

Manitoba Water Stewardship

Coping with Drought

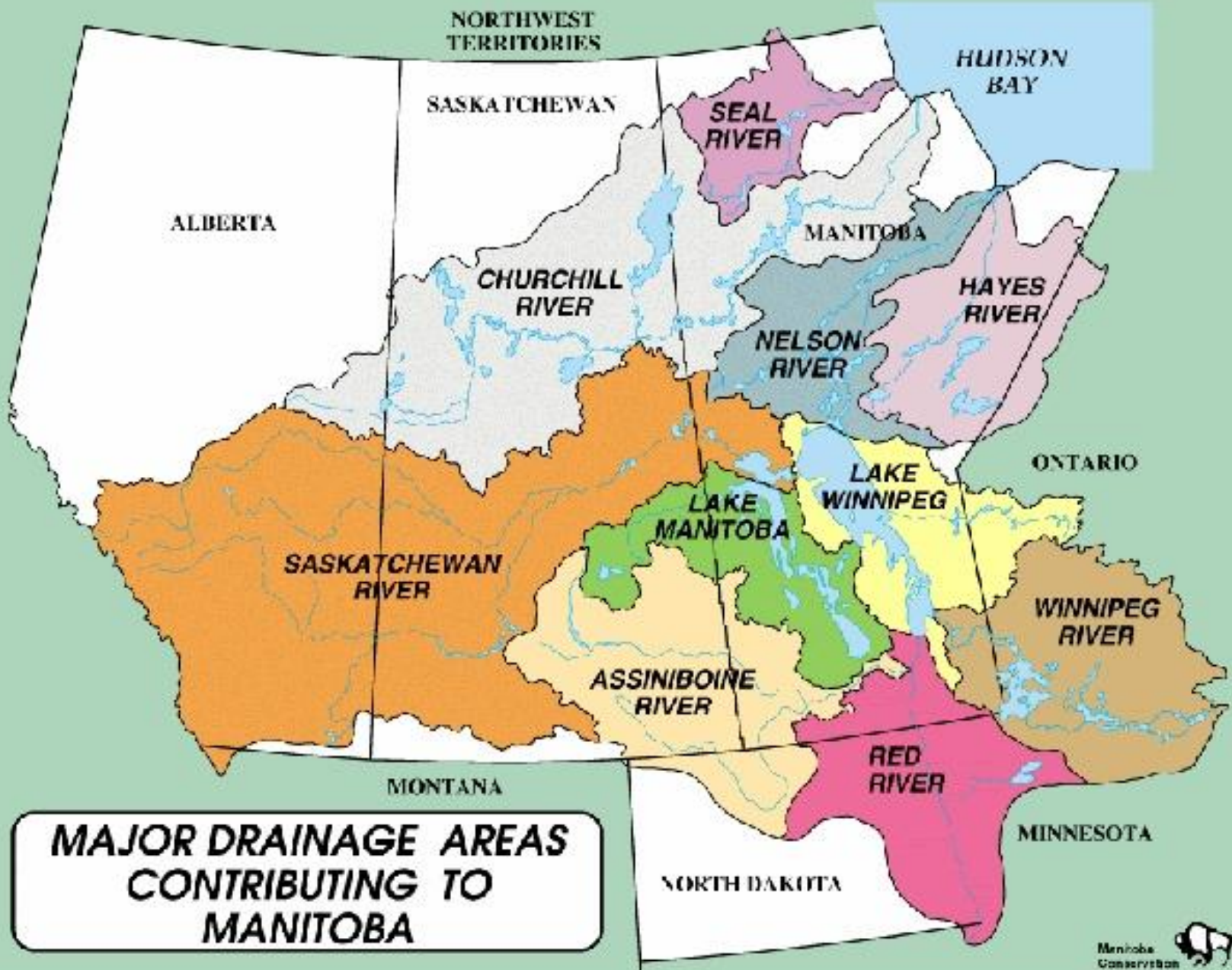
**Drought Research Initiative
Workshop**

Inn at the Forks, Winnipeg.
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A.A. Warkentin

January 11-13, 2007





Annual Renewal of Water Supplies

Important Precipitation-based Parameters:

1. **Soil Moisture at Freeze-Up (May-Oct. antecedent Year).**
2. **Snow Accumulation (November-March).**
3. **Spring/Early Summer Rains (April-July).**

Parameter Analysis for Period 1933 – 2006 (74 years)



Mean of 9 Long-Term Stations in Southern Manitoba

**Soil Moisture at Freeze-Up:
out of 74**

Dry 19 years

**Winter Precipitation:
74**

Dry 19 years out of

**April – July Precipitation:
out of 74**

Dry 16 years

Drought Persistence based on Parameter Analysis

(Average of 9 Climate stations in Southern Manitoba)

Manitoba



For 19 Years when SM at Freeze-Up was Low:

Winter	was	Dry	5 times
		Wet	5 times
		Average	9 times
April – July	was	Dry	2 times
		Wet	7 times
		Average	10 times

Drought Analysis – Average of 9 Stations in Southern Manitoba



Of the 74 Years (1933 – 2006) in Southern Manitoba

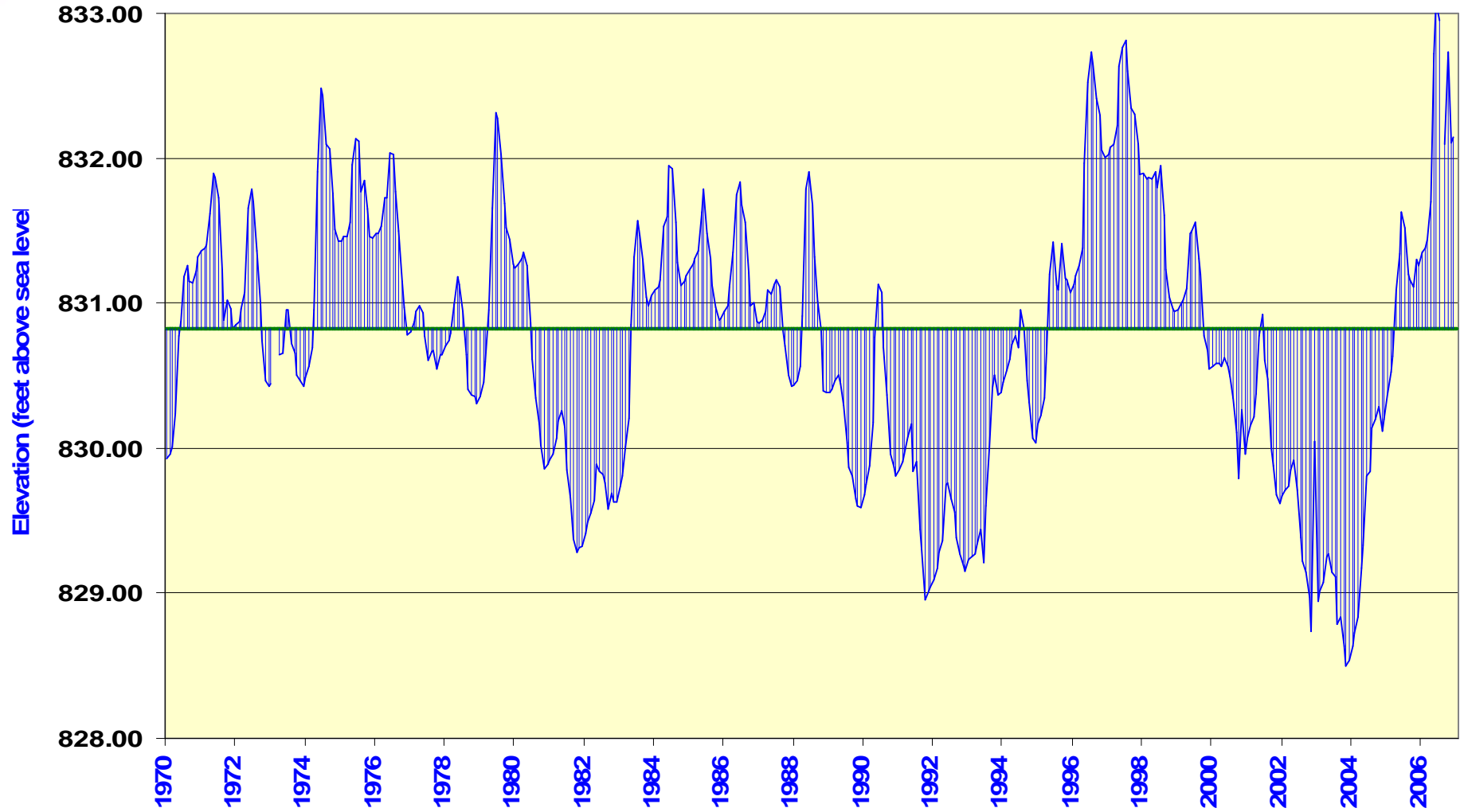
None had all three parameters below 80% of average.

Following 12 years had low Parameters

1933	1973
1934	1977
1934	1980
1940	1988
1952	2002
1961	2004

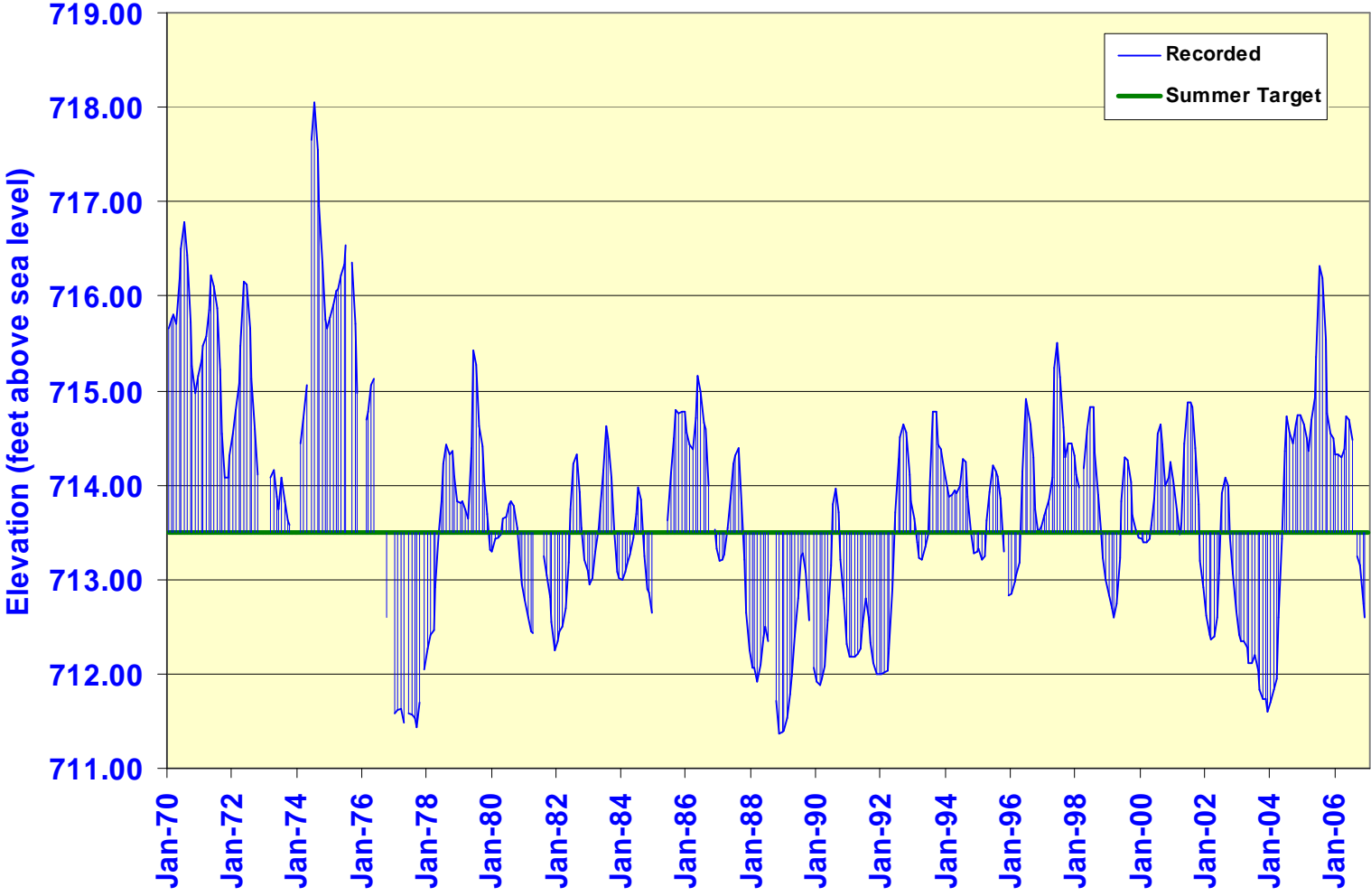


Lake Winnipegosis
Mean Monthly Elevation

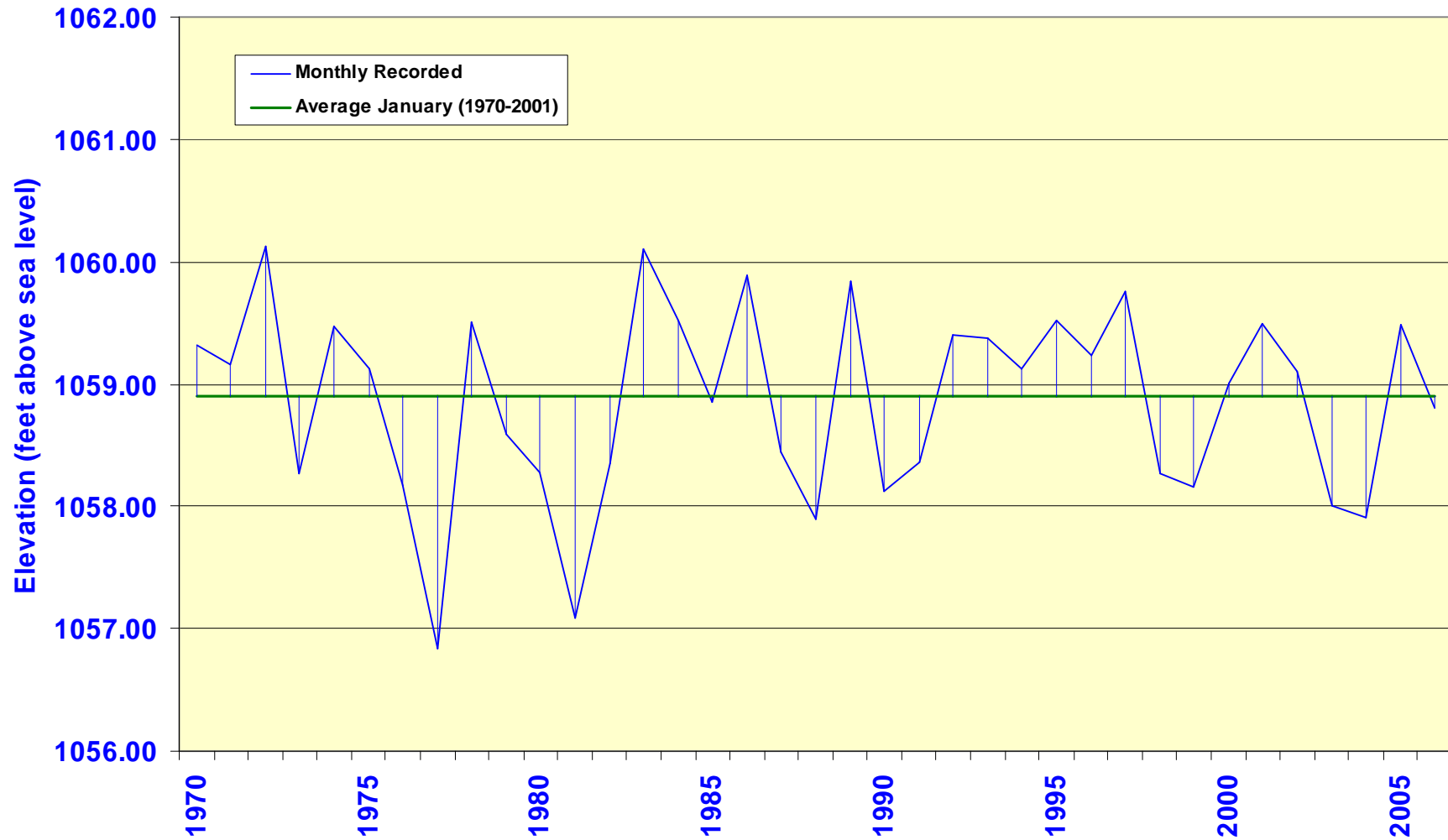


Lake Winnipeg

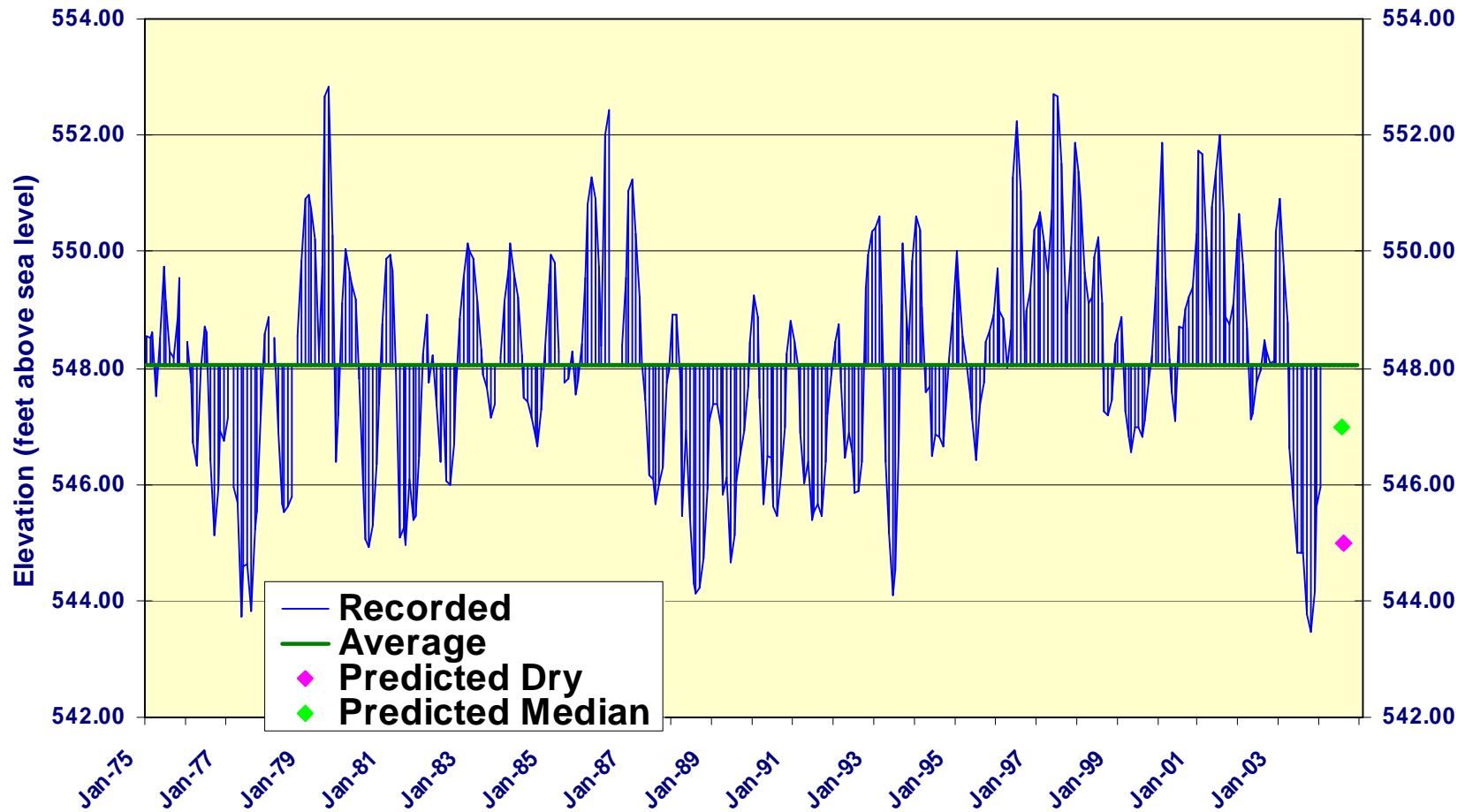
Mean Monthly Elevation



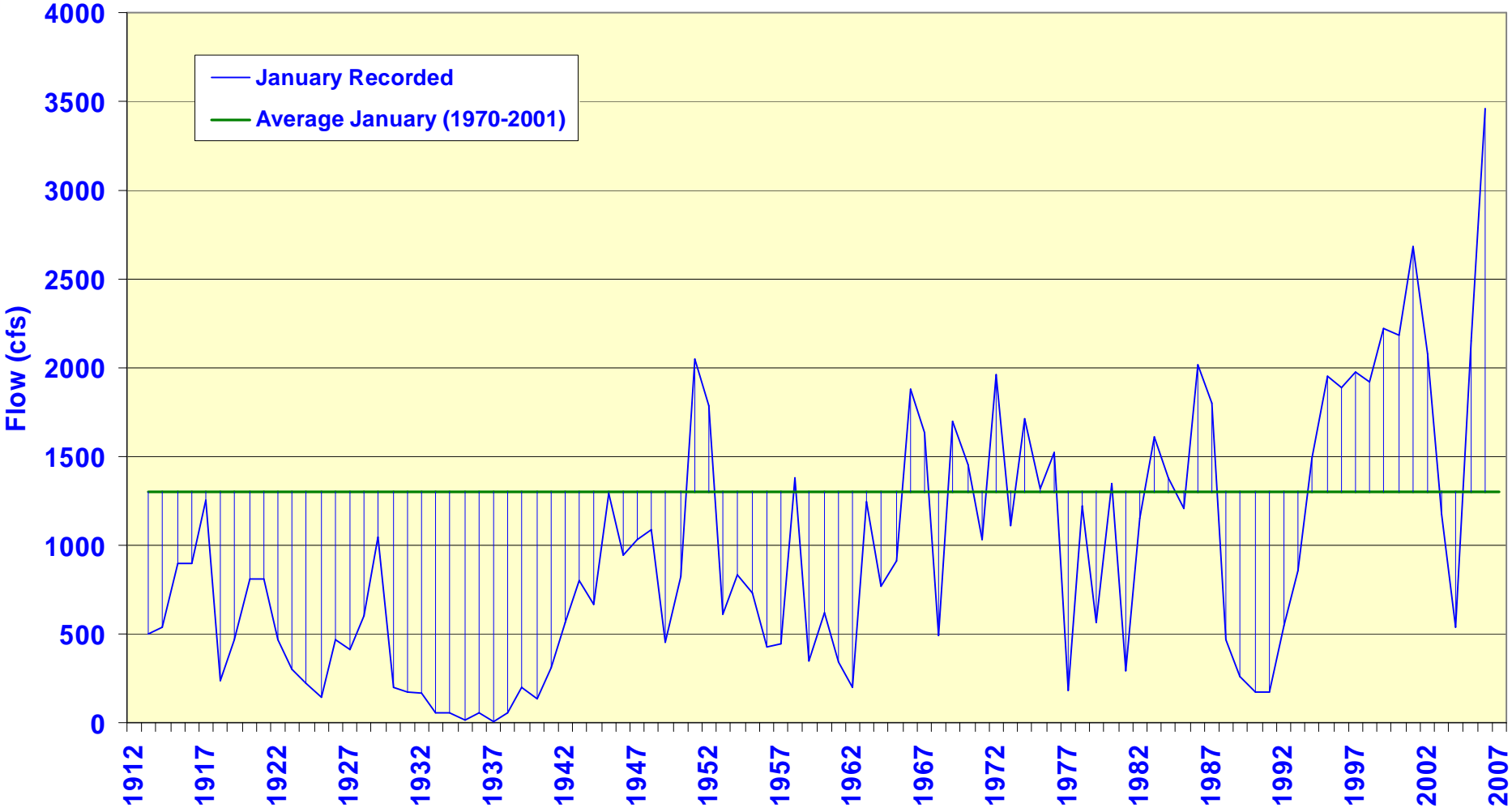
Lake of the Woods *Mean Monthly Elevation for January*



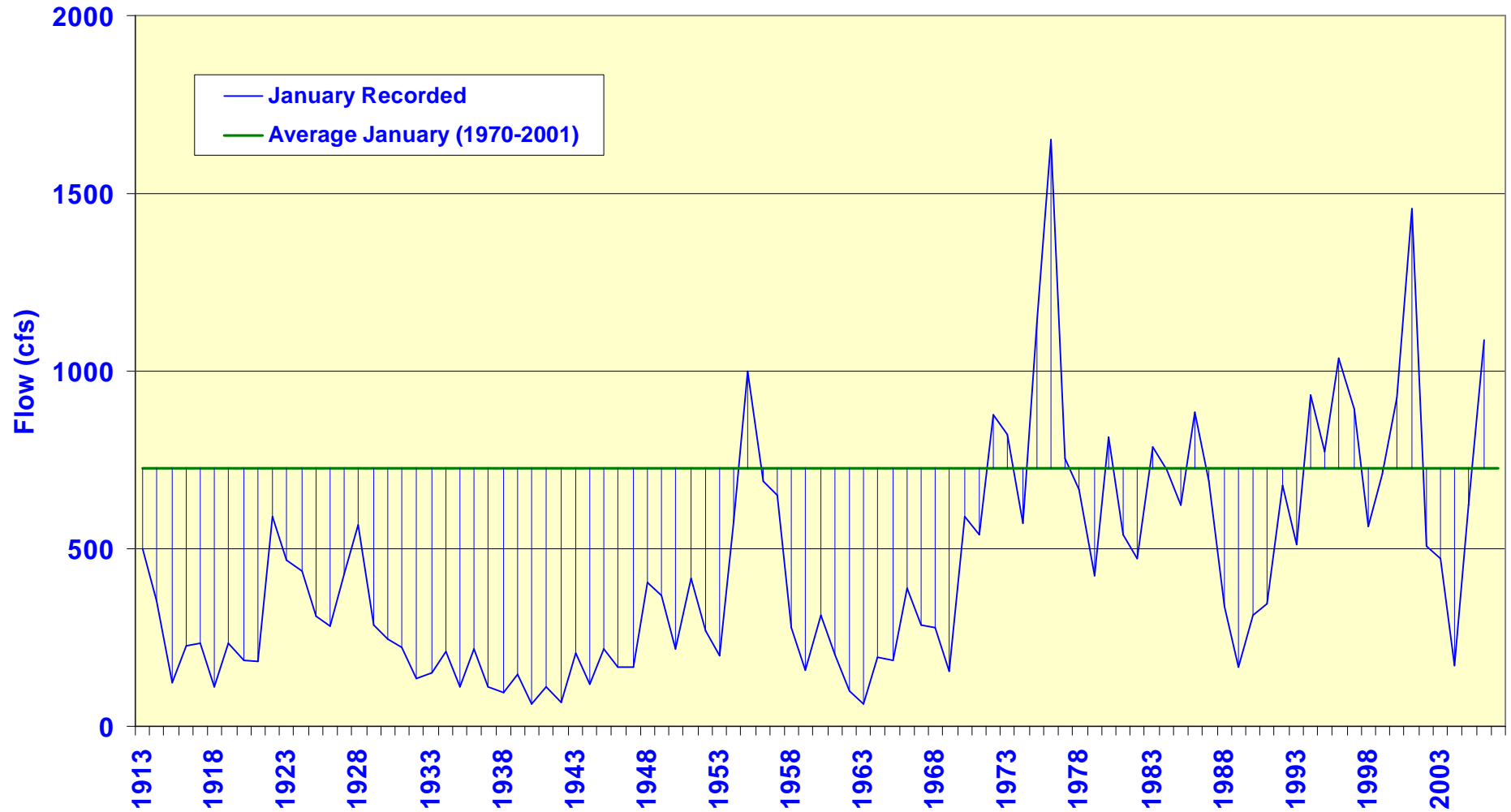
Split Lake at Split Lake Mean Monthly Elevation



Red River at Emerson Mean Monthly Flow for January

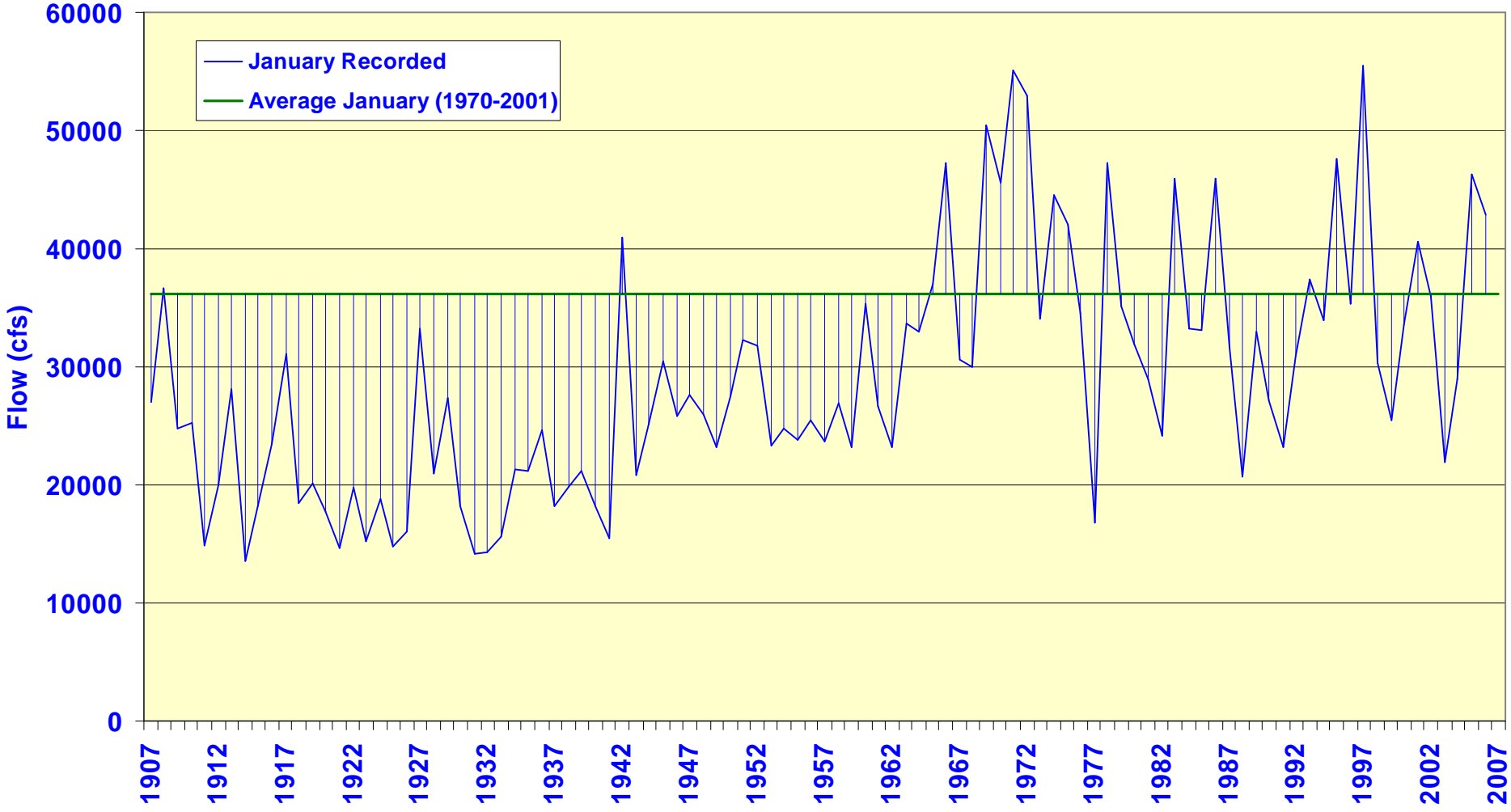


Assiniboine River at Headingley Mean Monthly Flow for January

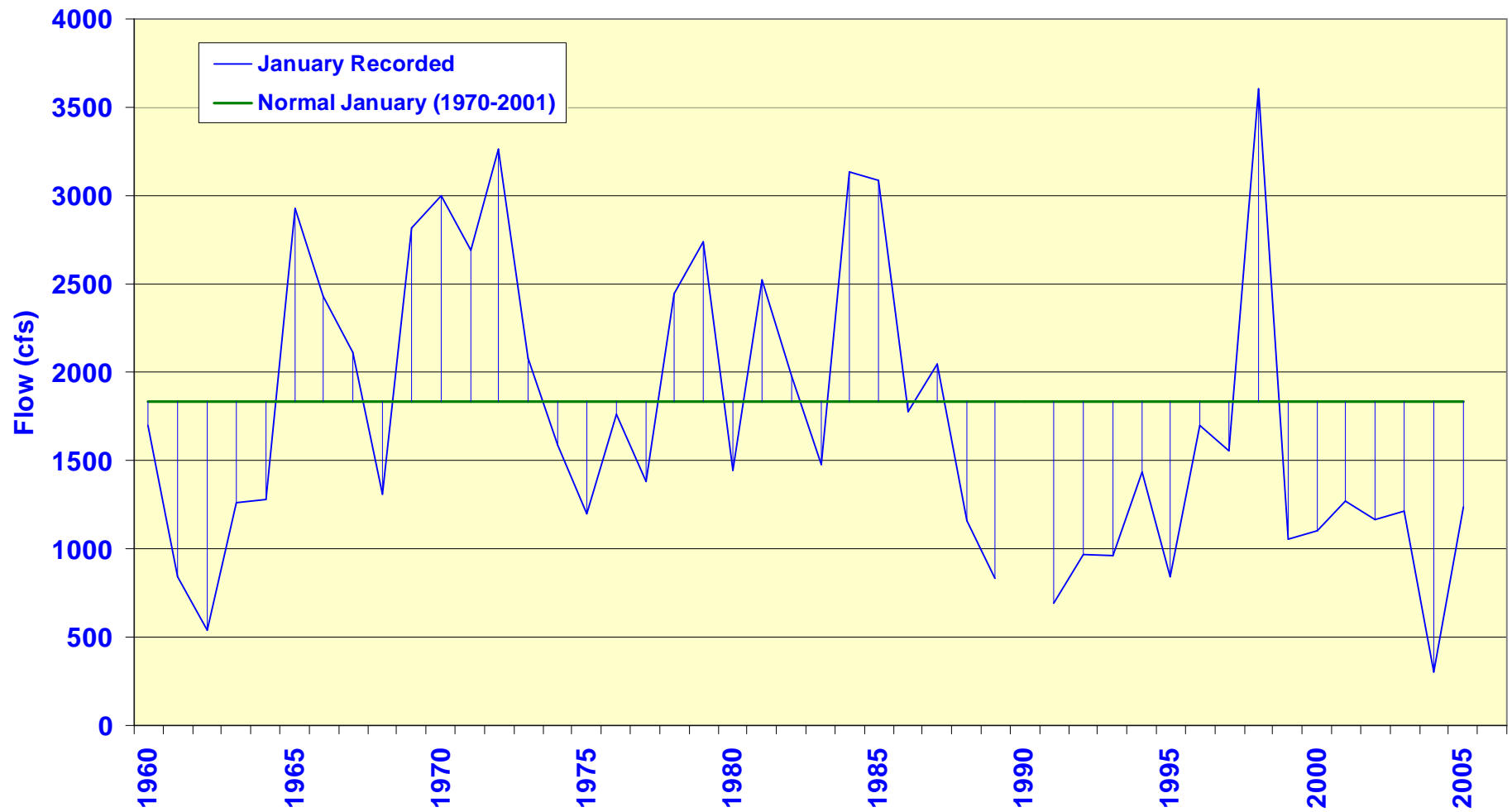


Winnipeg River at Slave Falls

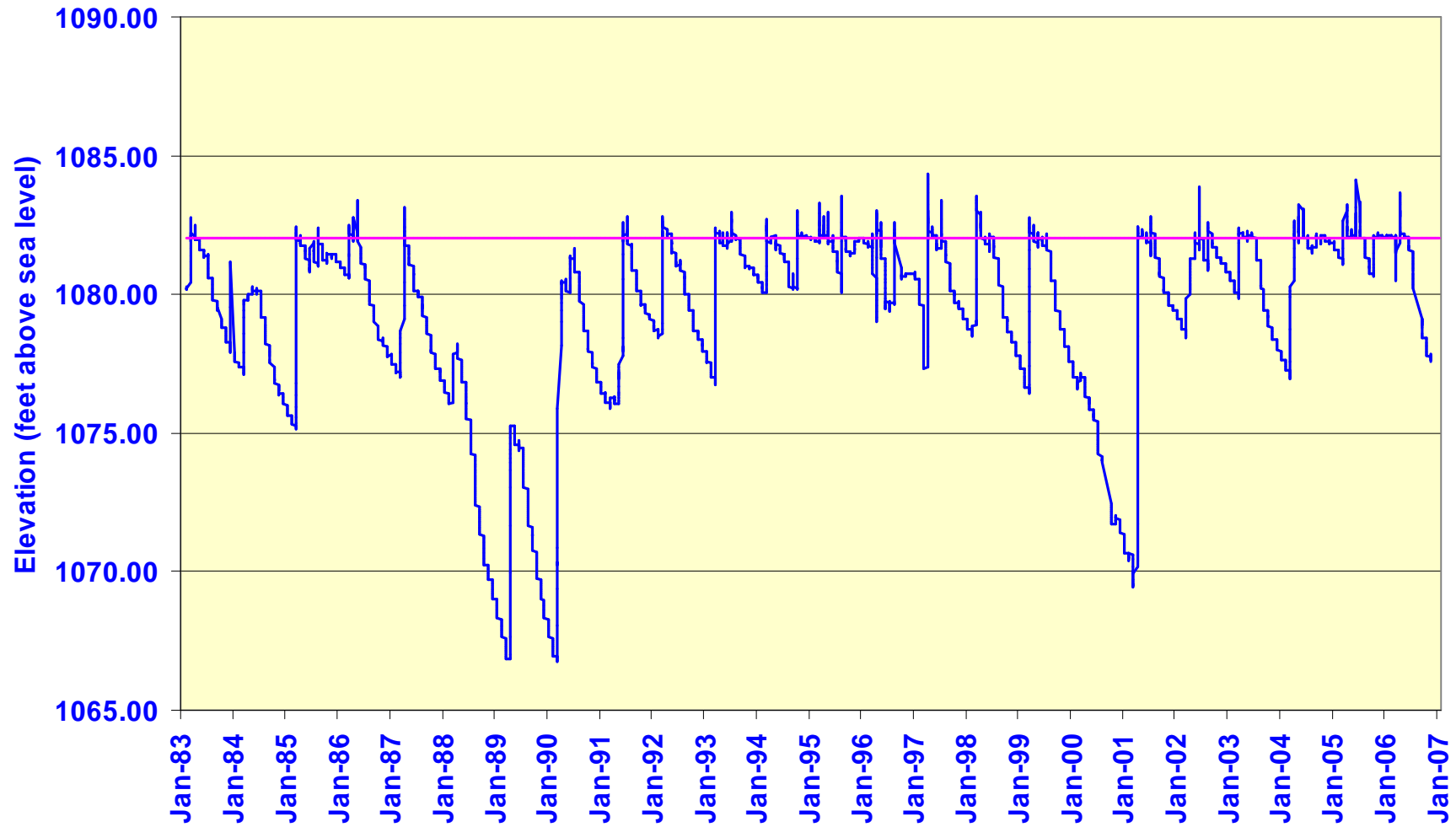
Mean Monthly Flow for January



Grass River at Standing Stone Falls *Mean Monthly Flow for January*



Lake Minnewasta near Morden *Daily Average Elevation*



Primary Drought Related Concerns



- **Reservoir storages supplying communities.**
- **River levels to enable pumping for cities, towns, irrigation.**
- **Aquifer levels supplying communities, farms.**
- **Dugouts supplying water for cattle.**
- **Suitable lake levels for water supply, fish, recreation.**
- **Supplies for hydroelectric generation.**
- **Deterioration of Water Quality.**

Primary Drought Sensitivities



- **Summer reservoir operations sensitive to short intense meteorological droughts (2 – 4 weeks) within a relatively dry period.**
- **Multiple use reservoir operations sensitive to longer dry periods (several months to years).**
- **Rivers, dugouts sensitive to short droughts like 2006.**
- **Spring runoff very important but rest of year important also.**
- **Aquifers sensitive to multiple year droughts.**
- **Long term drought-proofing strategies sensitive to design drought (worst on record).**
- **Water uses sensitive to temperature.**
- **Water quality sensitive to flow rates temperature and**

Drought Information Sources



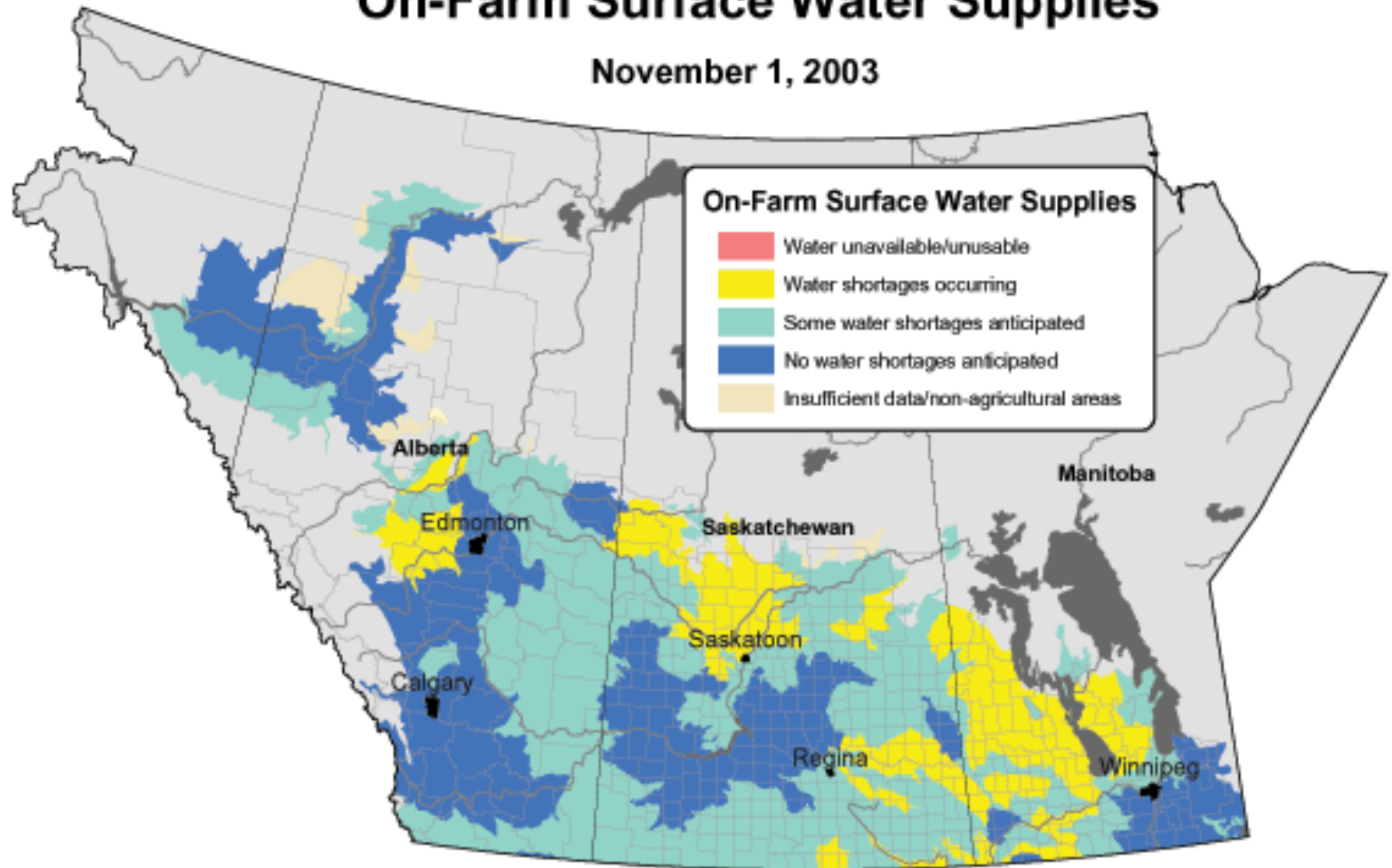
- **Historical and real time levels of rivers, lakes, reservoirs, aquifers – Water Survey of Canada, Manitoba Water Stewardship.**
- **Information on water uses – Manitoba Water Stewardship and licensed users.**
- **Precipitation Data and Statistics – Timely Climate Monitoring Network.**
- **Climate Outlooks – MSC and NOAA.**
- **Soil Moisture – Manitoba Water Stewardship, Manitoba Agriculture.**
- **Snowcover – Manitoba Water Stewardship, Climate Research Branch.**
- **Drought Indices (NADM) – PFRA.**
- **On-farm water supplies – Manitoba Water Services Board, PFRA, Manitoba Agriculture.**
- **Information on local conditions – regional staff of provincial and municipal government.**





On-Farm Surface Water Supplies

November 1, 2003





**HYDROLOGIC CONDITIONS
AND
OUTLOOK
FOR
MANITOBA**

November 14, 2003

Prepared by:

Hydrologic Forecast Centre, Groundwater Section

Manitoba Water Stewardship

**Box 14, 200 Saulteaux Crescent
Winnipeg, Manitoba
R3J 3W3**

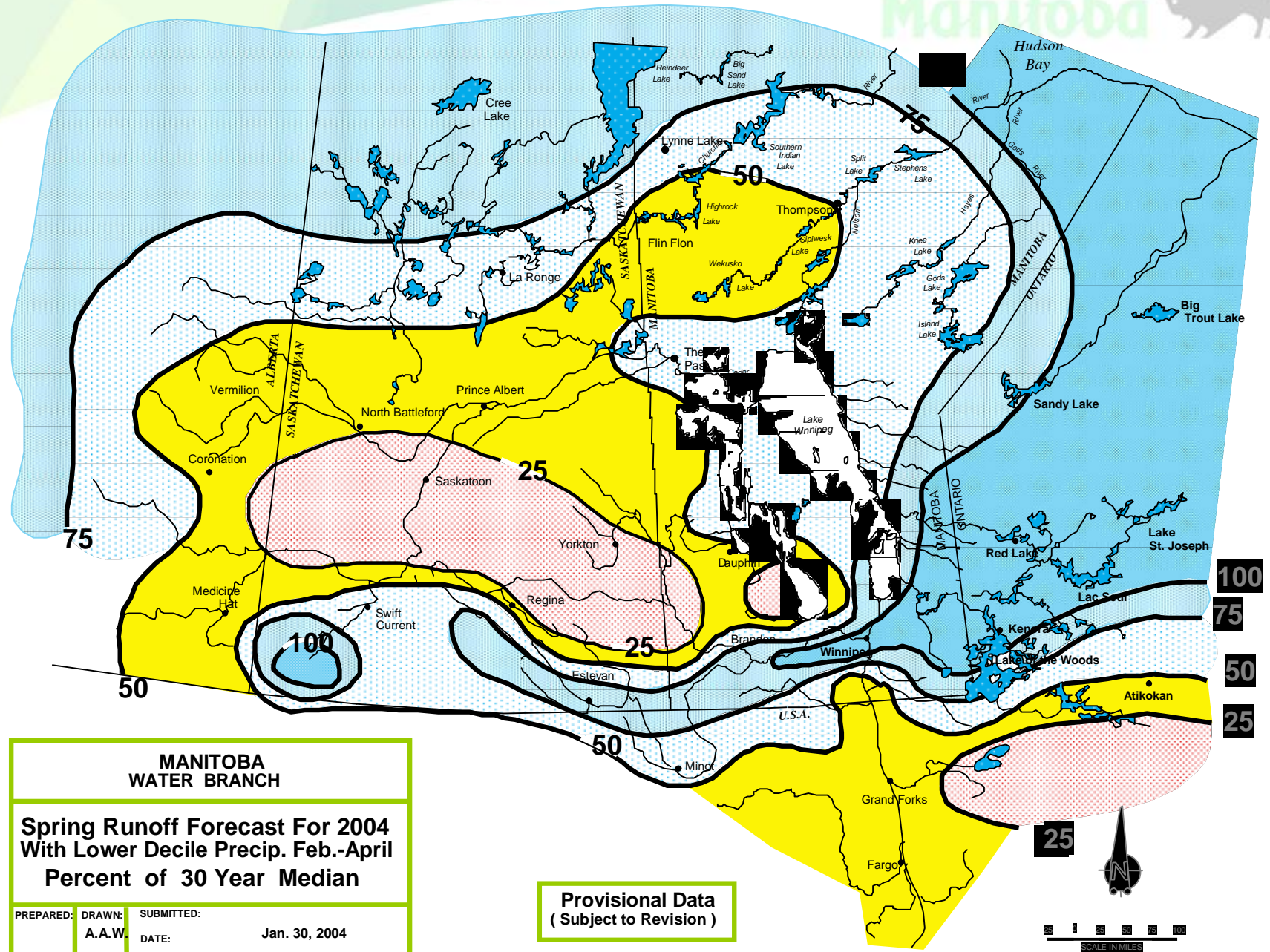
Water Supply Conditions and Outlook for Manitoba 2004



Based on **Lower Decile** Precipitation from February onward

Water Branch, Manitoba Water Stewardship, **February 5, 2004**

- **Historical Droughts, Weather.**
- **Soil Moisture and Snowcover Conditions**
- **Status / Forecast for Major Rivers, Lakes, Reservoirs
Aquifers, On-Farm Water supplies**
- **Potential Problems within each Major Watershed.**



**MANITOBA
WATER BRANCH**

**Spring Runoff Forecast For 2004
With Lower Decile Precip. Feb.-April
Percent of 30 Year Median**

PREPARED:	DRAWN:	SUBMITTED:
	A.A.W.	
DATE:	Jan. 30, 2004	

**Provisional Data
(Subject to Revision)**



Feb. 3, 2004

Manitoba Water Stewardship

Summary of Water Supply / Spring Flood Outlook for 2004

Based on *Lower Decile* Weather from now on.

Spring Runoff:

- Well below average most areas due to dry soil, low depression storage (flood risk is very low).

Rivers:

- **most larger rivers presently at 10 – 20 year lows.**
- Red, Assiniboine, Churchill lower than in 2003.
- some improvement on Winnipeg River, Nelson River.
- continued water shortages for optimum hydroelectric generation.
- water quality, fishery a concern.

Lakes:

- **Many lakes presently at 10 – 20 year lows.**
- minor rise or decline expected in 2004.
- water quality, recreation and fish a serious concern.

Summary of Water Supply / Spring Flood Outlook for 2004



Reservoirs: (operated by Manitoba Water Stewardship) **Based on Lower Decile Weather from now on.**

- most reservoirs close to full after spring runoff.
- reservoirs with small drainage areas will remain low.
- could be some stress on Shellmouth Reservoir.

Aquifers:

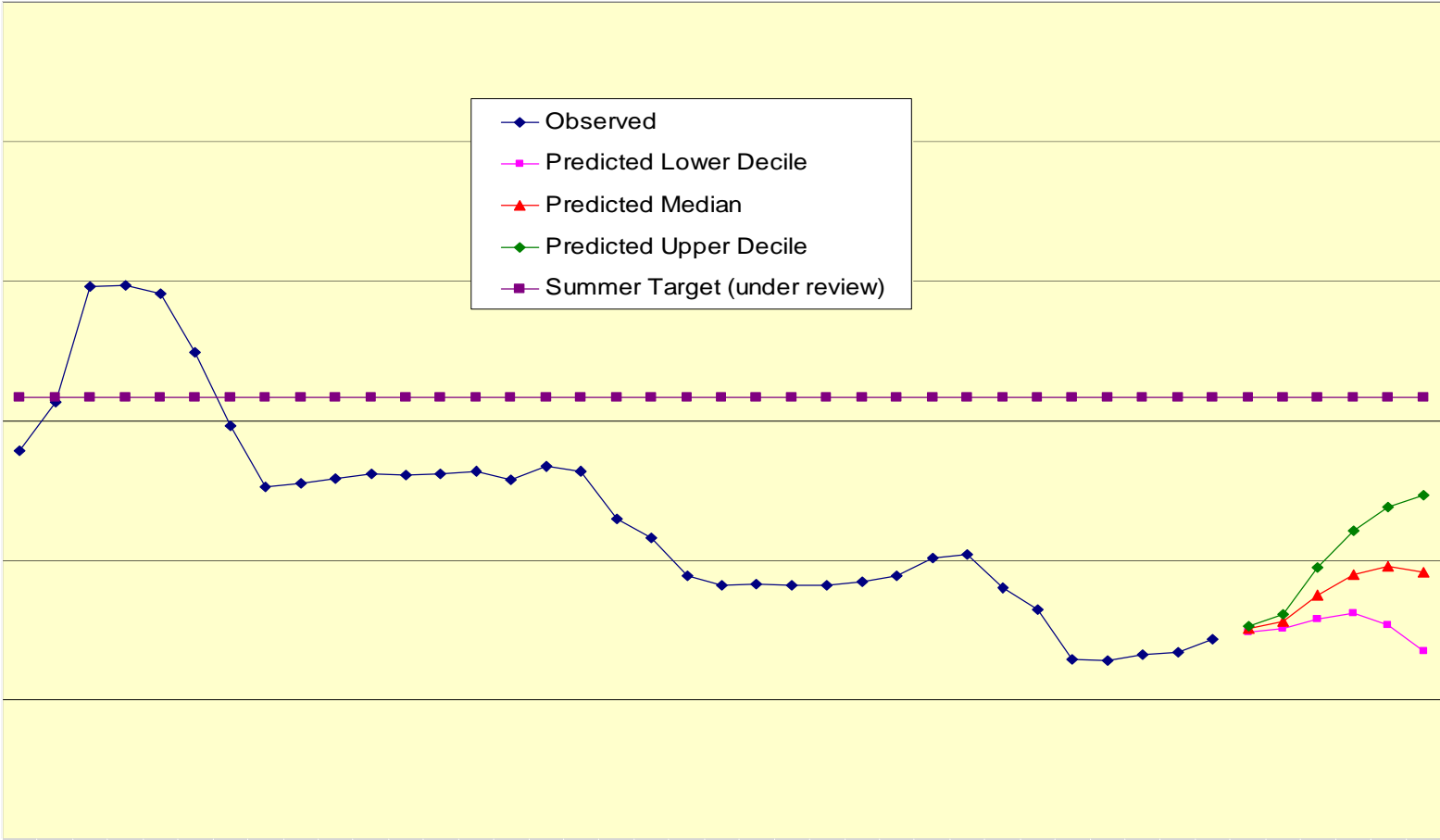
- Most aquifers low but not as low as in early 1990's.
- minor rise in spring likely (significant in confined aquifers).
- levels in autumn lower than in 2003 on heavily used aquifers.
- wells on smaller aquifers could run dry.
- fringe areas of major aquifers could run dry.
- continued problems at Ogilvie Aquifers.
- possible water access problems at Selkirk, Birds Hill, McCreary.

On-Farm Water Supplies:

- dugouts are very low in most areas except SE Manitoba.
- should be enough water to pump-fill most dugouts this spring.
- many shallow farm wells likely to run dry by late summer.
- water hauling will be necessary where piped water not available.

Lake Manitoba Forecast---2004

Feet above Sea Level



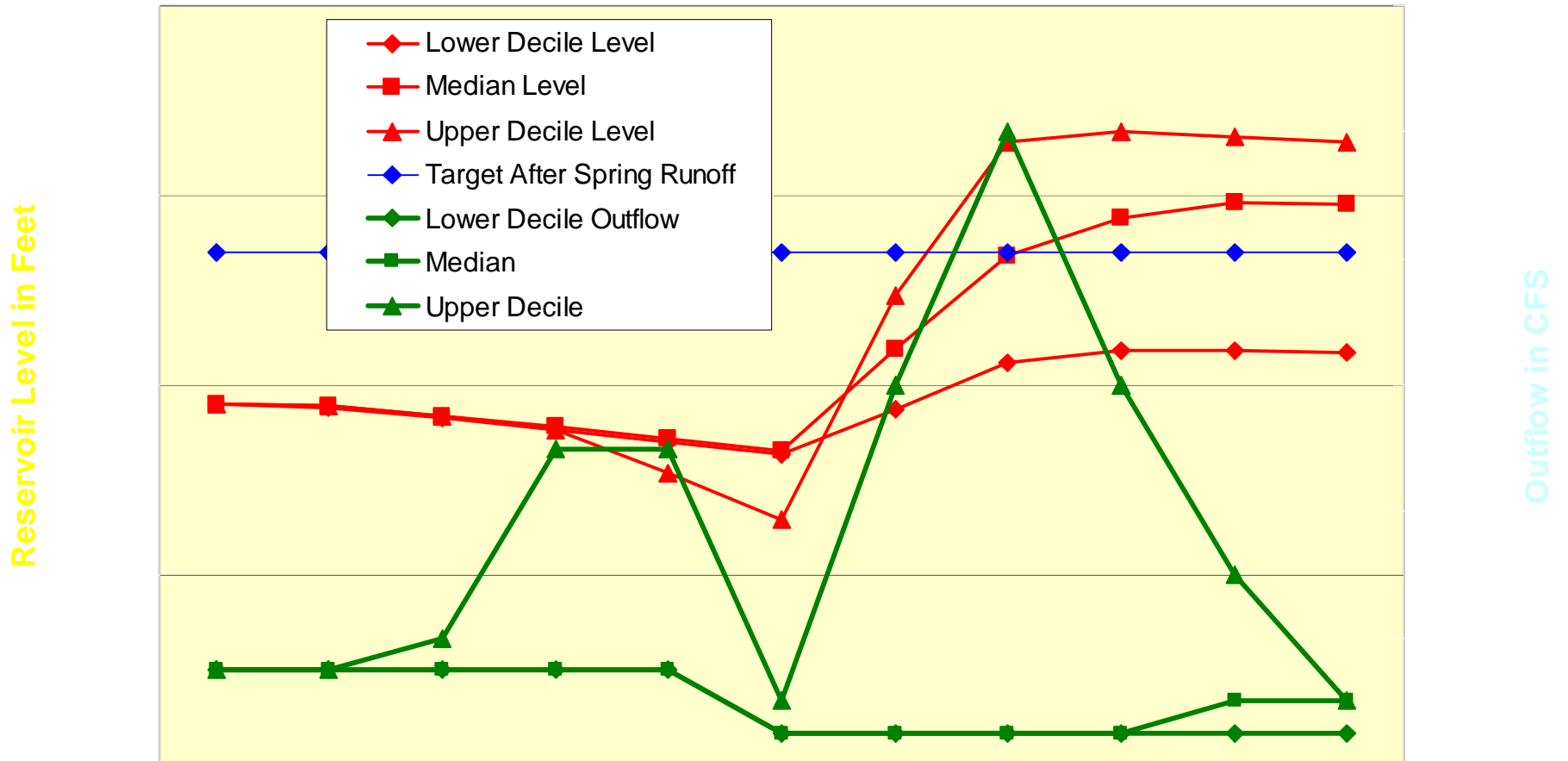
Manitoba

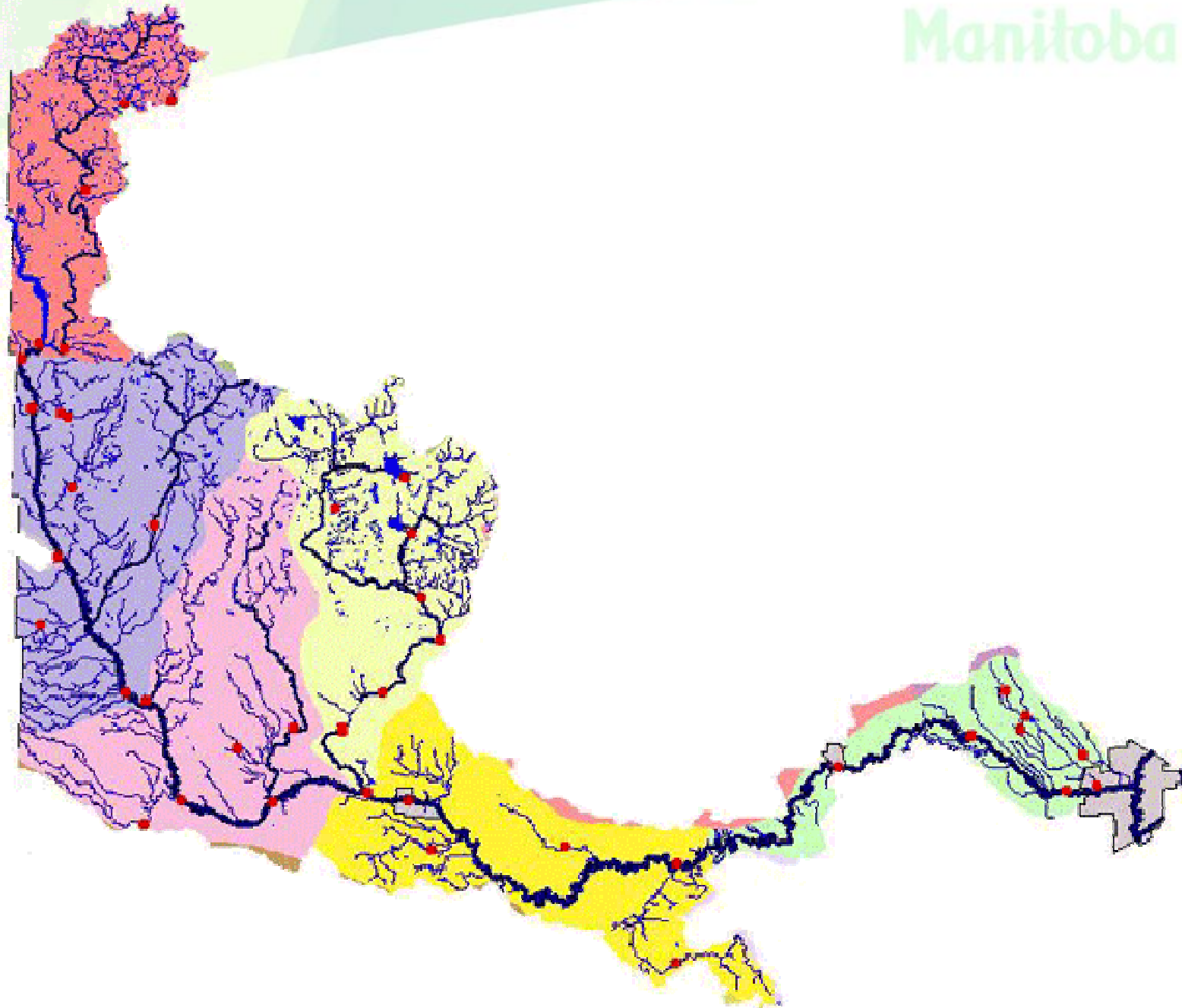




Shellmouth Reservoir Operation Scenarios---Jan. 28, 2004

Maintain 150 cfs unless Heavy Snow develops





Uses of Drought Information



- Hydrologic data is used in combination with soil moisture, precipitation, and climate statistics to prepare forecasts for rivers, reservoirs, and lakes.
- Control works operated based on forecasts and risk of drought continuing.
- Inter-Departmental Drought Committee activated when risk of water shortages is high. Plans formulated to cope with drought.
- Water conservation is undertaken – uses restricted to important needs.
- Actions such as:
 - pumping to fill dugouts during spring.
 - water hauling.
 - deepening of wells, drilling new wells.
 - using alternate sources of water.
 - water rationing.

Pertinent DRI Research



- **Forecasting onset of Droughts.**
- **Forecasting Duration of Droughts.**
- **Forecasting Spatial Extent of Drought.**
- **Forecasting Severity of Droughts.**
- **Statistics (probability) of various types of droughts for several time horizons e.g. 2050, 2100.**

(Frequency, Duration, Extent, Severity)

- **Knowledge of Causes.**

e.g. Less Snow, Greater Evapotranspiration, different annual time distribution of runoff, summer dry or winter dry.

Short Term (first year):

- **Outline Objectives and Research Conducted.**
- **Ask Partners for Feedback.**
- **Progress Report at end of Year.**

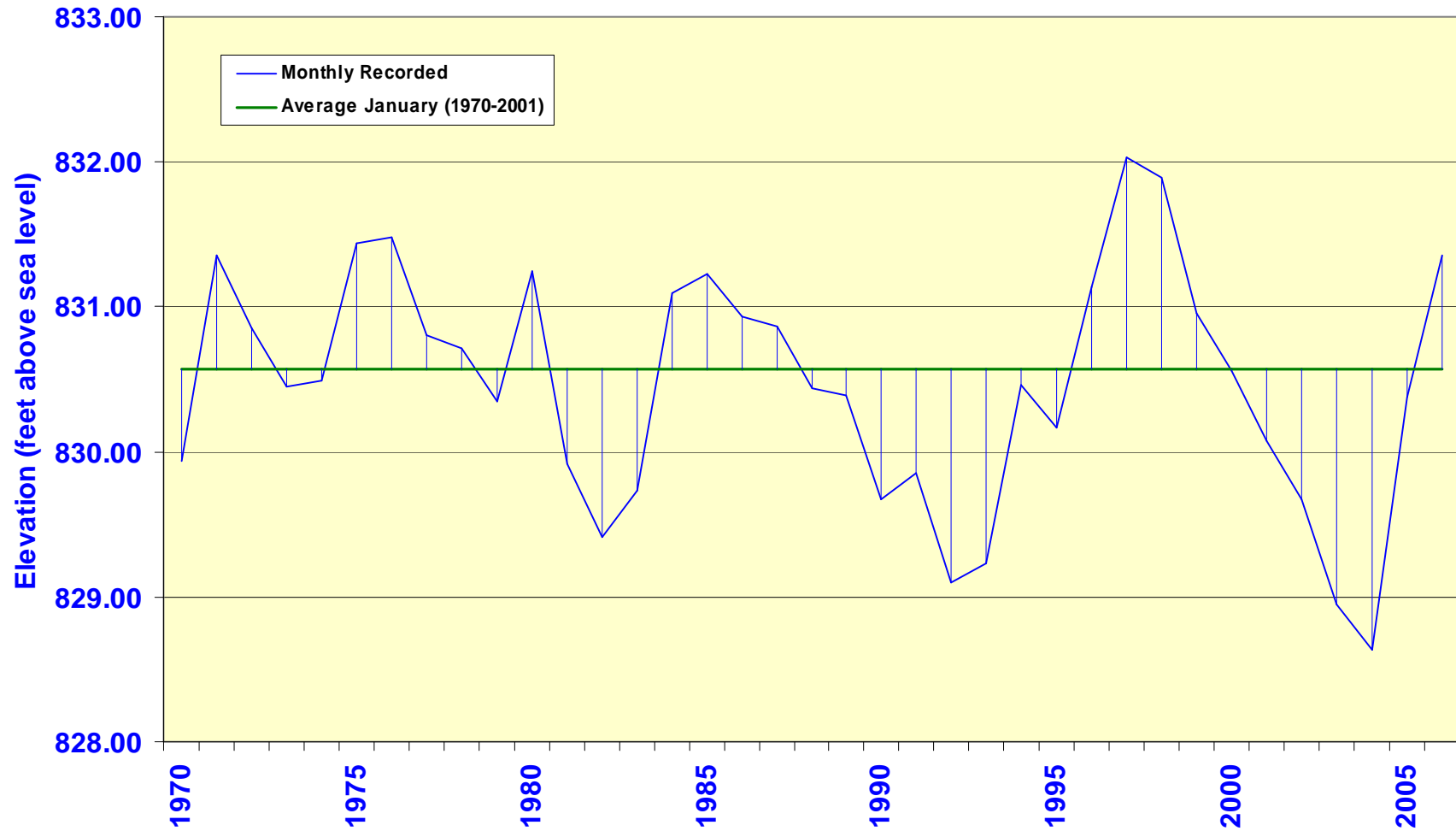
Longer Term (next 4 years):

- **Annual Progress Reports.**
- **Additional Workshop at end of 2nd Year (or as Recommended by Researchers).**
- **Overview of significant results as soon as available.**



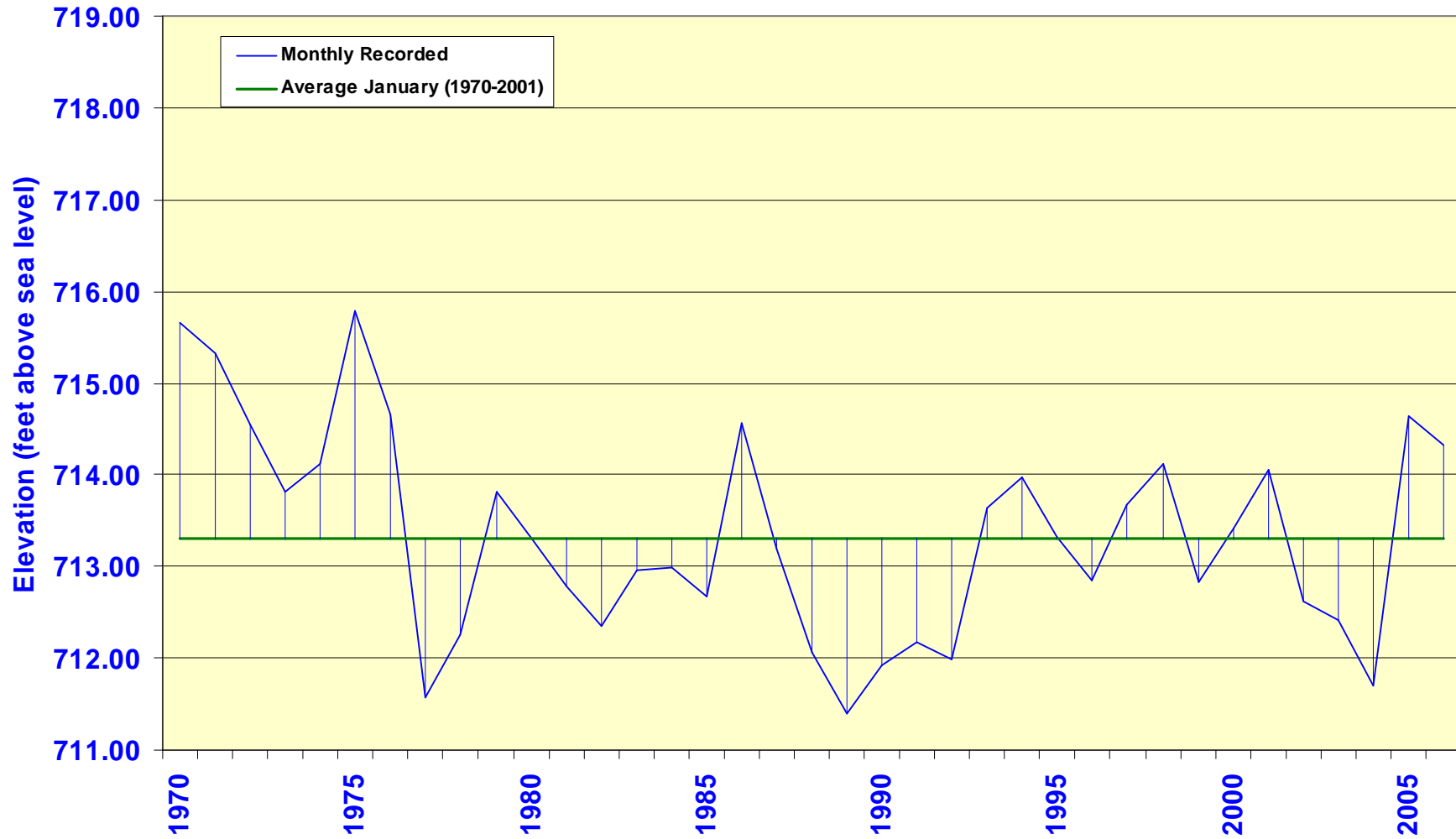


Lake Winnipegosis Mean Monthly Elevation for January

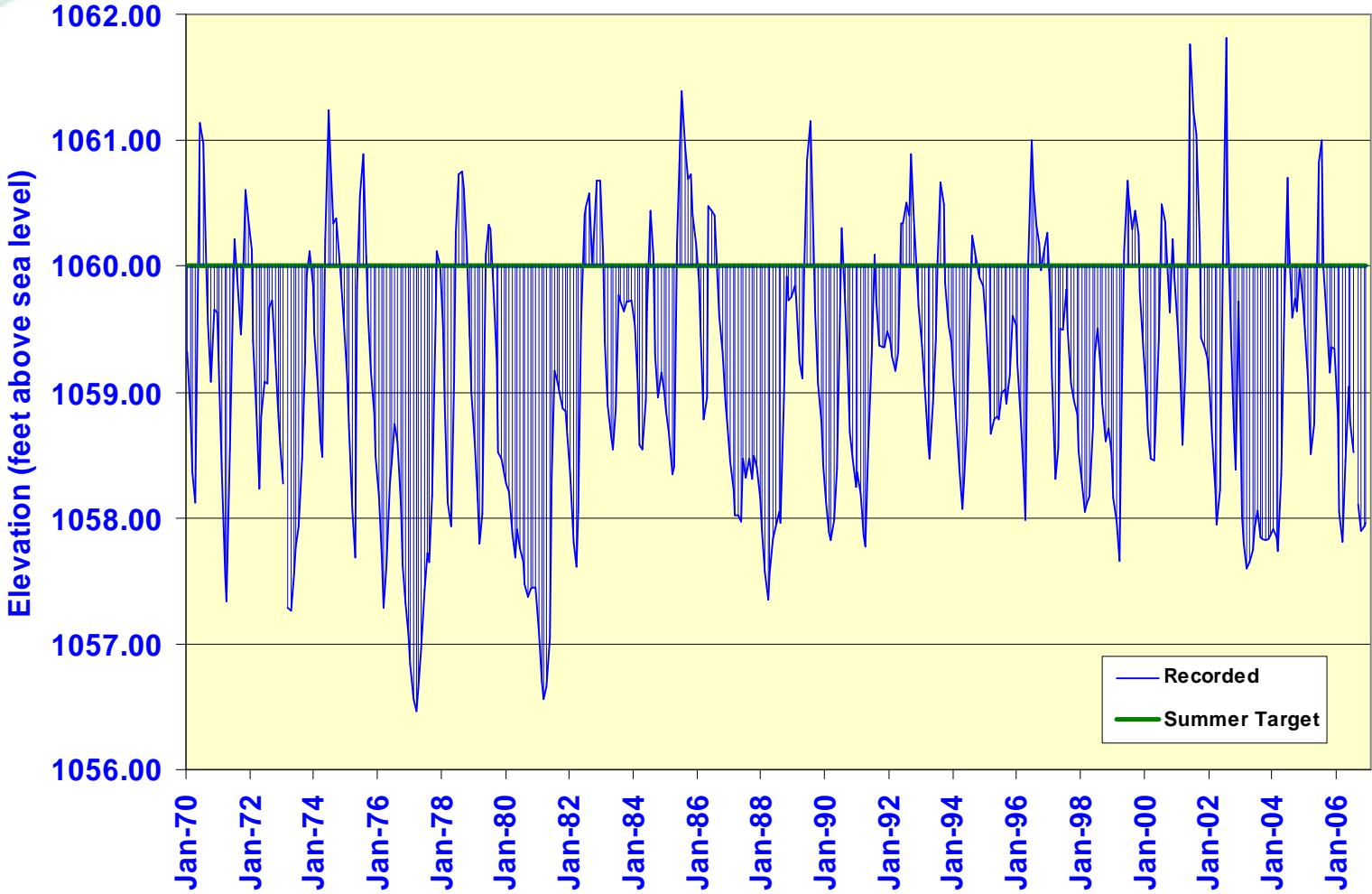


Lake Winnipeg

Mean Monthly Elevation for January



Lake of the Woods Mean Monthly Elevation



Churchill River at Leaf Rapids Mean Monthly Flow for January

