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Hydrology Input for West Souris River IWMP

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Manitoba Water Stewardship

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Outline

- Overall view of:
  - drainage area
  - watershed characteristics
  - gauging stations
  - meteorological stations
- Runoff from selected rivers
  - annual volumes
  - monthly distributions
  - runoff productivity
  - 1976 flood
- Climate
  - precipitation
  - air temperature

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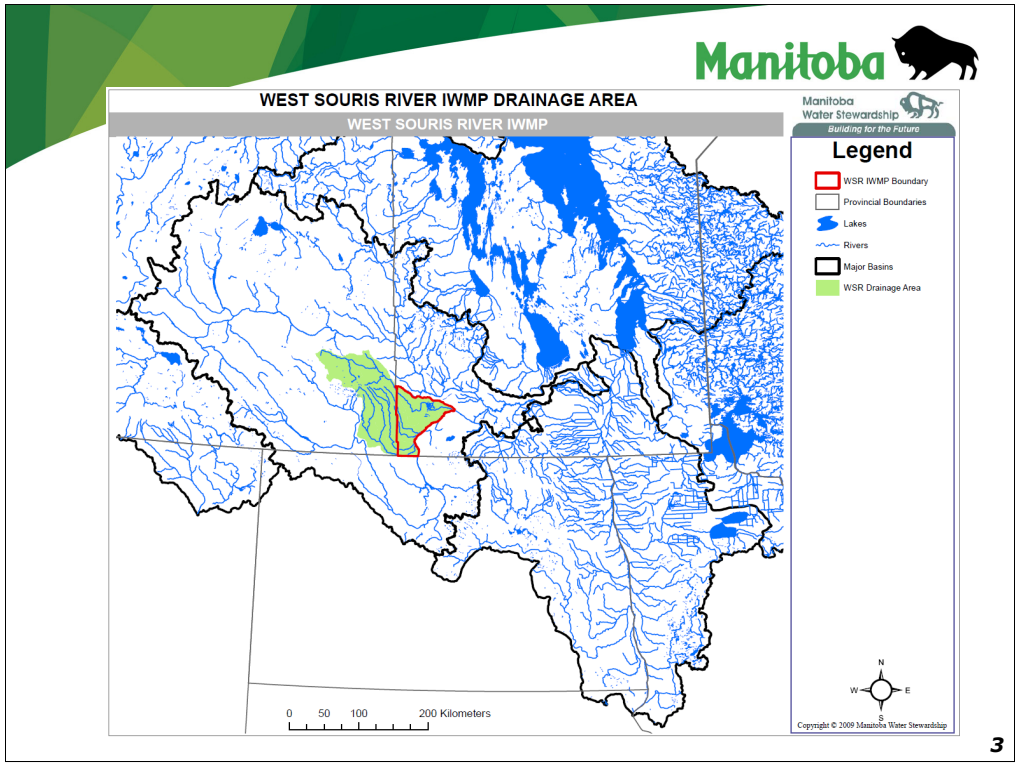

The drainage area of the creeks and rivers of the WSR IWMP extend into Saskatchewan. The creeks travel in a southeast direction through the WSR IWMP before discharging to various points into the Souris River. The total drainage area (shown in green) of the tributaries draining through the WSR IWMP is 13,330 km^2, while the IWMP area alone is 4320 km^2.

The drainage area of the WSR covers a large area of the north and central region of the Souris River watershed. The main branch of the Souris River originates west of the WSR drainage area and travels in a “U” shape down into the U.S.A. from Saskatchewan before reentering into Manitoba. The Souris River watershed (61,000 km^2) is approximately 38% of the Assiniboine River watershed. Runoff from the WSR watershed eventually ends up in Lake Winnipeg by travelling down the Souris, Assiniboine, and Red Rivers.

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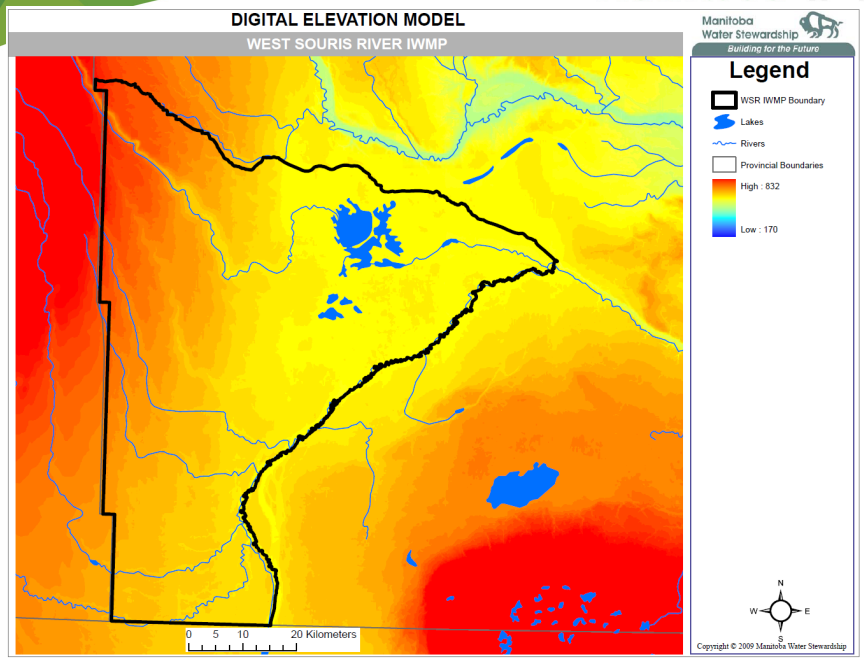
DIGITAL ELEVATION MODEL
WEST SOURIS RIVER IWMP
Manitoba Water Stewardship
Building for the Future
Legend
WSR IWMP Boundary
Lakes
Rivers
Provincial Boundaries
High : 832
Low : 170
0 5 10 20 Kilometers
N
W
E
S
Copyright © 2009 Manitoba Water Stewardship

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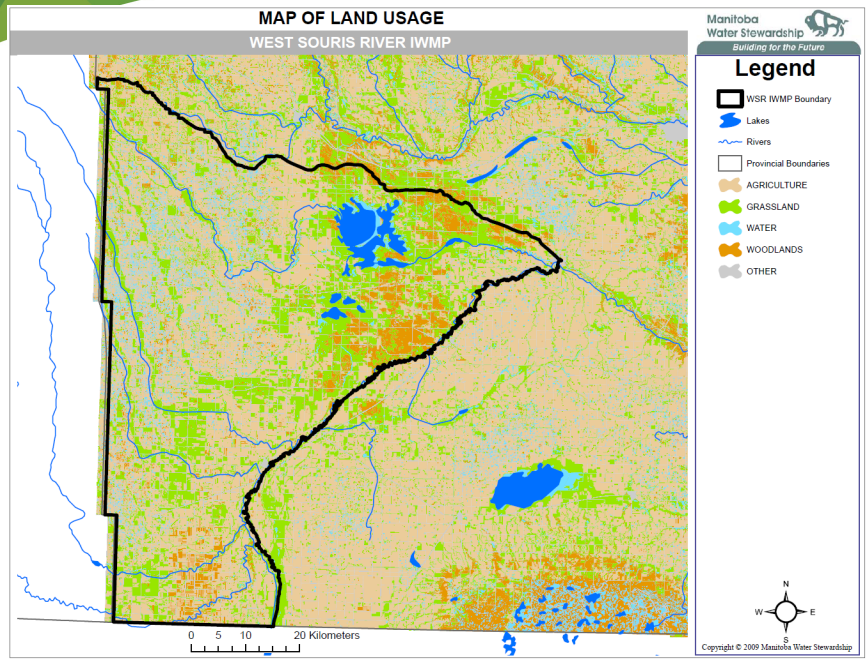
MAP OF LAND USAGE
WEST SOURIS RIVER IWMP
Manitoba Water Stewardship
Building for the Future
Legend
WSR IWMP Boundary
Lakes
Rivers
Provincial Boundaries
AGRICULTURE
GRASSLAND
WATER
WOODLANDS
OTHER
N
W
E
S
0 5 10 20 Kilometers
Copyright © 2009 Manitoba Water Stewardship

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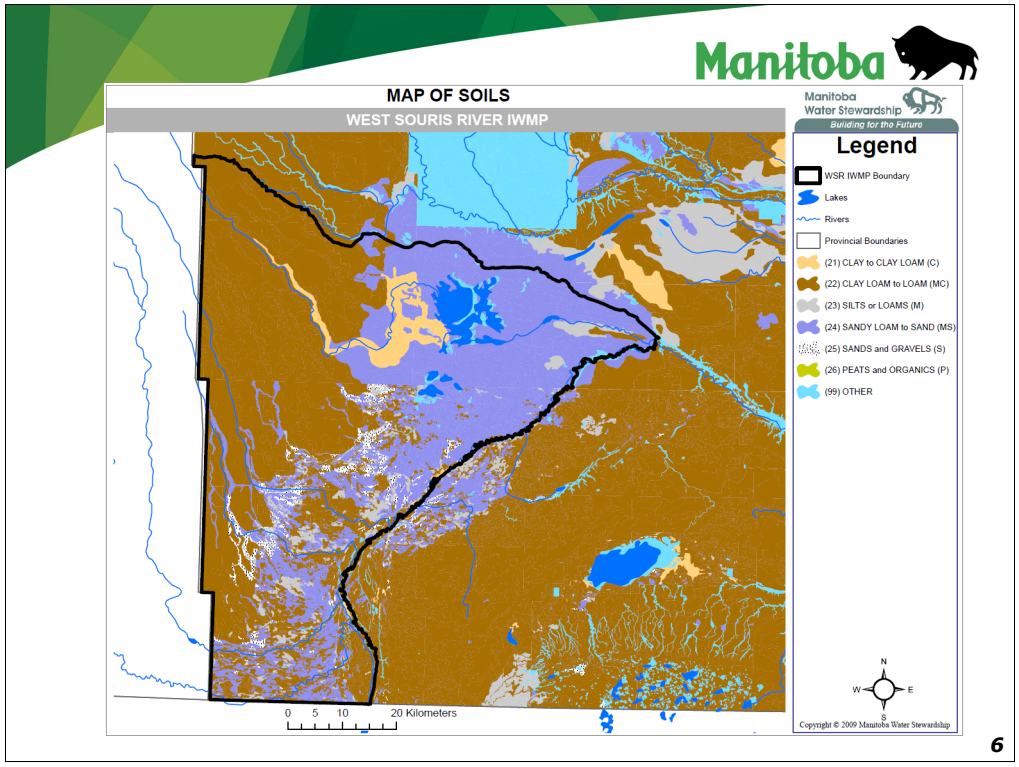
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MAP OF SOILS
WEST SOURIS RIVER IWMP
Manitoba Water Stewardship
Building for the Future
Legend
WSR IWMP Boundary
Lakes
Rivers
Provincial Boundaries
(21) CLAY to CLAY LOAM (C)
(22) CLAY LOAM to LOAM (MC)
(23) SILTS or LOAMS (M)
(24) SANDY LOAM to SAND (MS)
(25) SANDS and GRAVELS (S)
(26) PEATS and ORGANICS (P)
(99) OTHER
N
W
E
S
0 5 10 20 Kilometers
Copyright © 2009 Manitoba Water Stewardship
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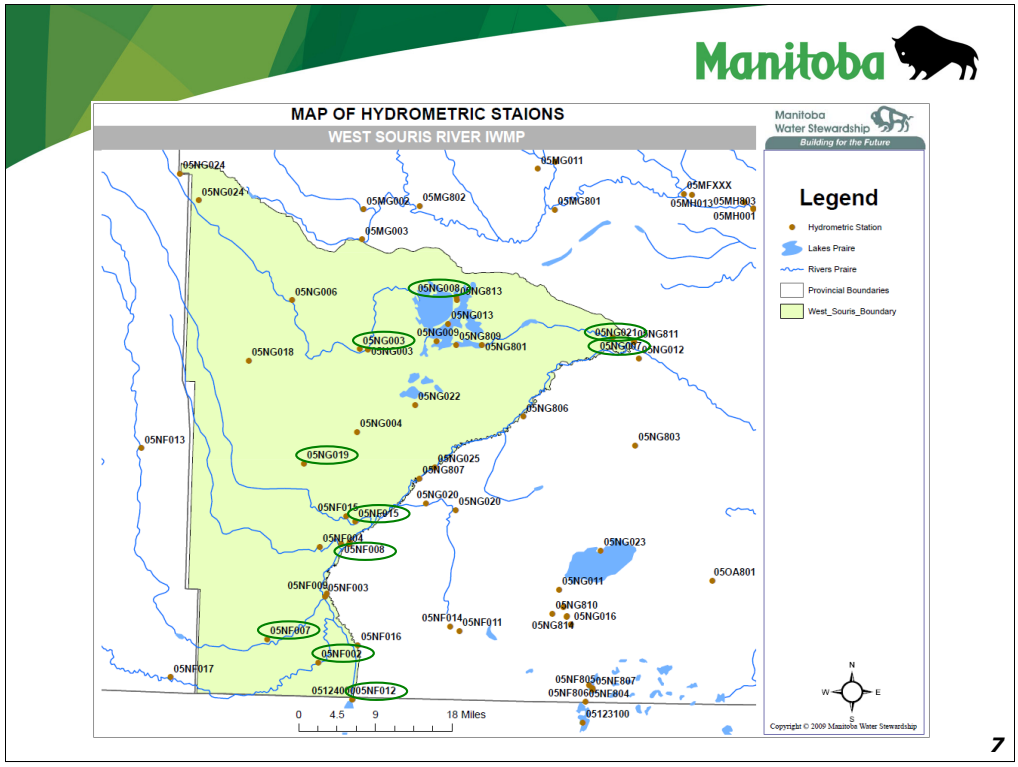

There are many hydrometric stations for the creeks, rivers and lakes in the WSR IWMP boundary. However, the length and completeness of the data varies from station to station. Most of the stations shown in the figure have either short lengths of record or have been discontinued many years ago. Fortunately, each of the main water courses running through the WSR IWMP has at least one station with a reasonable length of data. The data for the stations circled in green were obtained for analysis.

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Summary of investigated stations

Station #	Station name	Gross Drainage Area (km^2)	Effective Drainage Area (km^2)	Average Annual Discharge (dam^3)	Maximum Annual Discharge (dam^3)	Series
05NF002	Antler River near Melita	3,210	1,360	2,4514	186,572	1943-2008
05NF007	Gainsboro Creek near Lyleton	1,150	561	9,871	90,149	1956-2008
05NF008	Graham Creek near Melita	730	178	3,105	40,847	1943-1996
05NF012	Souris River near Westhope	43,700	14,600	220,289	1451906	1931-2007
05NF015	Jackson Creek near Melita	448	Not available	4,556	46,530	1975-1990
05NG003	Pipestone Creek near Pipestone	4,200	1,560	34,422	246,180	1957-1998
05NG019	Stony Creek near Broomhill	460	202	4,740	38,823	1965-1991
05NG007	Plum Creek near Souris	5,380	2,100	22,291	282,046	1956-1993
05NG021	Souris River near Souris	58,700	20,500	431,119	2,456,288	1967-2008

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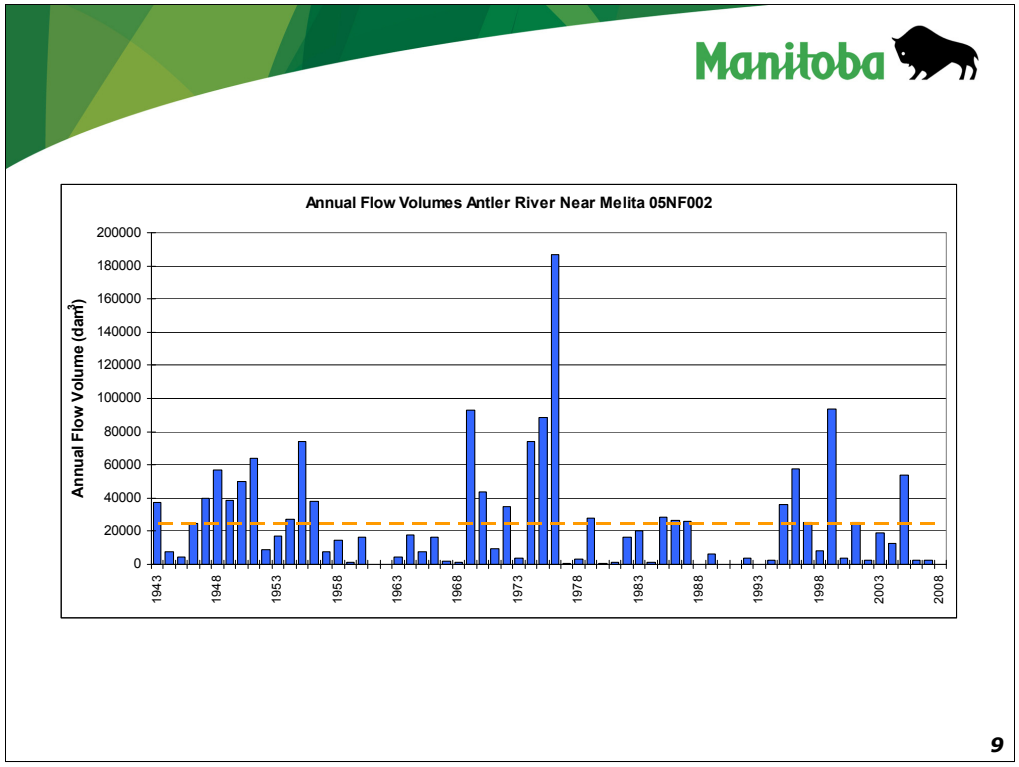
Summary of the name, drainage area, average and maximum annual discharge, and series length of the gauges analyzed. Analysis results are shown in the following graphs.

The average and maximum annual discharge data was used to regionalize flows with different sizes of drainage area, as shown a on a later slide.



Annual flows on the Antler River. The orange dashed line represents the mean annual flow volume.

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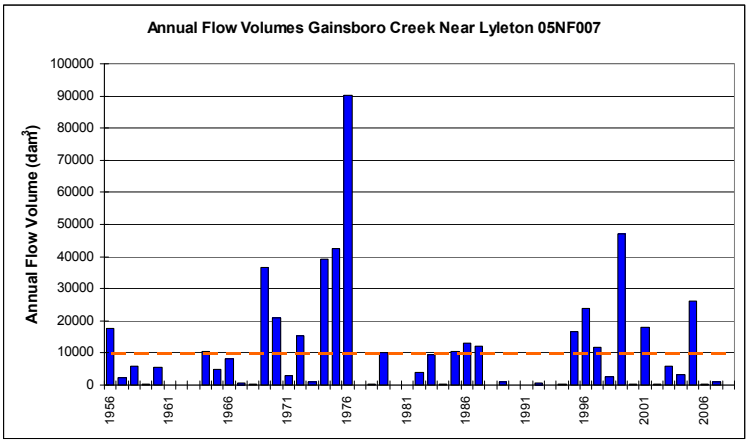
Annual Flow Volumes Gainsboro Creek Near Lyleton 05NF007
Annual Flow Volume (dam³)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1956
1961
1966
1971
1976
1981
1986
1991
1996
2001
2006

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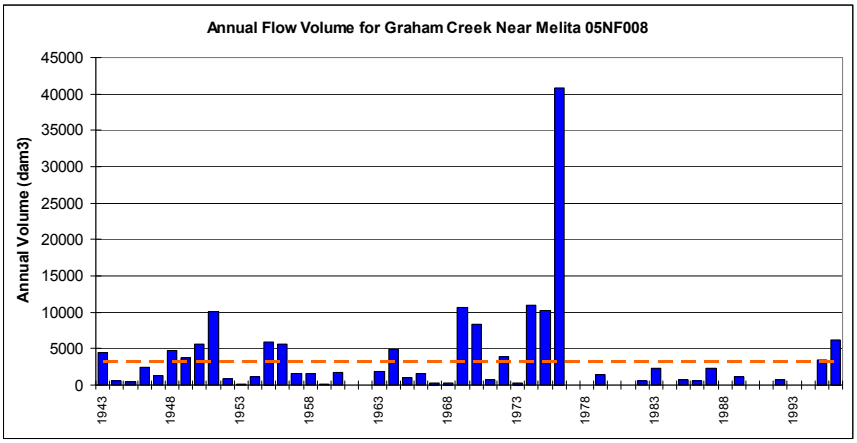
Annual Flow Volume for Graham Creek Near Melita 05NF008
Annual Volume (dam3)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1943
1948
1953
1958
1963
1968
1973
1978
1983
1988
1993

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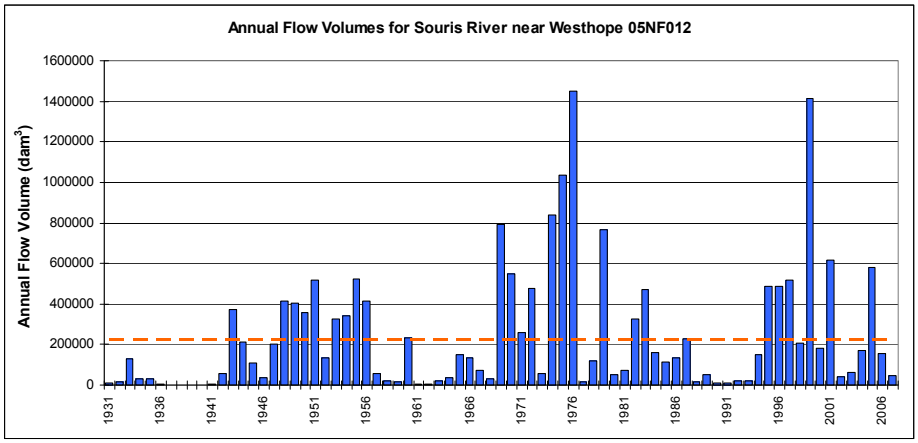
Annual Flow Volumes for Souris River near Westhope 05NF012
Annual Flow Volume (dam3)
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
1931
1936
1941
1946
1951
1956
1961
1966
1971
1976
1981
1986
1991
1996
2001
2006

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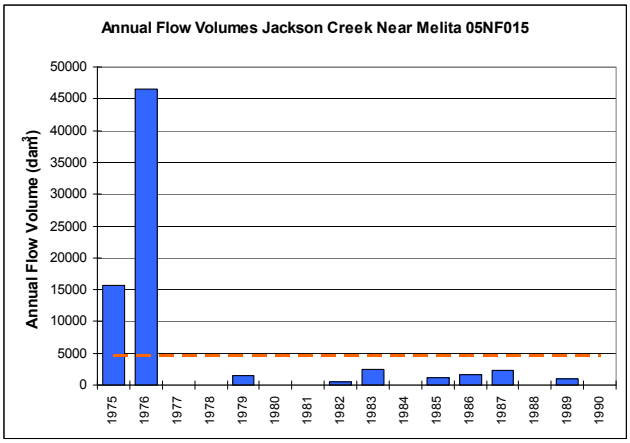
Annual Flow Volumes Jackson Creek Near Melita 05NF015
Annual Flow Volume (dam³)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990

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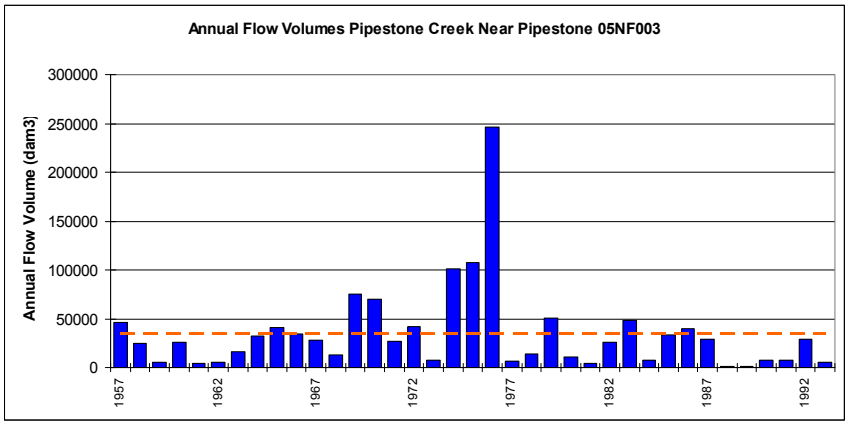
Annual Flow Volumes Pipestone Creek Near Pipestone 05NF003
Annual Flow Volume (dam3)
300000
250000
200000
150000
100000
50000
0
1957
1962
1967
1972
1977
1982
1987
1992

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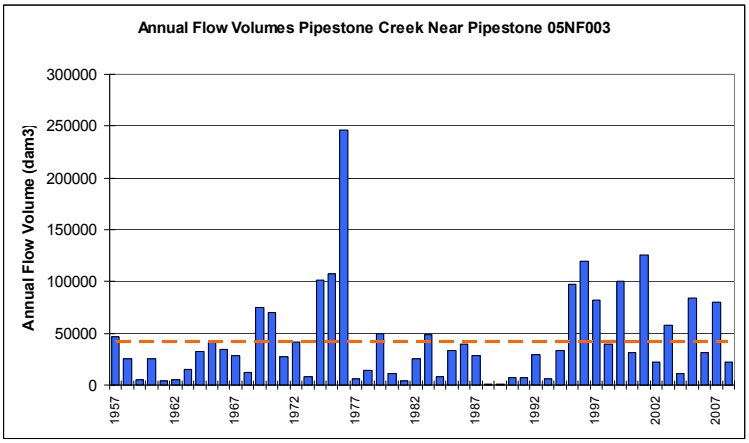
Annual Flow Volumes Pipestone Creek Near Pipestone 05NF003
Annual Flow Volume (dam3)
300000
250000
200000
150000
100000
50000
0
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007

15

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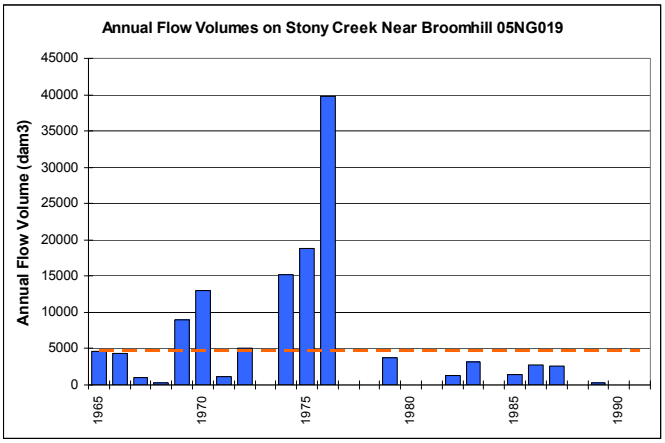
Annual Flow Volumes on Stony Creek Near Broomhill 05NG019
Annual Flow Volume (dam3)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1965
1970
1975
1980
1985
1990

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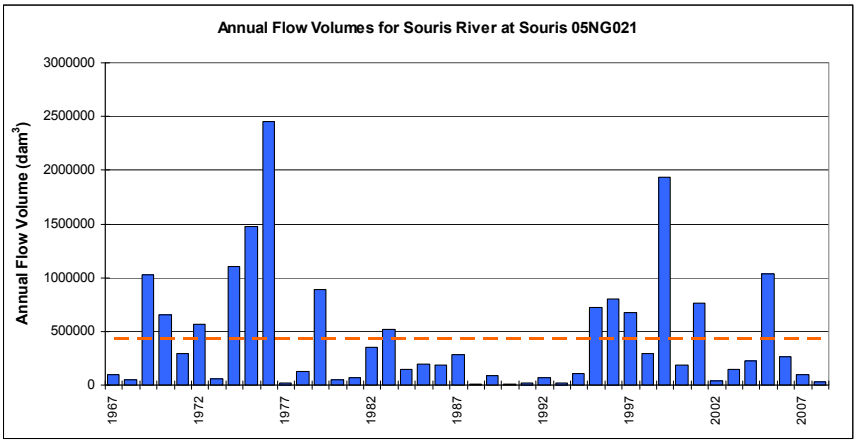
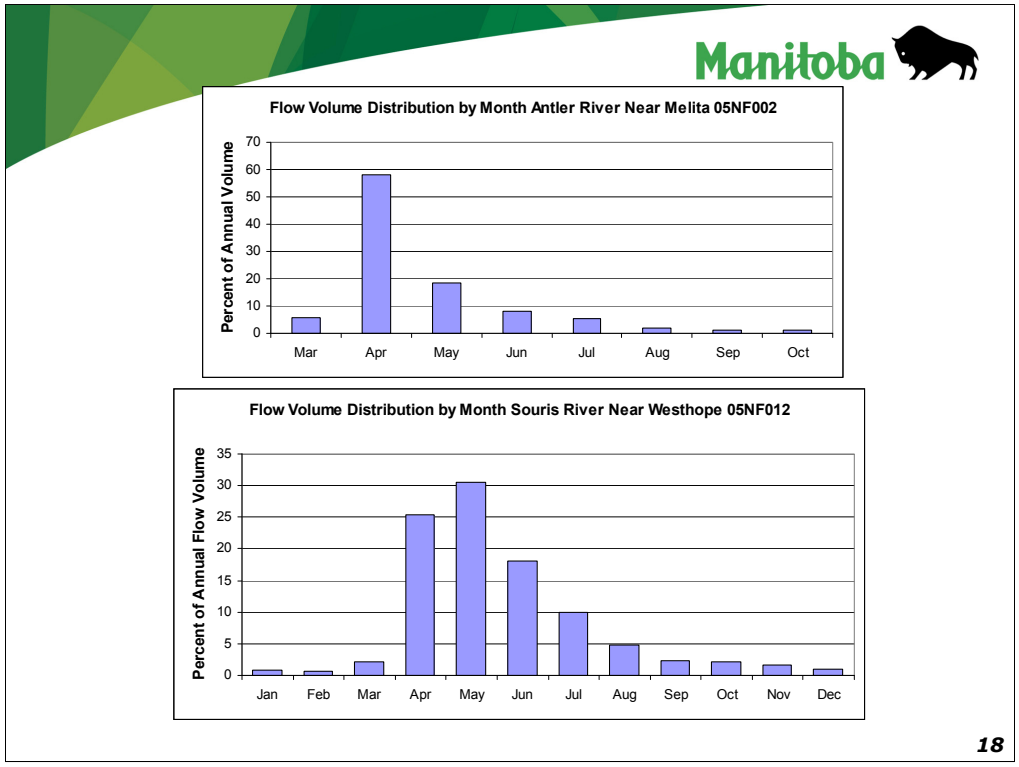
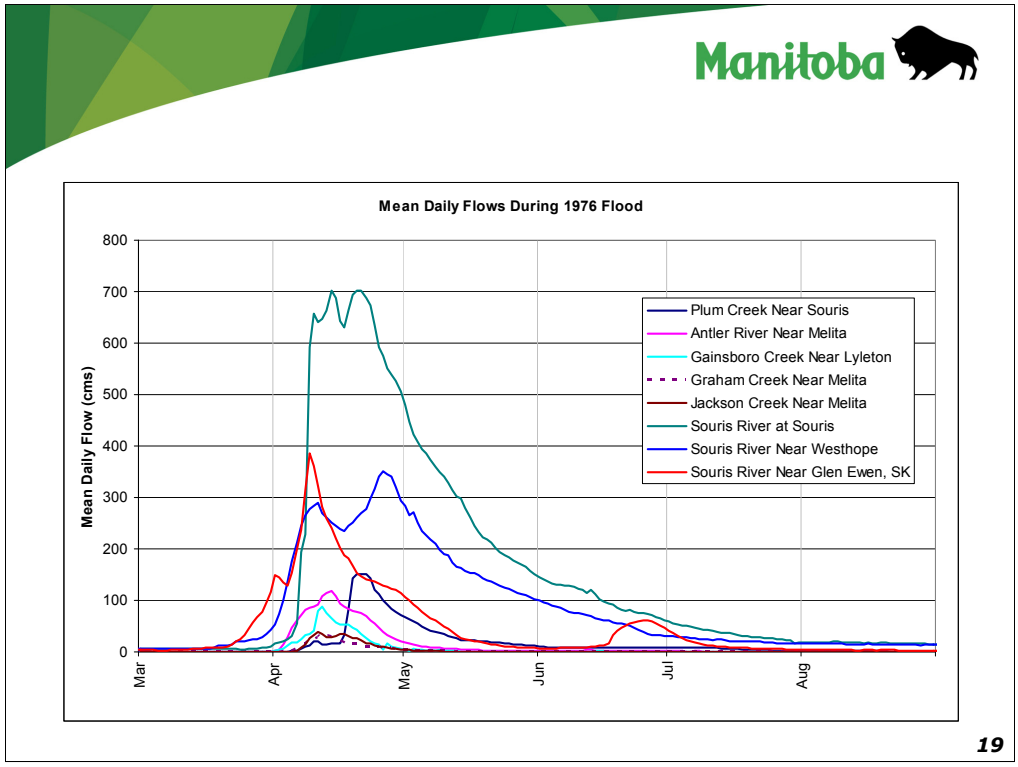

Annual Flow Volumes for Souris River at Souris 05NG021
Annual Flow Volume (dam³)
3000000
2500000
2000000
1500000
1000000
500000
0
1967
1972
1977
1982
1987
1992
1997
2002
2007

17



Monthly distribution of flow are shown in the figures. The pattern of flow in the Antler River is typical of the other streams in the WSR watershed. Flow is concentrated into the spring melt and no flow, or very little flow, is experienced in the winter months.

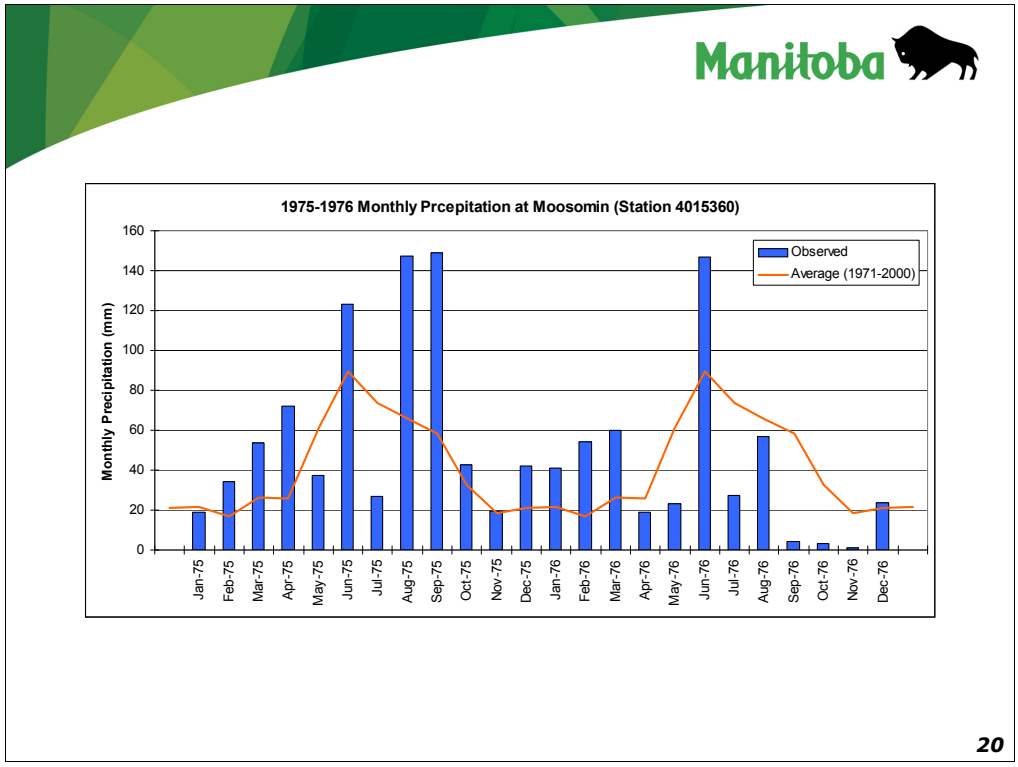
With a much larger watershed, the flow in the Souris River is more dispersed throughout the year compared to the WSR tributaries, although flows are still much higher during the spring melt. Flow is usually sustained during the winter months.



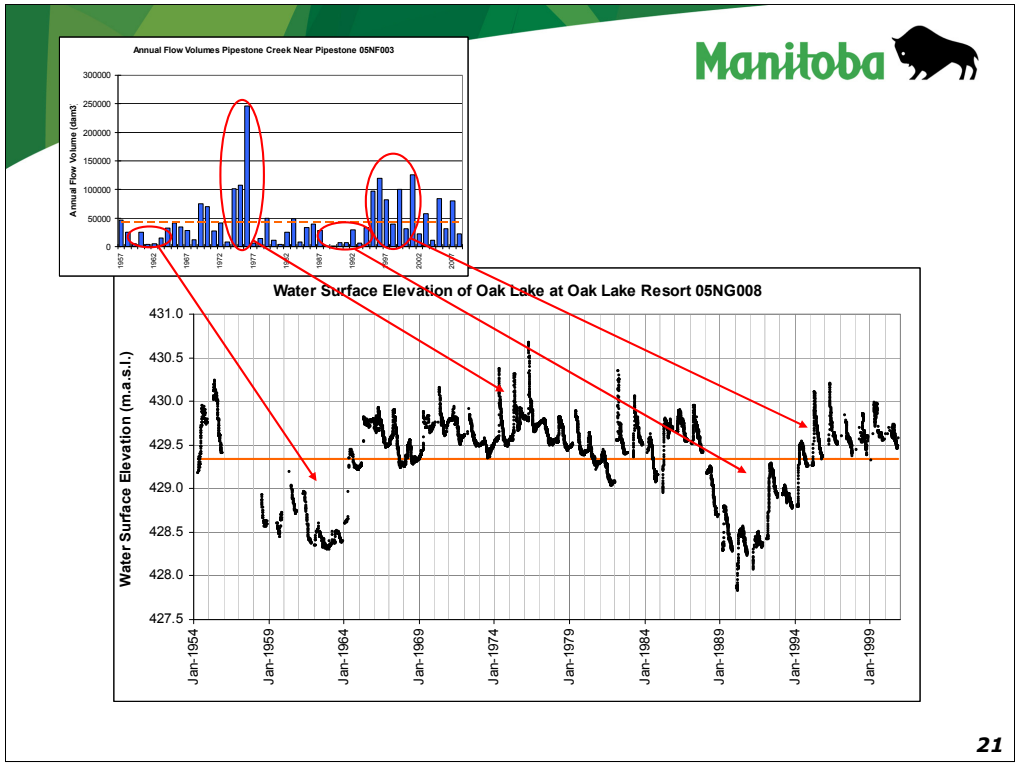
At all stations the largest annual flow volumes and the highest peak flows were observed in 1976. Flow data for 1976 was extracted from many of the stations and plotted on the figure shown.

Hydrographs are shown for three different points on the Souris River, one upstream in Saskatchewan (near Glen Ewen), one near the Manitoba-U.S.A. border (near Westhope) and one at the downstream extent of the West Souris River Watershed (at Souris). The graph also features smaller hydrographs of the main local tributaries of the Souris River in the West Souris River Watershed area.

The Souris River hydrographs feature two crests in the Manitoba portion on the river. The first peak is created by the peak flows from local tributaries. The second peak is a result of the delayed response of the snowmelt from the western most portion of the watershed in Saskatchewan. This water runs into the main stem of the Souris River and must travel south into the U.S.A. before arriving in Manitoba. The Souris River is peaking at Glen Ewen at the same time the local tributaries in Manitoba are peaking.

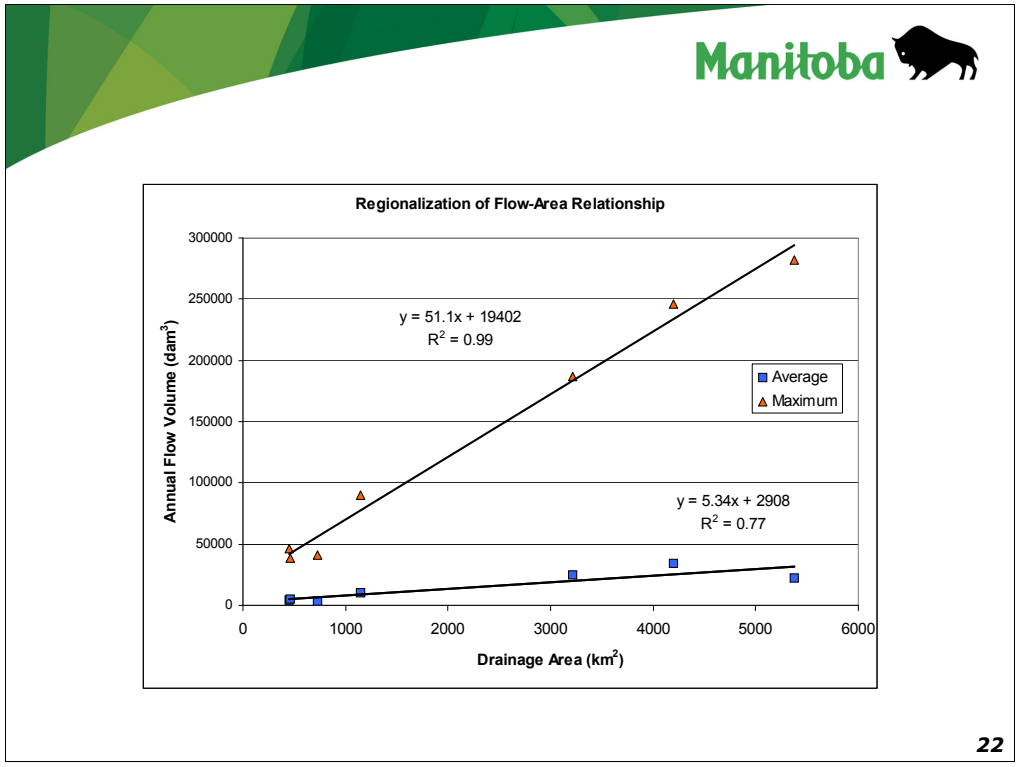


The average precipitation is compared the precipitation during 1975 and 1976 at Moosomin, SK. It can be seen that precipitation was well above the normal conditions during the fall of 1975 and during the winter and early spring of 1976.



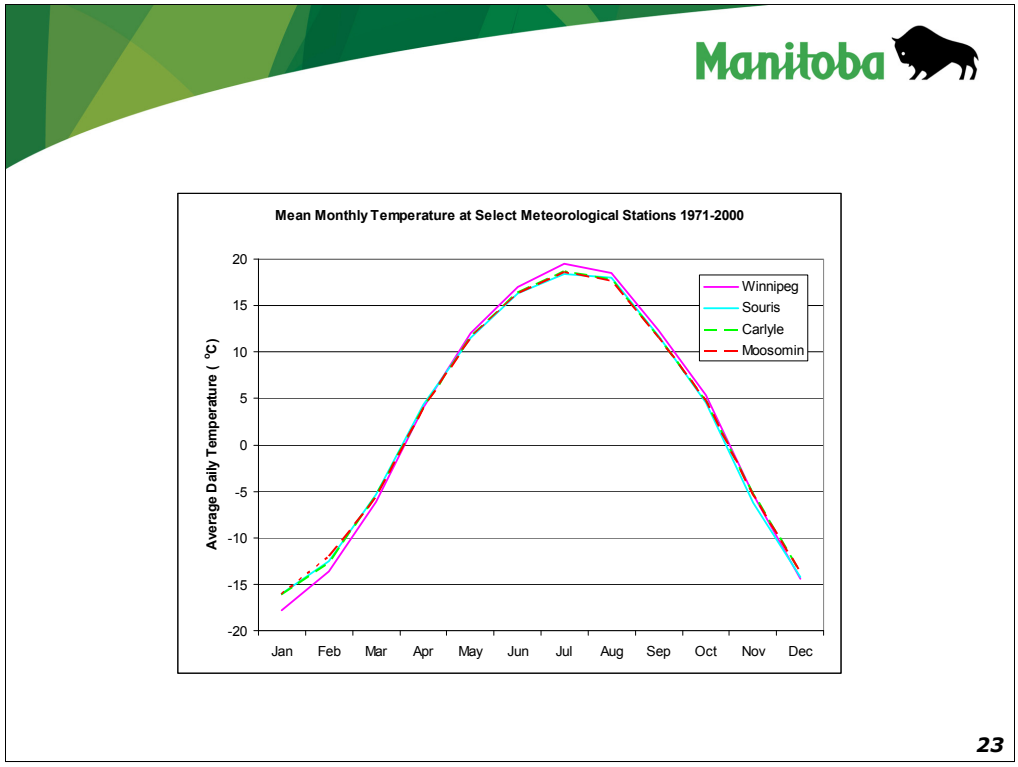
The figure shows the levels on Oak Lake from 1954 to 2000. During this period the lake was highest in April 1976 (430.76 m.a.s.l.) and lowest in February 1990 (427.84 m.a.s.l.). Each year the lake level fluctuates as levels increase in during the spring melt and then decrease as water leaves via Plum Creek and evaporation.

Longer trends in lake levels are correlated to periods of wet or dry years. Lake levels decreased during low flow periods in the late 50's and early 60's, and the late 80's early 90's. Lake levels rebounded after these dry periods when above average flows were experienced in the 70's and mid and late 90's.

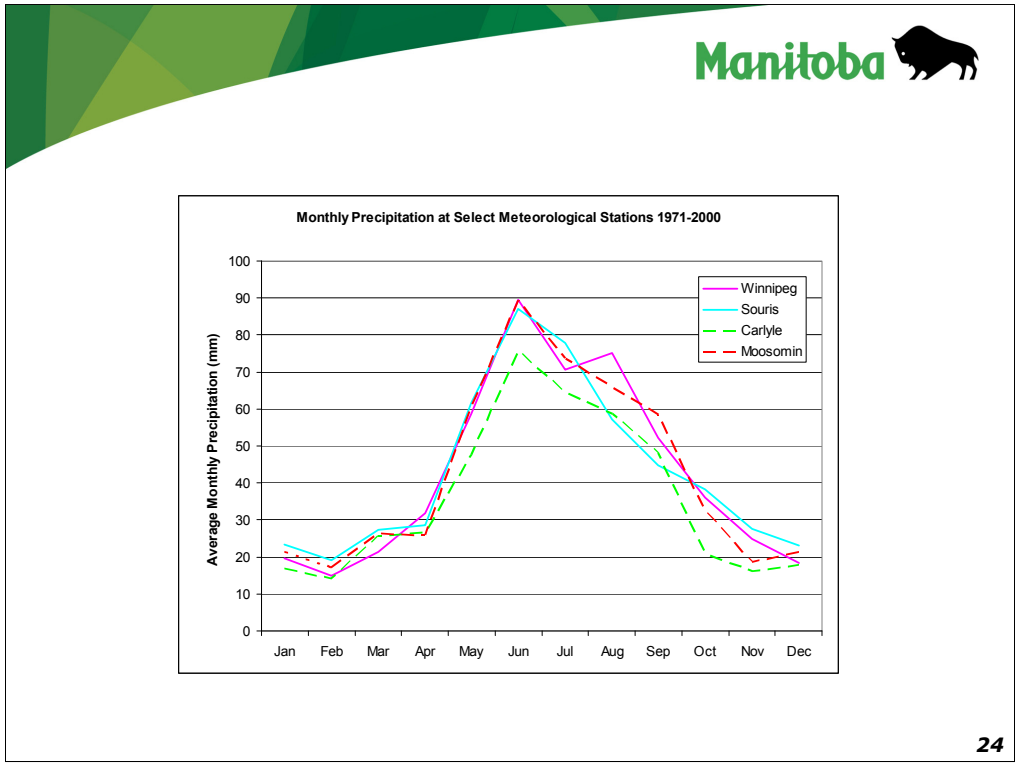


These lines represent a regionalization of the maximum and average annual runoff volumes from many catchments of different areas found within the West Souris River Watershed region. The data used to create the plot can be found in the table of hydrometric stations investigated shown earlier.

The maximum and average annual volumes of runoff at other points in the watershed can be estimated from the equations fitted to the data in the figure.



The monthly average of daily temperature for three stations close to the drainage area of the WSR IWMP as well as Winnipeg was retrieved from Environment Canada. All stations experience similar tmeperture throughout the year.



The monthly average of precipitation for three stations close to the drainage area of the WSR IWMP as well as Winnipeg was retrieved from Environment Canada.

Winnipeg, Souris, and Moosomin receive very similar amounts of annual precipitation, 513.7 mm, 511.4 mm, and 516.2 mm respectively. However, Carlye is located in the drier southeast area of Saskatchewan and recieves 432.4 mm of precipitation annualy.


Thank you