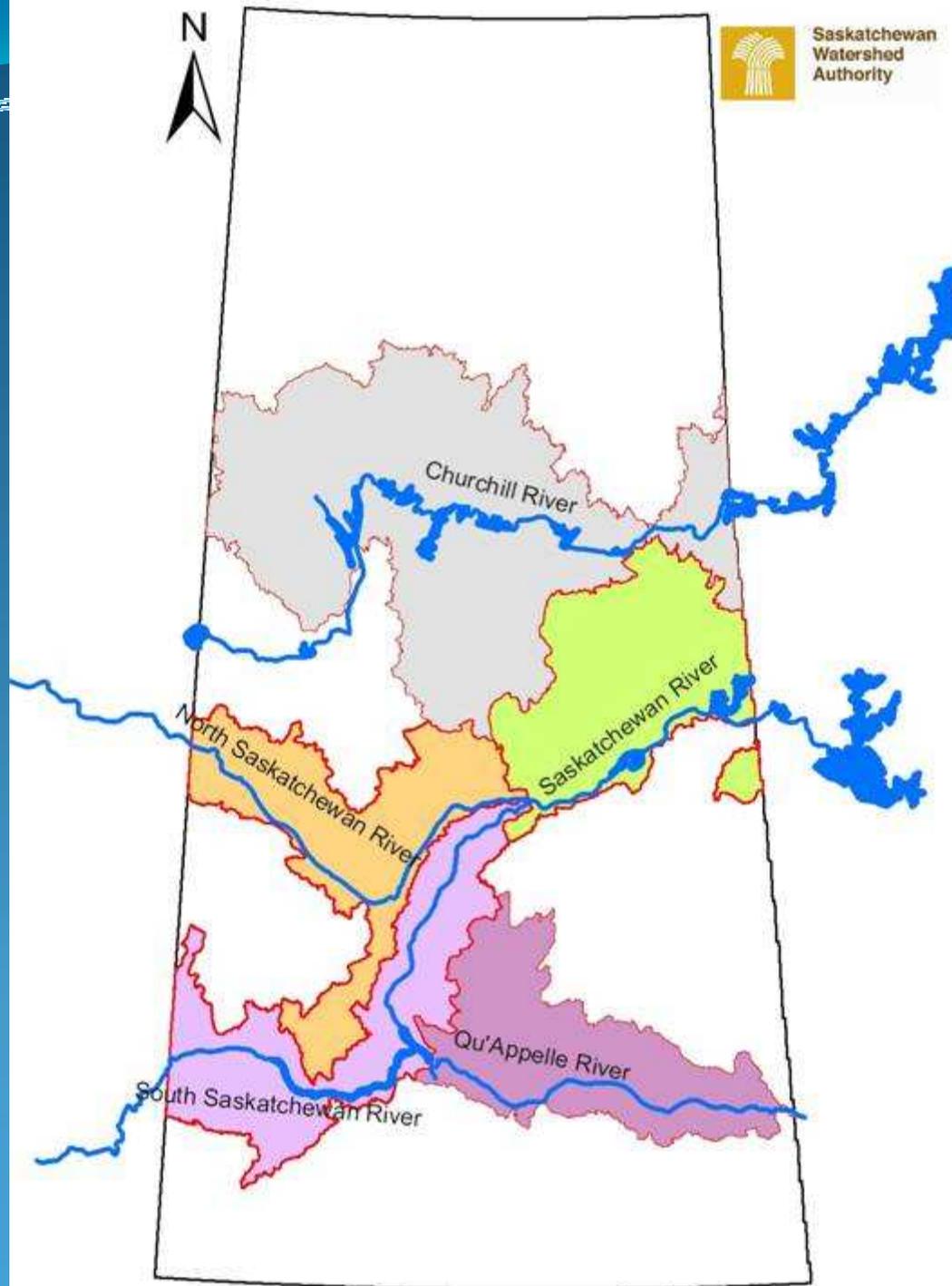
# Natural Flow Trend Analysis

- Natural flow arrays are useful as input to water supply and availability assessments.
- This purpose of this project is to extend natural flow analysis to a number of unapportioned watersheds in Saskatchewan.
- This project will also examine all available natural flow series for stationarity and/or trend in mean annual and seasonal flow volumes.
- Knowledge of the significance and direction of any trends in natural flows can be used to better gauge future water availability and the appropriateness of using the assumption that past flows are a good indication of future water supplies.



## Water Supply Availability for Major Basins

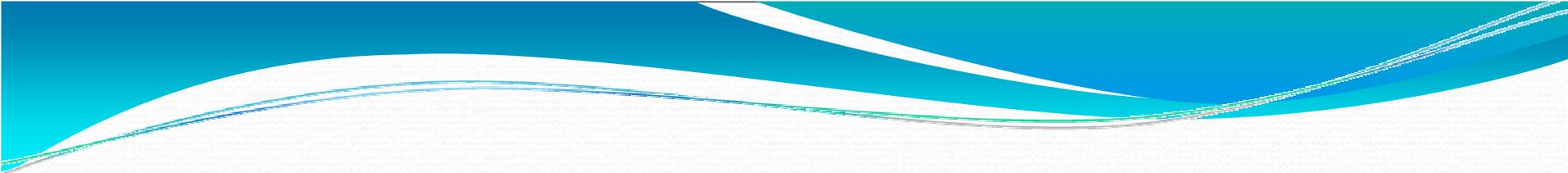
- Unprecedented growth potential on several basins
- Uncertainty around the current water supplies
- Uncertainty around future water supplies
- Interest from SaskPower in some of the above information, that they will use in system planning
- The water sharing agreements that Saskatchewan has with its neighbours



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# Examples of Potential New Demands

- Qu'Appelle River to Buffalo Pound Lake
  - 60 to 70000 dam<sup>3</sup> of new development
- Souris River Clean Coal and Carbon Sequestration
- South Saskatchewan River/Lake Diefenbaker
- Irrigation – West Side Irrigation (400,000 dam<sup>3</sup>) & Qu'Appelle South (140,000 dam<sup>3</sup>)
- North Saskatchewan River/Saskatchewan River
- Hydro Development (900,000 dam<sup>3</sup>)
- Churchill River
- Hydro Development



# Study Has Major Components

- Background Work
- Model Development
- Simulation and Assessment of Various Water Demands, Environmental Use and Water Supply Scenarios

# Background Work

- Review work on the 1990's and 2005 South Saskatchewan River basin studies

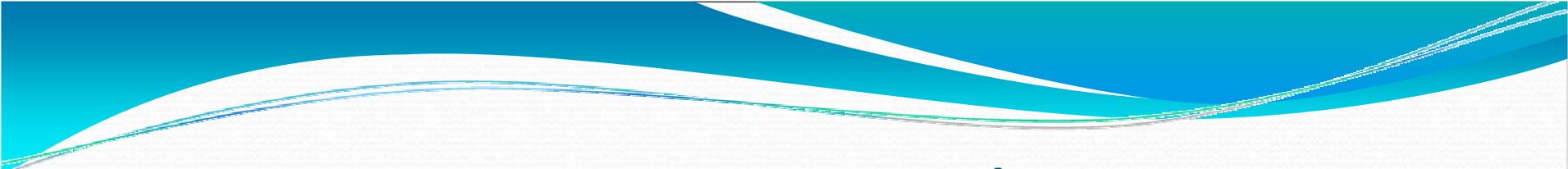
# Model Development/Projections

- Develop Water Supply models (Water Resource Management Model or other) for:
  - South Saskatchewan River/Lake Diefenbaker
  - Qu'Appelle River
  - North Saskatchewan River
  - Souris River
  - Churchill River
- Run Models using current levels of development and inflows to verify models
- Compile a listing of potential water use developments and project growth



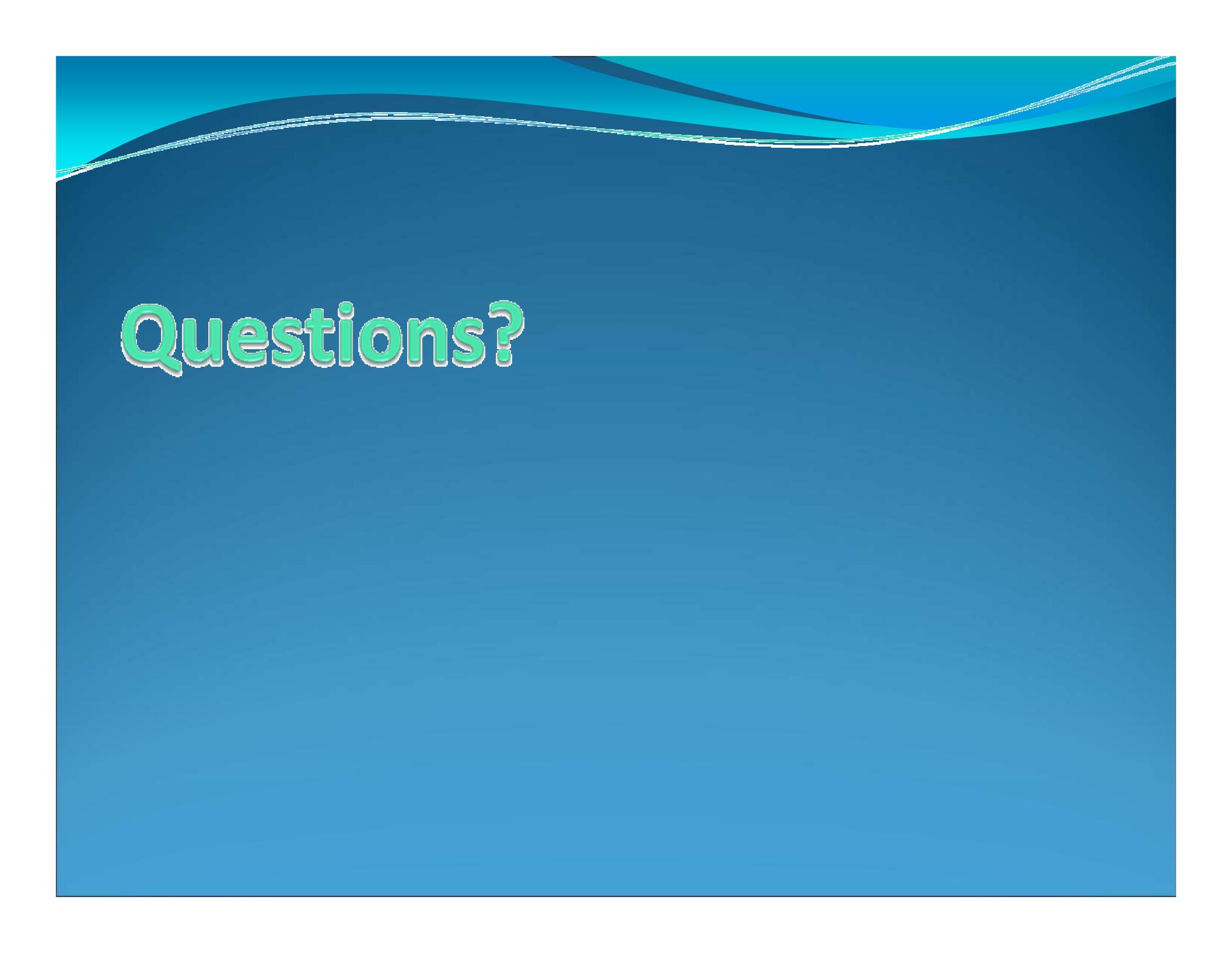
# Water Supply and Availability Projections

- Run models using future development scenarios with future projected upstream development and future natural flow projects to determine sustainable water supplies
- Develop flow series information for the SaskPower Plants in the Saskatchewan and Churchill River basins for the current level of development, future use scenarios and climate change impacts with future use scenarios.
- Compilation of a report on the findings



# Future Work

- Establishing in-stream flow requirements to support ecological health.
- Assessing the limits to the capacity of Saskatchewan's water control infrastructure.
- Understanding future sensitivities due to climate change.
- Determining the economic value of water



Questions?