ASSESSMENT OF THE HISTORIC HYDROLOGY OF THE ASSINIBOINE RIVER AND WATERSHED 1793-1870

W.F.RANNIE
University of Winnipeg

Geological Survey of Canada Open File 4087

2001

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Cover illustration

Assiniboine Valley at Fort Ellice, April, 2001
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The greatest debt, of course, is to the fur traders, missionaries, diarists and others whose remarkably conscientious and detailed observations provide such a rich resource for reconstructing their environment nearly two centuries later.

PART ONE

THE ASSINIBOINE RIVER AND WATERSHED

1.1 - INTRODUCTION

In the aftermath of the 1997 Red River flood, archival materials were used to reconstruct the hydrologic history of the Red River prior to 1870 as part of the Geological Survey of Canada/Manitoba Geological Survey contribution to the study of the Red River (Rannie, 1999). All historic Red River floods were documented and general runoff conditions were characterized for most water-years from 1793-94 to 1869-70. Although the report noted several large floods on the Assiniboine and described general climatic conditions as they related to the state of the Red, the Assiniboine River and watershed were given less-detailed attention.

In this respect, the report was typical of the treatment of the Assiniboine River in other hydrologic studies. "Always the bridesmaid, never the bride", the Assiniboine has been considered mainly insofar as it contributes to the flood problems on the Red rather than as an important river in its own right. The two largest public expenditures in the watershed (the Shellmouth Dam and Assiniboine Diversion) were initiated as measures to assist in managing Red River floods by reducing the Assiniboine's contributions; conservation and flood control along the Assiniboine were secondary (although not unimportant) objectives. Paleoclimatic investigations in the Palliser Triangle (part of which includes the headwaters of the Qu'Appelle and Souris tributaries to the Assiniboine) have emphasized the region to the west of the Assiniboine basin and there has been little systematic study of pre-instrumental climate and flow within the Assiniboine basin itself.

The relative anonymity of the Assiniboine is the more surprising since it may be described as the "quintessential large Prairie river". Located between the flood-prone, subhumid, Red River valley on the east and the drought-prone, semiarid, Palliser Triangle region to the west, the Assiniboine displays characteristics of both regions. The axis of the watershed runs through the parkland ecoregion, approximately along the boundary between forests to the north and east and grasslands to the south and west. In contrast to the large rivers of the western Prairies (such as the Saskatchewan, Red Deer and Oldman) which derive much of their flow from mountain sources, the Assiniboine is dependent on the Prairies for its entire flow and, with a drainage area of 153,000 km^2 at Headingley, it is the largest purely prairie-fed river in western Canada. Furthermore, the Assiniboine watershed is one of most topographically and climatologically varied of large prairie streams.

This report will focus on the historical hydrology of the Assiniboine River and watershed. Its specific objectives are

- to provide an overview of the hydrometeorological characteristics of the basin which are relevant to hydrologic and dendroclimatic reconstructions;

- to review the literature on the pre-instrumental hydroclimate and environmental conditions in and near the watershed; and

- to reconstruct the hydrologic history of the Assiniboine River prior to the beginning of gauging records, using archival and other historical materials..

1.2 - TERRAIN AND PHYSIOGRAPHY

Most of the basin lies on the Second Prairie Level above the Manitoba Escarpment (Figure 1). The terrain is subdued, ranging from extensive flat areas marking the floors of former glacial lakes to low-relief rolling topography with many closed basins produced by glacial deposition over essentially horizontal bedrock. Within the basin, however, are forested upland regions such as parts of Riding and Duck Mountains, Wood Mountain, and Moose Mountain, and dramatic wide, deep valleys created by a remarkable network of glacial spillways which determine the configuration both of the mainstem of the Assiniboine and of its most important tributaries. The largest of these tributaries, the Souris, was added to the basin during the early Holocene by capture of the upper Pembina near Wawanesa which increased the Assiniboine's drainage area by about 60,000 km^2 (Brooks, 1968).

From its headwaters in Saskatchewan to near Brandon, the Assiniboine follows a large spillway. The floodplain occupies the entire spillway floor but the river itself is unconfined since its meander amplitude is only about half the width of the valley. Because of the flatness of the valley floor and steep valley walls, the inundated area is essentially the same for all significant flood stages (PFRA, 1961). Downstream of Brandon, the river has eroded a deep valley into the sediments of the late-glacial Assiniboine Delta as it descends from the Second Prairie Level to the Lake Agassiz Plain. In this section, the sharply steeper gradient and larger discharge caused by the addition of the Souris and Little Saskatchewan Rivers have produced meanders which have a large amplitude, somewhat wider than the valley floor and confined by large cutbanks. At Portage la Prairie, the river encounters the Lake Agassiz Plain and between Portage la Prairie and Winnipeg it is completely unconfined. In this reach, the river has built a large, low angle alluvial fan with numerous alluvial ridges and downstream of Portage la Prairie, overbank flow is able to spread across a broad area both northward to Lake Manitoba and eastward to the Red River (Rannie et al., 1989; Rannie, 1990). As a consequence, during the largest floods a significant portion of the discharge may "escape" from the lower Assiniboine basin and peak flows at Headingley may be smaller than at Portage la Prairie 70 km upstream. The elevation of the river at the fan apex just west of Portage la Prairie enabled the construction of the Assiniboine Diversion (described below).

1.3 - CLIMATE

The climate of the region is dominated by cold winters and moderately warm summers, with relatively short spring and fall transition seasons; the seasonal boundaries

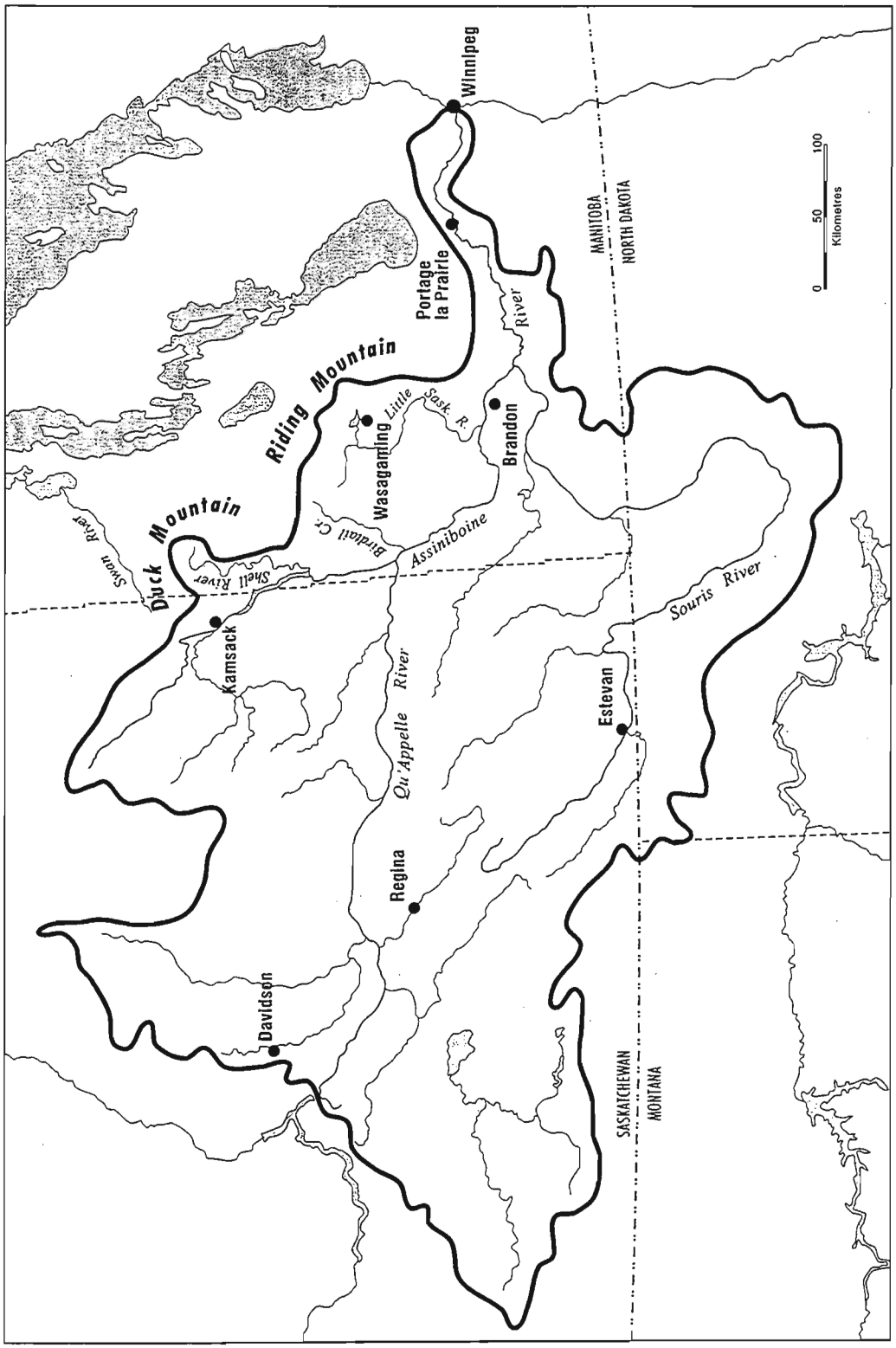

FIGURE 1: The Assiniboine watershed.

defined by McGinn (1988) for Brandon are shown in Figure 2.

Annual precipitation over the watershed averages 430 mm (determined from 22 Theissen polygons and using the 1961-1990 station Normals). This varies from 500-525 mm in the Riding Mountain and eastern sector to less than 400 mm in the Palliser Triangle region of southern Saskatchewan (Figure 3). Annual precipitation is much smaller than Class A pan evaporation over the entire basin (Figure 3).

The monthly distribution of precipitation at three representative stations is shown in Figure 4. June is the wettest month and the months June-September account for about 55% of annual precipitation at all three stations (Figure 5). Because of the strong evaporative demand during the summer, however, rainfall in July and August is much less effective (in terms of streamflow) than late winter and spring amounts.

Snowfall is relatively evenly distributed throughout the winter months (November to March) and accounts for 25-33% of total annual precipitation with no systematic variation in this percentage across the basin. A clear separation exists between snow and rain seasons with April and October the only months in which significant quantities of both may occur (Figure 6). Over most of the basin, rain dominates April and October precipitation but on the eastern uplands of the Riding and Duck Mountains, April snow exceeds rainfall (eg. Wasagaming in Figure 6). In individual years, however, snow may fall in May and October, and even in September.

1.4 - HYDROLOGY

A detailed treatment of the hydrology of a basin as large as the Assiniboine is beyond the scope of this report. The hydrologic overview in this section will concentrate on aspects which appear to be most relevant in reconstructing the river's hydroclimatic history from historical materials.

1.4.1 - Record Length and Control Structures

Stream gauging began on the Assiniboine at Brandon in 1906, at Russell and Headingley in 1913, near Portage la Prairie in 1923, at Kamsack in 1944, and at Holland in 1961. For the Souris River, the longest record is for Wawanesa from 1912. The longest complete record on the lower portion of the Qu'Appelle River is for the Hyde gauging station from 1956 and records for most other tributaries also date from the mid-1950's.

The consistency of the records for the Assiniboine has been altered by two large flood control structures - the Assiniboine Diversion and Shellmouth Dam - which were constructed in the 1960's as part of the flood hazard reduction program for the Red River in Winnipeg. Both structures had the specific purpose of reducing the input of the Assiniboine to the Red in Winnipeg during large floods on the latter but they have the secondary effect of also controlling flooding along the Assiniboine in Brandon and below Portage la Prairie. The larger of these, the Assiniboine Diversion just upstream of Portage

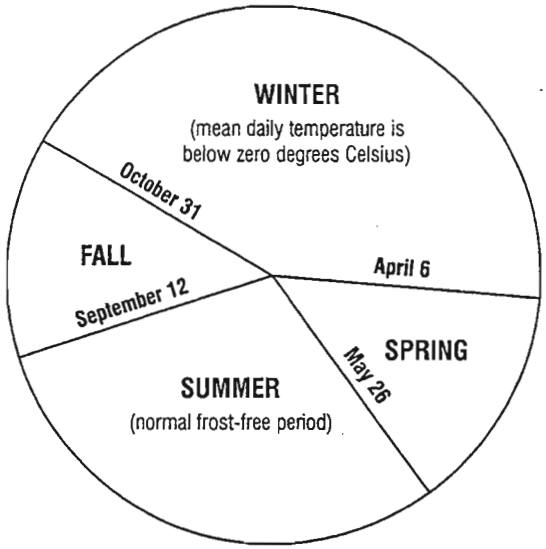

FIGURE 2: The seasons at Brandon (reproduced from McGinn, 1988).

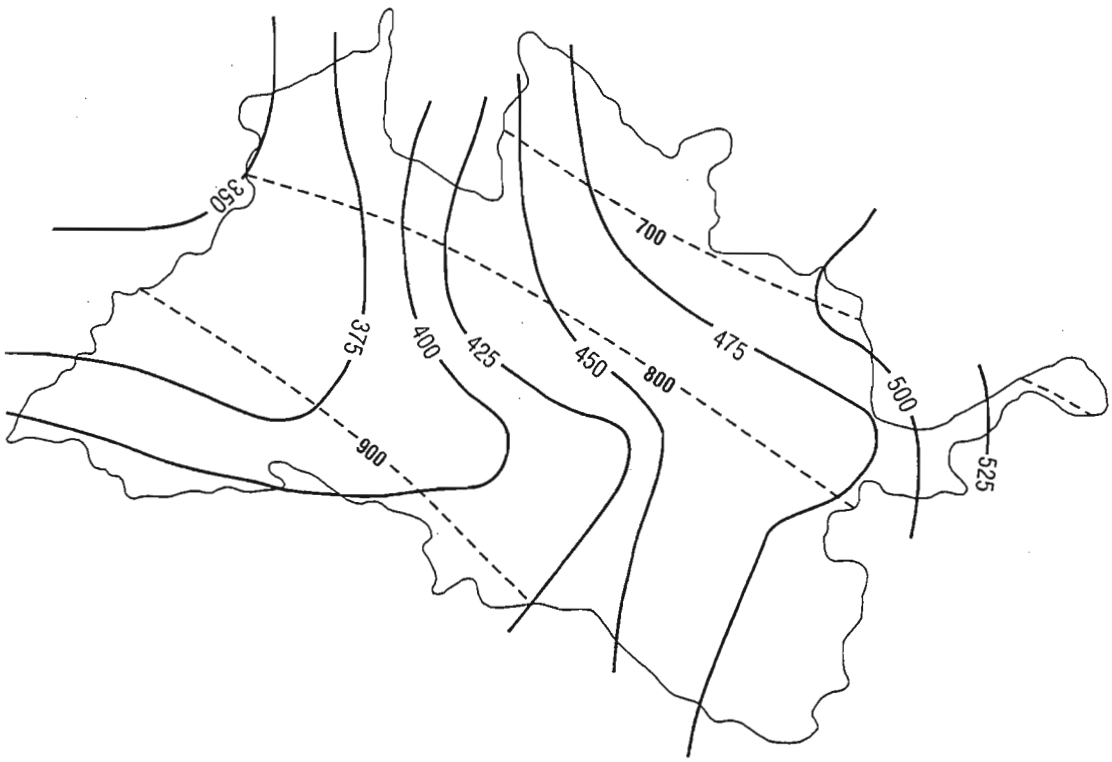

FIGURE 3: Mean annual precipitation (solid lines, mm), 1961-1990, and mean annual Class A pan evaporation (dashed lines, mm).

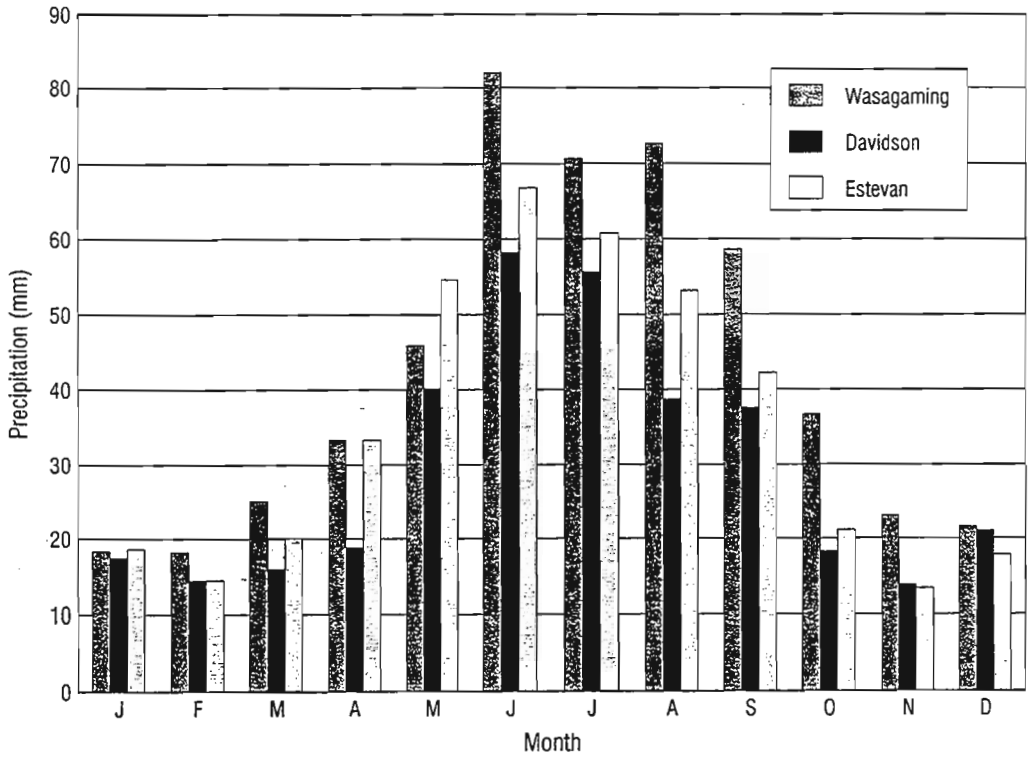

FIGURE 4: Mean monthly precipitation (mm), 1961-1990, Wasagaiming (Manitoba), Davidson, Estevan (Saskatchewan).

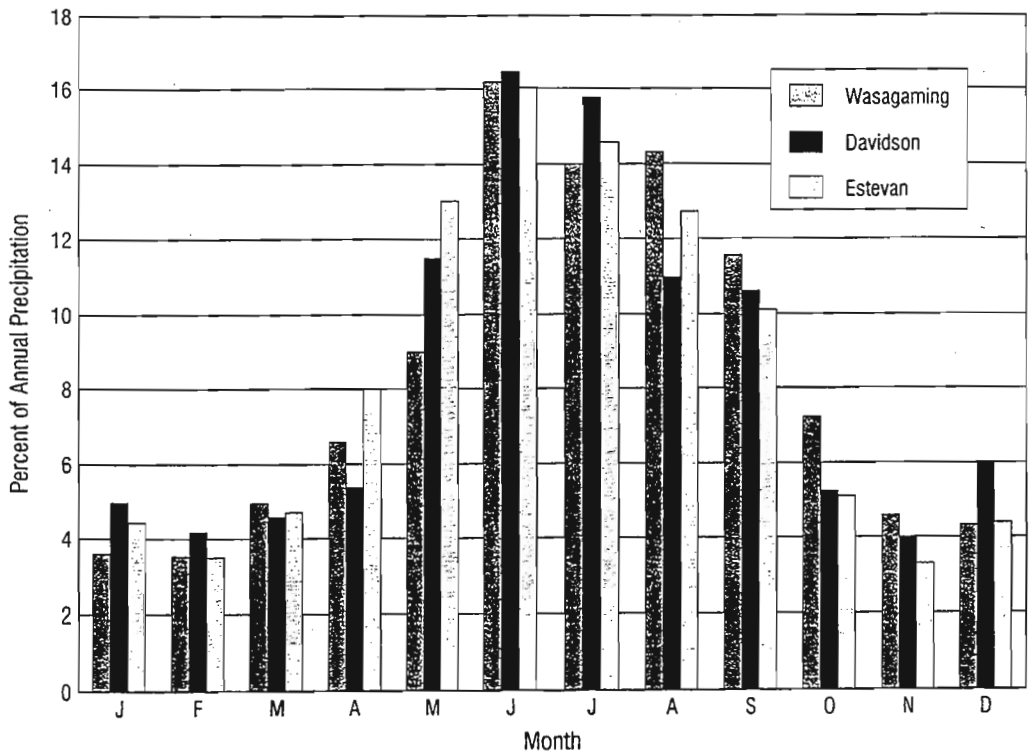

FIGURE 5: Mean monthly percent of annual precipitation (%), 1961-1990, Wasagaiming (Manitoba), Davidson, Estevan (Saskatchewan).

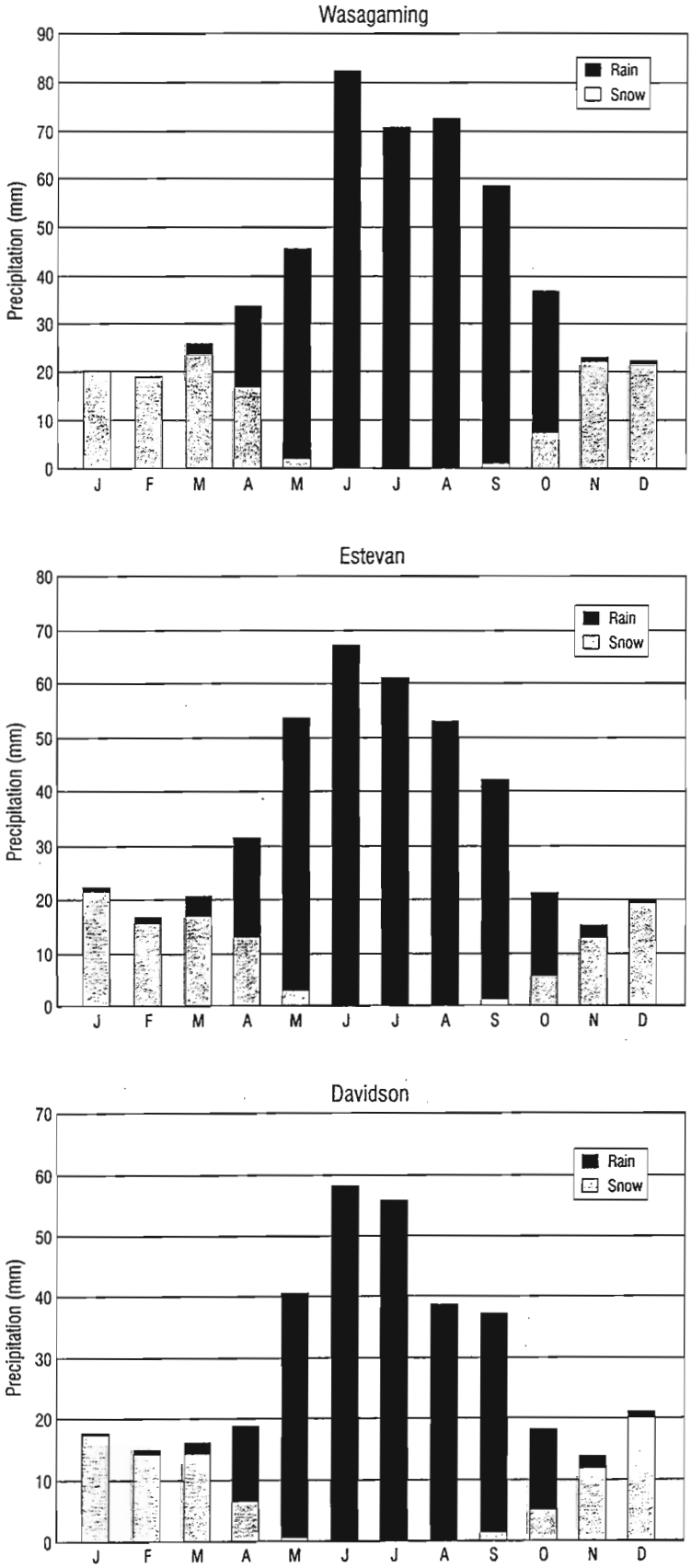

FIGURE 6: Mean monthly rain and snow, 1961-1990.

la Prairie, can divert up to 708 cms (cubic meters per second) out of the Assiniboine to Lake Manitoba, effectively doubling the capacity of the Assiniboine to convey floodwaters with no flooding downstream of the Diversion. This Diversion was completed in 1970 and has been used in many years since (most notably to control record floods on the Assiniboine in 1974 and 1976). The Shellmouth Dam (completed in 1972) is located in the spillway portion of the upper Assiniboine near Russell. The reservoir created by the dam is used both to retain floodwaters during high flow periods and to mitigate low flows downstream during dry periods. These structures have altered the gauge records downstream and "natural flow" conditions (i.e. those which would have occurred in the absence of the structures) must be reconstructed for many of the years following their completion. Other smaller structures occur on a number of the Assiniboine's tributaries.

1.4.2 - Sources of Runoff

The mean flow of the Assiniboine River at Portage la Prairie from 1957 to 1988 was 48.3 cms, equivalent to 10 mm of runoff averaged over the entire watershed (the period 1957-1988 was used because comparable records for numerous streams in the basin were readily available for that time period). This flow is derived from four principal regions or sub-basins which together account for more than 90% of the total basin area:

- Upper Assiniboine basin above Kamsack
- Qu'Appelle basin
- Souris basin
- Riding/Duck Mountain tributaries

Some characteristics of runoff from these sub-basins are summarized in Table 1.

Table 1
Comparison of Runoff from Sub-basins, 1957-1988

River and gauging station	Area (km^2)	Mean Discharge		Maximum Discharge	
		dam^3/yr	mm/yr	(cms)	(cms/1000 km^2)
Total basin, at Portage la Prairie	152000	1,524,750*	10.0*	1460**	9.6**
Upper basin, at Kamsack	13000	171875	13.2	273	21
Qu'Appelle River at Hyde	44100	142907	3.2	206	4.7
Souris River at Wawanesa	60400	415494	6.9	742	12.3
Riding Mtn/Duck Mtn Sector					
Birdtail Creek near Birtle	1120	39,846	35.6	48.7	43.5
Little Saskatchewan near Rivers	3910	135,166	34.7	103	26.3
Shell River near Inglis	2000	88,200	44.1	68.8	34.4

* includes amount diverted to Lake Manitoba ** at Holland

The two largest tributaries, the Qu'Appelle and Souris, occupy the driest regions of the basin and on average generate only about 3 and 7 mm of runoff respectively. Together, they comprise about 71% of the basin area but contribute only about 37% of the

average flow. Under unusual conditions, however, the Souris is capable of large contributions to Assiniboine flow, as in the extreme flood of 1976 when the river accounted for about 50% of the peak flow and 44% of the annual flow on the lower Assiniboine. At the other extreme, there are many years when the Souris contribution to Assiniboine is insignificant- for example, in 1988, 1977, and 1968, its contributions were only 1.4%, 3.5%, and 6.8% respectively of the total flow, and in 1940, it was virtually 0%. The Qu'Appelle River drains nearly one-third of the basin but contributes even less water than the Souris, only about 10% of the average annual Assiniboine flow at Portage la Prairie.

The Upper Assiniboine sector, above Kamsack, Saskatchewan, has higher average runoff (c. 13 mm) but because of its smaller drainage area, its average contribution is intermediate between those of the Qu'Appelle and Souris Rivers.

The largest depth of runoff in the basin is generated in the more humid, forested Riding/Duck Mountain sector, represented by Birdtail Creek, Little Saskatchewan River, and Shell River in Table 1. Streams in this region average 35-45 mm of runoff per year and the region acts as a stabilizer on the flow of the Assiniboine downstream. For example, in the drought of the 1930's, total annual flow in the Souris River was only 10% of long-term average whereas in the Assiniboine, total flow was maintained at 48% of average and the average peak flow was about 75% of the long-term average.

Groundwater inflow from the Assiniboine Delta Aquifer provides an additional source of water and further moderates extreme low flows on the lower Assiniboine below Brandon.

1.4.3 - Runoff Ratio and Effective Drainage Area

Neglecting short-term storage changes, runoff of 10 mm and average precipitation of 430 mm imply a gross Runoff Ratio (R_R) of only about 2 % for the Assiniboine basin, with the remaining 98% returned to the atmosphere as evapotranspiration. Simple calculation of R_R from prairie basins is complicated, however, by the problem of "contributing area" or "effective drainage area" which makes the normally straightforward attribute "drainage area" one of the more complex variables in prairie hydrology. The glacial drift cover, much of it the result of stagnating ice processes, has produced extensive areas of closed drainage which do not normally contribute surface runoff to the stream system. In more humid environments, these areas would become ponds or lakes integrated in the drainage network but in the Prairies, where evaporation exceeds precipitation, they remain closed depressions. Artificial drainage of such areas (which would integrate them into the stream system) has not been employed as extensively in the Assiniboine basin as in the Red River Valley and a large portion of the basin remains non-contributing for much of the time.

Following the initial recognition of the problem by Stichling and Blackwell (1957), Durrant and Blackwell (1959) distinguished "gross drainage area" (the area enclosed by the topographic drainage divide), "effective drainage area" (the area which might contribute to runoff in an average year), and "wet drainage area" (the area which would probably contribute to large flood peaks). Later studies operationally defined "effective area" as the area which might be expected to contribute to the 2-year flood and also recognized "dead

drainage area", the area of truly closed drainage which does not contribute surface runoff to the stream system, even under very wet conditions (Mowchenko and Meid, 1983, 1991). Some examples of the difference between gross and effective drainage areas for the Assiniboine and some of its major tributaries are given in Table 2.

Table 2
Gross and Effective Drainage Areas for Various Stations on the Assiniboine River and Selected Tributaries
(Mowchenko and Meid, 1991)

River	Drainage Area (km^2)		% Effective
	Gross	Effective	
Assiniboine River at Kamsack	12954	4324	33.4
Assiniboine River near Russell	19298	7664	39.7
Assiniboine River near St. Lazare	72087	25605	35.5
Assiniboine River at Brandon	85216	33227	39
Assiniboine River near Portage la Prairie	152370	58740	38.6
Assiniboine River at Headingley	153396	59767	36.6
Qu'Appelle River near St. Lazare	50201	17186	34.2
Souris River at Mouth	62511	22197	35.5
Little Saskatchewan River near Rivers	3905	2216	56.7
Shell River at Asessippi	2004	1132	56.5
Birdtail Creek near Birtle	1125	580	51.6

The distinctions among gross, effective, and wet drainage areas have a number of consequences for the assessment of the response of the Assiniboine to varying hydroclimatic conditions. Most obviously, it implies that the actual mean annual runoff from the "contributing" portion of the basin (and thus the Runoff Ratio) is 2-3 times greater than is indicated by the use of "gross drainage area" in the standard calculation of R_R. More importantly, the drainage area which is actually contributing water to the river is more dependent on antecedent conditions than is true of rivers in other regions where the difference between gross and effective areas is smaller. Because contributing area varies directly with the magnitude of the runoff (producing a "positive feedback effect"), droughts or wet periods are likely to be amplified, making the river more sensitive to climatic fluctuations. This probably accounts, in part at least, for the observation by Ashmore and Church (2001) that prairie streams are particularly sensitive to climatic changes (see below).

1.4.4 - Seasonality

As is typical of prairie rivers, the annual flow regimes of streams in the Assiniboine

watershed are dominated by the spring snowmelt freshet and runoff from June rainfall (Figure 7). For the Assiniboine at Brandon and Headingley, 64-66% of all runoff occurs in the period April-June and for the Souris, this figure rises to 78%. The ineffectiveness of summer precipitation is indicated by the low streamflow in July, August and September which account for 37-40% of annual precipitation but only 12-15% of runoff. Discharge from October through the winter months accounts for only about 20% of the average annual total for the Assiniboine at Brandon and less than 10% for the Souris annual flow.

Most peak discharges and large floods also occur during the snowmelt freshet (Figure 8). The median date of annual maximum discharge is earliest on the Souris River at Wawanesa (about April 15); for the Assiniboine at Brandon, the median date is later (April 26) but 75% of the peaks occur before May 15. Most of the later peak flow events are much smaller than the freshet floods and usually appear as the annual peak when the freshet was small. On occasion, however, large rainfall-induced floods have occurred in late June or early July (as in 1902 and 1954, discussed below). Peak flow dates for the Riding/Duck Mountain tributaries (based on shorter periods of record) are somewhat later still, reflecting the cooler temperatures and more abundant April snowfall and in these smaller basins, late May and June rainfall produces about 25% of the peak flow events.

1.4.5 - Variability

The flow of the Assiniboine River displays a large inter-annual variability, a normal consequence of its sub-humid/semi-arid climate which is probably compounded by the "contributing area problem". Table 3 shows the ten largest and smallest measured annual maximum and mean discharges from 1913 to 1999 (because of inconsistencies in the periods of gauging records and the effects of the Assiniboine Diversion, the lists were compiled from records for Portage la Prairie, Holland and Headingley).

Annual maxima display a 35-fold variation from the largest recorded annual maximum discharge (1460 cms at Holland in 1976) to the smallest (41.8 cms at Holland in 1981) and the largest annual mean discharge is about 25 times the smallest. Four of the ten largest and smallest annual maximum discharges in Table 3 occurred in adjacent years (1915-1916 and 1973-1974 when discharge increased, and 1960-1961 and 1976-1977 when discharges decreased).

This inherent variability is most dramatically illustrated by the comparison of flows in 1976 and 1977 (Table 4). In 1976, the largest floods ever recorded in the Assiniboine basin produced peak flow of 1460 cms at Holland with a Return Period of approximately 225 years. A year later, the basin experienced one of its most severe droughts and peak flow at Holland was only 42.2 cms, one of the lowest annual maxima ever recorded on the lower Assiniboine (1977 does not appear among the smallest mean annual discharges because flow was artificially augmented by releases from the Shellmouth Dam). To further illustrate the variability, after contributing 44% of the total Assiniboine flow in 1976, the Souris contribution in 1977 was only about 6% and maximum discharge of the Souris at Wawanesa was 230 times smaller in 1977 than in 1976!

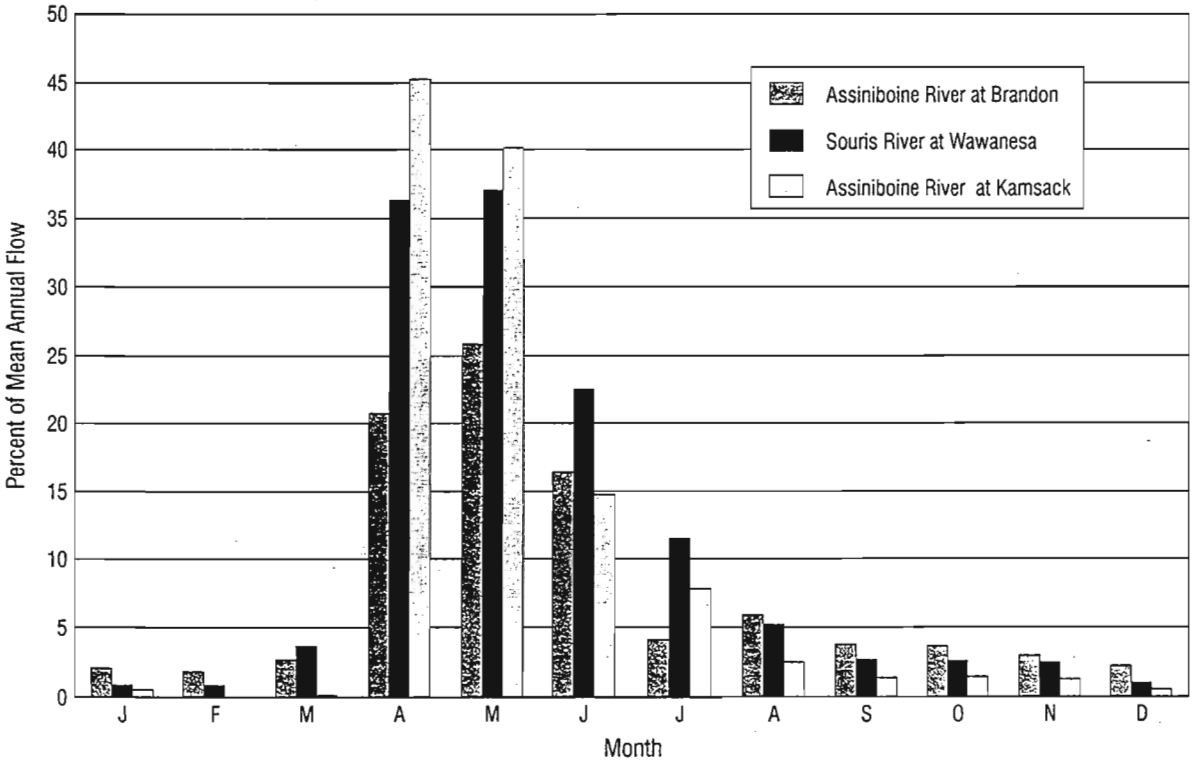

FIGURE 7: Monthly percent of mean annual flow.

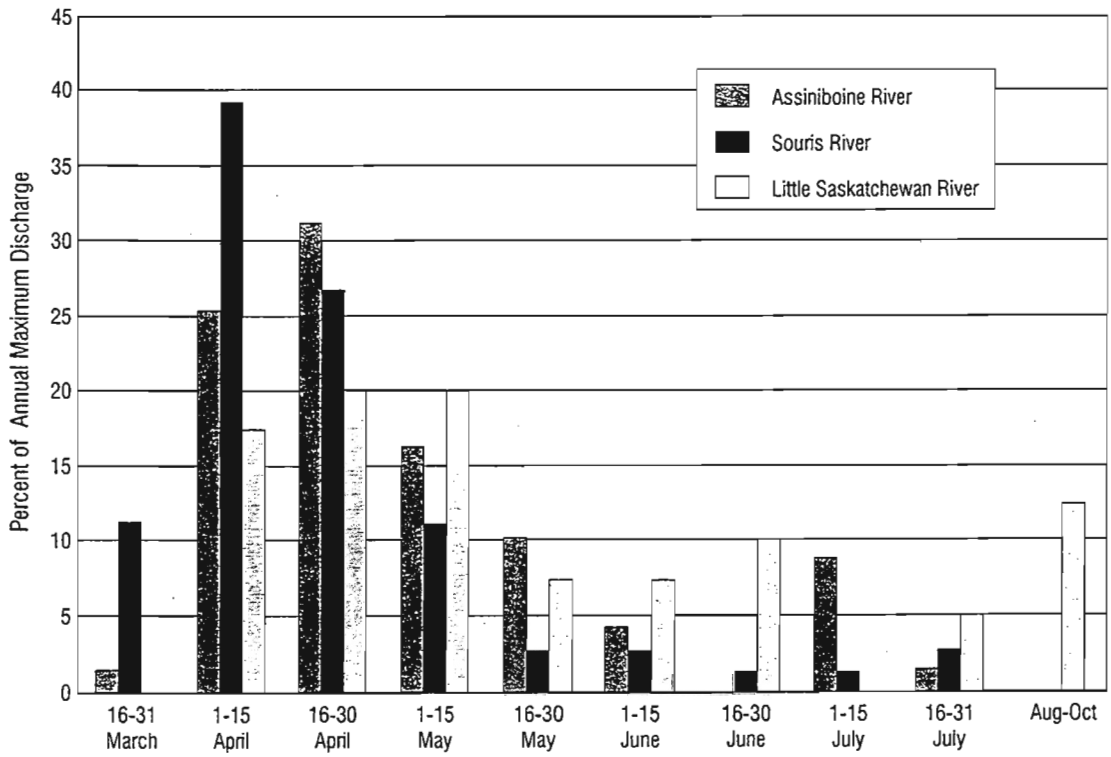

FIGURE 8: Percent of annual maximum discharge dates.

Table 3
Ten Largest and Smallest Recorded Annual Maximum and Mean Discharges, Assiniboine River, 1913 - 1999

ANNUAL MAXIMUM DISCHARGE			ANNUAL MEAN DISCHARGE		
LARGEST			LARGEST		
Year	Q (cms)	Station	Year	Q (cms)	Station
1976	1460	Holland	1976	184	Holland
1974	909	Holland	1955	139	Portage la Prairie
1969	694	Holland	1956	134	Portage la Prairie
1956	637	Portage la Prairie	1975	133	Holland
1955	629	Portage la Prairie	1974	132	Holland
1923	626	Portage la Prairie	1927	117	Headingley
1916	614	Headingley	1923	107	Headingley
1960	586	Portage la Prairie	1954	98.8	Headingley
1927	578	Portage la Prairie	1979	98.1	Holland
1922	547	Headingley	1922	95	Headingley
SMALLEST			SMALLEST		
1988	83.9	Headingley	1958	20.6	Headingley
1937	64.6	Headingley	1938	18	Headingley
1940	60.9	Headingley	1932	16.9	Headingley
1961	57.2	Holland	1981	17	Headingley
1973	56.4	Holland	1939	13.2	Headingley
1984	56.1	Holland	1915	13.1	Headingley
1931	54.4	Headingley	1937	12.2	Headingley
1915	47.9	Headingley	1931	11.4	Headingley
1977	42.2	Holland	1961	10.4	Headingley
1981	41.8	Holland	1940	7.28	Headingley

Table 4
Comparison of 1976 and 1977 Maximum Daily and Mean Daily Discharges, Various Rivers

		1976 (cms)	1977 (cms)	1977 as a % of 1976
Assiniboine River near Holland	Maximum daily	1460	42.2	2.9
	Mean daily	184	21.1	11.5
Assiniboine River at Kamsack	Maximum daily	273	23.1	8.5
	Mean daily	14.3	1.49	10.4
Qu'Appelle River at Hyde	Maximum daily	206	4.7	2.3
	Mean daily	—	—	—
Souris River at Wawanesa	Maximum daily	742	3.23	0.4
	Mean daily	81.6	1.19	1.5
Birdtail Creek near Birtle	Maximum daily	46.2	4.33	9.4
	Mean daily	4.38	1.17	26.7
Little Saskatchewan River near Rivers	Maximum daily	72.8	7.82	10.7
	Mean daily	8.79	2.05	23.3
Shell River near Inglis	Maximum daily	68.8	16.5	24.0
	Mean daily	5.64	2.18	38.7

1.5 - FLOODS

1.5.1 - Channel Capacities

In the reach between Shellmouth and Brandon, and at Brandon, the natural bankfull capacity of the Assiniboine is 224 cms (PFRA, 1961). At Portage la Prairie, the general flood level for the original (natural) channel was 340-425 cms (Mudry et al.,1983). Beginning early in the 20th Century, dyking gradually increased this to about 640 cms.

1.5.2 - Floods Prior to Gauging Records

Three large floods are known to have occurred prior to the beginning of gauging records along the Assiniboine (in 1906 at Brandon).

1882

Prior to 1976, the largest flood on the Assiniboine occurred in April/May, 1882. Using peak stages and the Manning Equation, Prairie Farm Rehabilitation Administration (PFRA, 1952) estimated the discharge at Brandon to have been 1218 cms (close to the value of 1133 cms obtained by simple extension of the rating curve) and 918 cms at Headingley (an anomalously low value of 600 cms obtained for Portage la Prairie using the same methodology was rejected because of suspect stage elevations). At Portage la Prairie, a portion of the overbank flow discharged northward to Lake Manitoba via paleochannels and the lake level was sufficiently high for it to overflow southeastward

through other paleochannels back into the Assiniboine below the alluvial fan 30 km east of Portage la Prairie (PFRA,1952).

1902

From a newspaper report of peak stage and the Manning Equation, PFRA (1952) calculated the discharge at Brandon to have been 692 cms, greater than the highest flow recorded from 1906 onward (651 cms in 1923). This flood occurred in late June (stage was rising on June 27), caused by heavy rains (PFRA, 1952).

1904

The second largest ungauged flood occurred as a spring freshet in late April, 1904. From peak stages and the Manning Equation, PFRA (1952) calculated peak discharges at Brandon and Headingley to have been 904 and 778 cms respectively. No value was suggested for Portage la Prairie.

The PFRA report expressed reservations about these calculations because of uncertainties about peak stages and because of the sensitivity of the Manning Equation to small changes in slope. In some of these events, the water levels at Portage la Prairie were artificially elevated due to ice jams. Nevertheless, even if the PFRA calculations are only treated as approximations, the three events were clearly large; the 1882 event would certainly be the largest known flood at Brandon and with even modest contributions from the Souris, probably downstream as well.

1.5.3 - Recorded Floods, 1913-1955

Some characteristics of several floods between 1913 and 1955 have been summarized by Morris (1955). Extracts from his report are given below.

1913

In 1913, the Assiniboine at Millwood produced a peak discharge of [360 cms]. Very little flooding was reported above Millwood. At Brandon, where the peak discharge was [419 cms], flats and low-lying lands were flooded. The peak discharge at Headingley was [396 cms]. (Morris, p. 27)

1916

The Assiniboine River at Headingley produced...a peak of [615 cms]. This high discharge was largely a result of high discharge in the Souris River...and the Qu'Appelle River, which was in unusually high flood. The discharge from the Assiniboine above Millwood was relatively small, and very little flooding was reported above Portage la Prairie. Ice jams formed at various points along the lower Assiniboine, particularly at bridges south and east of Portage la Prairie. These jams broke suddenly and the released water caused damages amounting to thousands of dollars. (Morris, p. 27)

1922

The flood of 1922 was probably the most severe flood experienced in the Assiniboine valley during the period of recorded floods [to 1955]. Heavy precipitation in late 1921 had saturated

the land, and filled lakes and sloughs prior to freezeup. The spring breakup occurred early in April, and no trouble was caused by the ice, which moved out of the river before the heavy run-off began. Heavy rain and snow fell on the saturated upper part of the watershed in April, followed by high temperatures and continued heavy rain. Practically none of this precipitation was absorbed, and the water quickly found its way into the main channel of the Assiniboine, causing flood stages. The heavy rains, continuing into May, prolonged the duration of the high stages.

At Millwood, the Assiniboine River rose eleven feet between April 19 and 26, and maintained its crest stage for nearly a week. The peak discharge at Millwood was [504 cms]...

At Brandon, 235 river miles below Millwood the river rose seven and one-half feet from April 29 to May 6 and reached a peak discharge of [623 cms]. The flooding of the river valley above Brandon was responsible for the smaller rise in stage here.

At Portage la Prairie, 162 miles below Brandon, the stage rose rive and one-half feet, reaching this crest on May 10, and at Headingley, the rise was five feet, cresting on May 19.

In spite of the larger drainage area, the peak discharge at Headingley, [547 cms], was somewhat less than at Brandon. This was due to the fact that, in the vicinity of Portage la Prairie, the river overflowed the banks on both sides of the river. Some of this water found its way northward to Lake Manitoba, while south and east of Portage la Prairie, the overflow travelled down the Sale River to the Red River.

The low-lying lands in the river valley were flooded from Kamsack, in Saskatchewan, to below Brandon. From Millwood to Brandon, the whole valley was flooded to a width varying from one-half to two miles...

Between Brandon and Portage la Prairie, where the river valley is considerably narrower, the flooding was not serious.

At Portage la Prairie, the most serious result of the flood was that a cut-off channel, which had been dug to serve as a by-pass for flood flows, was enlarged to such proportions that it became the main channel. It has continued to function as the main channel ever since...

East of Portage la Prairie, the river overflowed its north bank, flooding the country to a width of two or three miles, for a distance of twenty-five miles...On the south side of the river, hastily-constructed dykes prevented the flooding of a very large area of cultivated land. (Morris, p. 28-30)

1923

At most points along the Assiniboine in 1923 there were two peaks. The first was caused by ice jams when water from the upper part of the watershed reached the lower sections before the ice had broken. Severe local floods were caused, lasting for short periods until the jams were broken. At Portage la Prairie, the highest crest on record to that time, not exceeded until 1955, occurred on April 21... Heavy snow and rain continued over most of the drainage area and the Shell, Qu'Appelle, Minnedosa, and upper Assiniboine Rivers reached near-record peaks after the ice had gone. This second flood stage, which was higher than the first, except at Portage la Prairie, lasted 25 days at Brandon, where the [discharge was 651 cms]. Flood stages continued for 15 days at Portage la Prairie and for 35 days at Headingley. There was considerable storage of water on the land between Portage la Prairie and Headingley, and overland flow occurred both to Lake Manitoba and to the Sale River, but no measurement of these quantities were obtained. Some of the stored water eventually returned to the Assiniboine below Portage la Prairie. (Morris, p. 30-31)

1927

High river stages occurred again on the Assiniboine in 1927, though the floods did not reach the proportions of the 1922 and 1923 floods. In 1927, little trouble was experienced from ice jams, with the exception of a sharp rise for a few days at Portage la Prairie.

Heavy precipitation in March and May, following a wet fall in 1926, caused heavy runoff. Although crest stage at Millwood was of short duration, high stages continued at Brandon, Portage la Prairie and Headingley for some time, because of relatively high discharges from the Qu'Appelle and Souris Rivers.

Again the river flats at Brandon were flooded...Above Brandon, the river valley was flooded, in some places to a width of one mile, for a distance of some 50 miles.

East of Portage la Prairie, no flooding occurred on the south side of the river due to dykes which had been rebuilt and extended after the 1923 flood. A certain amount of dyking has also been done on the north side of the river, but these dykes were overtopped at several places and an area about a mile wide was flooded. The overflowing water practically all found its way back to the river some 25 miles downstream from Portage la Prairie... (Morris, p. 31-32).

1948

In 1948, after nearly 20 years of low flow, high discharges again occurred on the Assiniboine and its tributaries. The peak discharge at Millwood was [221 cms], about 190 percent of the mean peak, and at Brandon the peak was [450 cms]. Both the Qu'Appelle and Souris Rivers produced large discharges in this year - in the case of the Qu'Appelle, the second highest discharge that had been recorded up to that time. The recorded peak at Headingley was [473 cms]. (Morris, 1955, p.32-33)

1954

The 1954 flooding on the Assiniboine was similar to that of 1902, though the discharge was much less. It occurred in the latter part of June, much later than the usual flood peaks. By May 4, the peak discharge due to snowmelt had passed down the river causing no difficulty. Then in the early part of June, heavy rains in the upper Assiniboine Valley began to raise water levels at Kamsack, and the possibility of flooding along the lower reaches became apparent. Heavy rains continued in June, and evacuation of some areas around Brandon was begun as the discharges continued to increase.

On July 7...the rising water breached the protective dyke and allowed the market garden fields to be inundated. The crest passed Brandon on July 9th, with a discharge of [360 cms], and continued downstream, passing Portage la Prairie on July 15 with only minor flooding...between Portage la Prairie and Winnipeg, the dykes prevented any overflow to the plains. (Morris, 1955, p. 33)

1955

The spring floods of 1955 on the Assiniboine River were unprecedented in only one respect - that they were caused primarily by the very large discharges of the Qu'Appelle River. The peak discharge of the Qu'Appelle was six times the average spring peak, and three and one-half times the largest previously recorded peak. This contribution to the Assiniboine flow caused the discharge at Brandon to rise to nearly three times its normal peak discharge...

During the first week in April of 1955, before the ice had broken up, high discharges from the upper Assiniboine caused a rapid rise in the river levels at St. Lazare, Brandon, and Portage la Prairie. Following the breakup, a severe ice jam below Portage la Prairie caused the water level at Portage la Prairie to rise on April 9 to its highest crest in the 41-year period of

record...Overflowing water spread south to the Sale River causing flooding of short duration at several points along the river.

In the meantime, heavy rains on the upper Assiniboine and Qu'Appelle valleys continued to increase the discharge... [A] second flood crest... was expected toward the end of April, having passed Millwood on April 22nd. On April 30, the crest had passed Brandon...

Then, during the first week of May, an intense storm centre moved into Manitoba from the Dakotas, bringing winds of gale force, blowing dust, and thunderstorms. As the storm centre moved northeastward, cold air swept into Saskatchewan and the rain changed to snow. On May 3, blizzard conditions prevailed in many parts of central and eastern Saskatchewan. During the next ten days, two weather disturbances moved across the prairies from the Pacific bringing more rain to most districts. In central and western Saskatchewan, precipitation totals for the week ranged from one to three inches.

On May 13, the Qu'Appelle River, swollen by the runoff from these storms, reported a peak discharge at Tantallon of [240 cms], by far the largest discharge...recorded on this river [to 1955]. The entire Qu'Appelle valley was declared a disaster area as millions of acres of Saskatchewan farm land lay under water. The upper Assiniboine River also rose although not to the record-breaking levels of the Qu'Appelle. The peak discharge at Millwood on the Assiniboine, recorded on May 15, was [273 cms].

The flood crest reached Brandon on May 20, with a peak discharge of [535 cms], the third highest on record [to that date].

As the crest passed Brandon, and water levels began to drop there, the centre of attention moved downstream to the reach between Portage la Prairie and Winnipeg. Here, dykes defended both sides of the river...

On the north side of the river the dyke was maintained, except for a break near Poplar Point on May 20. This break was prevented from enlarging but water continued to escape north of the river for some time. In the area east of Poplar Point, the Winnipeg-Portage la Prairie highway was threatened with inundation as the water level rose behind the protective dykes to elevations three feet higher than the highway grade. Particular attention was given to the maintenance of the dykes in this locality, and the highway remained open continuously. The failure of the dyke on the south bank, by reducing the level of the river, to some extent assisted in the efforts to save the highway on the north side.

On the south side, a break occurred on May 22 about 10 miles east of Portage la Prairie, quickly widening to about 1,400 feet, and allowed about 25 per cent of the Assiniboine's discharge to flow south, flooding a large area. Some of this overflow reached the Sale River, again threatening the towns which had previously been flooded during the short overflow early in April...

Not all the overflow water from the Assiniboine passed down the Sale River, a large portion of it returning to low reaches of the Assiniboine, and a large part of it remaining in storage on the land...The breaking of the river dyke, with the resulting diversion and storage of part of the Assiniboine flow resulted in the peak flow at Headingley being only [479 cms] whereas at Portage la Prairie, the peak had been [630 cms]. (Morris, 1955, p. 7-10)

1.5.4 - 1974 and 1976

In 1974, high spring discharges occurred on most tributaries, notably the Souris where a record discharge was established at Wawanesa. On the lower Assiniboine

downstream of the Souris, peak discharge at Holland was 40-50% higher than the previous records at Portage la Prairie and Headingley but this flow was easily accommodated without flooding of Portage la Prairie by the diversion of more than half of the flow northward to Lake Manitoba.

In 1976, runoff far beyond all previous recorded flows occurred simultaneously throughout the watershed, caused by high river levels and soil moisture in the fall of 1975, an early hard freeze, an unusually heavy late-lying snowpack in the spring (2-3 times normal for the Assiniboine basin and 3-4 times normal for the Souris), and a very rapid melt produced by temperatures 10-15° C above normal in late March (Long, 1976). Virtually all streams achieved record flows and the combined effects were astonishing for mainstem rivers. Most dramatic was the Souris River. At Wawanesa, its peak discharge of 742 cms was more than double the previous peak since 1913 and greater than the highest recorded flows on the Assiniboine itself prior to 1974. The Assiniboine peak of 1460 cms near Holland was almost 2.5 times the minimum flood level at Portage la Prairie and would have been greater without the impoundment of runoff by the Shellmouth Dam. With the Diversion (operating slightly above design capacity) redirecting as much as 736 cms northward, however, downstream flows were just barely contained with minimal localized flooding. Without the Diversion, as much as 600 km^2 may have been flooded between Portage la Prairie and Winnipeg (based on data reported in PFRA, 1961). The 1976 flood had a Return Period of about 225 years at Portage la Prairie (for natural, i.e. undiverted, flow).

1.5.5 - Sources of Flood Peaks

Peak flows recorded for each major sub-basin during large recorded floods are given in Tables 5a and 5b. Each of these produced flows which were significantly larger than the natural channel capacity at Portage la Prairie, several approached or slightly exceeded the dyked capacity, and the 1974 and 1976 floods greatly exceeded the dyked capacity and were only contained by the diversion of excess flow to Lake Manitoba. The table indicates the variations in sources of water which have occurred during known floods. The discharges should only be regarded as indices of the relative contributions; the actual contribution of each tributary to the peak would be affected by the precise timing of the peaks, the distance above Portage la Prairie, and the routing of the water downstream.

Tables 5a and 5b indicate considerable variation in the causes of individual floods. For example, in 1955, the bulk of the water originated upstream of Brandon (Upper Assiniboine and Qu'Appelle), with only a small contribution from the Souris, whereas in 1969 (and to a lesser extent in 1960), these sources were minor in comparison with the Souris and Riding/Duck Mountain contributions. In 1956, all sectors made important contributions. The largest recorded flood, in 1976, was dominated by conditions in the Souris basin; although the contributions from the other sectors were large in absolute terms, they were dwarfed by the Souris which alone produced discharge larger than had been observed on the Assiniboine prior to 1974. In the 1882, 1902, 1904, 1922, and 1923 floods, however, extremely large flows were estimated or recorded at Brandon, indicating that under appropriate conditions, the basin above Brandon is capable of producing large

Table 5a
Sources of Peak Flows at Portage la Prairie/Headingley
(Selected Years)

	Peak Flow (cms)					
	1913	1916	1922	1923	1927	1948
Upper Assiniboine at Russell[1] / Kamsack[2]	360[1]	160[1]	504[1]	411[1]	357[1]	238[2]
Qu'Appelle at Tantallon[1] /Welby[2]	—	—	56[1]	—	—	78[2]
Souris at Wawanesa	43	173	58	167	65	117
Riding/Duck Mountain Tributaries*	—	—	—	—	—	—
Assiniboine at Brandon	422	259	603	651	484	450
Assiniboine at Headingley[1]/Portage la Prairie[2]	396[1]	614[1]	547[1]	626[2]	578[1]	473[1]
* Riding/Duck Mountain Tributaries = ∑ Little Saskatchewan + Birdtail + Shell						

Table 5b
Sources of Peak Flows at Portage la Prairie/Holland
(Selected Years)

	Peak Flow (cms)						
	1954	1955	1956	1960	1969	1974	1976
Upper Assiniboine at Kamsack	269	239	203	121	64	190	273
Qu'Appelle River at Tantallon[1]/Hyde[2]	62[1]	240[1]	157[1]	26[1]	84[2]	122[2]	206[2]
Souris River at Wawanesa	53	116	205	229	323	345	742
Riding/Duck Mountain Tributaries*	84	88	116	69	139	155	188
Assiniboine at Brandon	360	541	430	241	360	309	617
Assiniboine at Portage la Prairie[1]/Holland[2]	425[1]	629[1]	637[1]	586[1]	626[1]	909[2]	1460[2]
*Riding/Duck Mountain Tributaries = ∑ Little Saskatchewan + Birdtail + Shell							

floods independent of the state of the Souris (peak discharges of 504 and 411 cms were recorded at Russell in the upper basin in 1922 and 1923).

1.5.6 - Causes of Floods

Most floods occur during the spring freshet and the following description of the circumstances leading to the 1922 flood is representative.

> The Autumn of 1921 was unusually wet and heavy precipitation was recorded throughout headwater areas and also the Duck Mountains. The sloughs and lakes were filled almost to overflowing and the land became thoroughly water-soaked. When in this condition freezeup took place. The snowfall throughout the winter was fairly normal and melted under fairly average conditions this spring, but was followed by a heavy snowfall of about eight inches before the frost began to leave the ground. This snowfall was followed immediately by warm weather and heavy rainfall and the whole headwater area experienced flood conditions. Small creeks, ravines, etc., became torrents, sloughs and lakes overflowed and the Assiniboine rose rapidly and soon overflowed its banks...Owing to the thoroughly soaked nature of the upper watershed the runoff remained fairly steady for some time and the flood conditions prevailed for a period of more than ordinary length. (D.B.Gowe, memorandum appended to Attwood, 1923).

Heavy rains in late May and June (normally the rainiest month) may also produce floods. These are normally somewhat smaller than the snowmelt events but on occasion very large rainfall-induced floods have occurred. In 1902, rain over the upper watershed produced a peak at Brandon which, if the PFRA estimate of 692 cms is correct, would have been higher than any gauged discharge there since records began in 1906.

1.5.8 - Flood Frequency

Flood frequency curves (from Manitoba Water Resources) for several stations on the Assiniboine and major tributaries are compared in Figures 9 and 10. The importance of the upper Assiniboine and Souris basins in generating the largest floods is clear. The Riding/Duck Mountain tributaries are more important than is indicated by Figure 9. The three basins used are individually small but are representative of a larger area which collectively can generate large volumes of water. This is more apparent in Figure 10 where the discharges are expressed on a unit-area basis. The relatively lesser contribution of the Qu'Appelle (which drains about 30% of the basin) is a function of both its dry climate and numerous lakes on the spillway floor which modulate peak flows.

1.5.9 - Correlation Among Basins

Correlation coefficients among various Assiniboine stations and major tributaries are given in Tables 6 and 7 for annual mean and maximum discharge. Also given are the coefficients between the Assiniboine basins and the Red River at Emerson. The coefficients indicate high coherence among regions in the Assiniboine basin and suggest that information from one region is strongly relevant to other regions of the basin. The lower correlations between the Red and Assiniboine basins are not surprising, given the

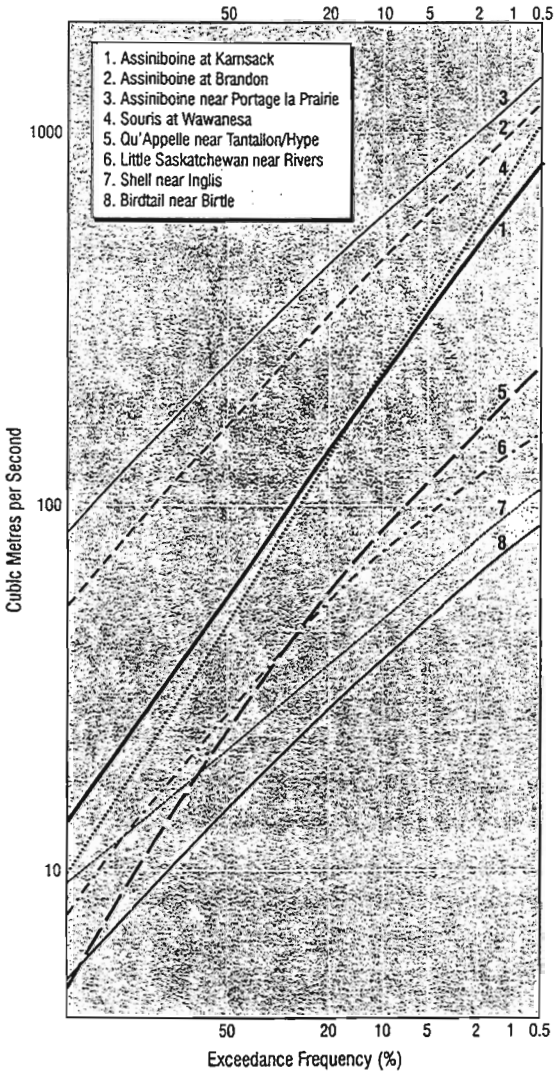

FIGURE 9: Flood frequency curves (Manitoba Water Resources)

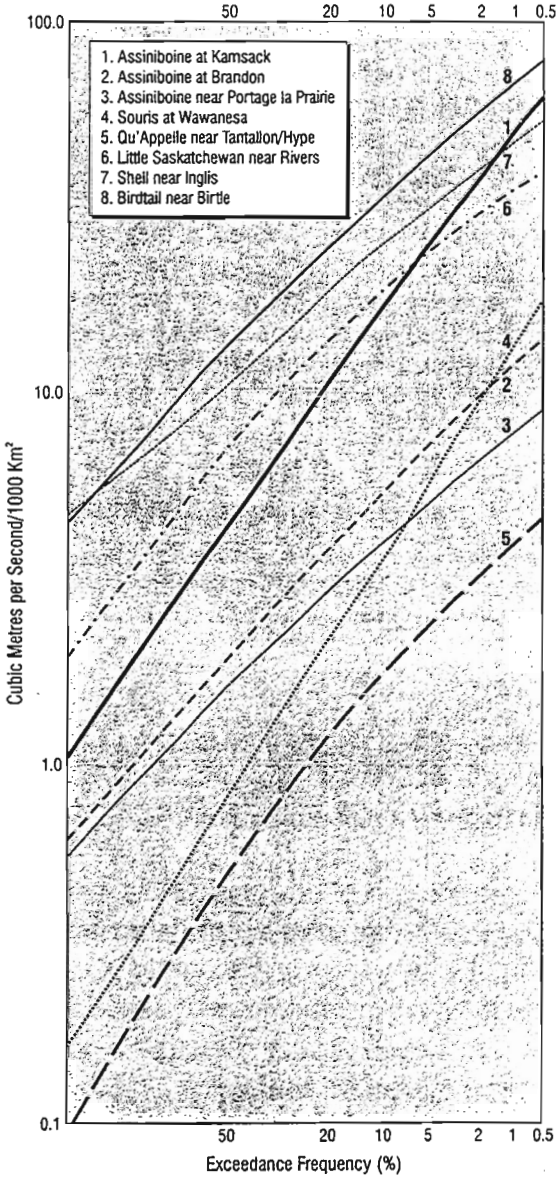

FIGURE 10: Flood frequency curves standardized by area.

Table 6
Correlation of Mean Annual Discharges Among Assiniboine Basins and with the Red River at Emerson, 1957-88

	Assiniboine Stations					Riding/Duck Mountain Tributaries			
	Kamsack	Brandon	Portage	Souris	Qu'Appelle	Birdtail	Little Sask.	Shell	Red
Kamsack	1.00								
Brandon	0.90	1.00							
Portage	0.83	0.94	1.00						
Souris	0.71	0.89	0.91	1.00					
Qu'Appelle	0.73	0.90	0.87	0.88	1.00				
Birdtail	0.87	0.91	0.85	0.72	0.76	1.00			
Little Sask.	0.75	0.88	0.81	0.73	0.75	0.87	1.00		
Shell	0.88	0.84	0.85	0.67	0.70	0.85	0.87	1.00	
Red	0.53	0.50	0.41	0.37	0.37	0.57	0.57	0.39	1.00

Table 7
Correlation of Annual Maximum Discharges Among Assiniboine Basins and with Red River at Emerson, 1957-88

	Assiniboine Stations					Riding/Duck Mountain. Tributaries			
	Kamsack	Brandon	Portage	Souris	Qu'Appelle	Birdtail	Little Sask.	Shell	Red
Kamsack	1.00								
Brandon	0.76	1.00							
Portage	0.73	0.94	1.00						
Souris	0.69	0.90	0.91	1.00					
Qu'Appelle	0.76	0.79	0.78	0.83	1.00				
Birdtail	0.77	0.80	0.82	0.66	0.70	1.00			
Little Sask.	0.57	0.81	0.78	0.61	0.62	0.83	1.00		
Shell	0.73	0.65	0.66	0.62	0.61	0.69	0.52	1.00	
Red	0.45	0.48	0.51	0.36	0.47	0.56	0.58	0.30	1.00

distance and climatic differences. They suggest that the hydrologic conditions in the Red and Assiniboine basins are sufficiently independent that transferring climatic information from the Red to the Assiniboine should be done with caution.

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PART TWO

CLIMATE HISTORY OF THE ASSINIBOINE WATERSHED REGION

SENSITIVITY OF PRAIRIE STREAMS TO CLIMATIC CHANGE

The prospect of global warming has heightened interest in the possible responses of rivers to scenarios of future climates, most of which anticipate warmer temperatures and uncertain changes in precipitation. As the evidence reviewed later in this chapter indicates, these conditions are similar to those which have prevailed in the region throughout much of the Holocene, at least until the establishment of "modern" climate and vegetation characteristics about 3000-2500 years ago.

The purpose of this report, however, is to "hindcast" flood and runoff conditions from 1793 to 1870, a period corresponding to the cooler, wetter conditions of the late Little Ice Age (discussed below). For this scenario, in the Palliser Triangle region west of the Assiniboine basin, Lemmen et al. (1998) suggested that

> Although a cooler and wetter climate would undoubtedly increase stream discharge, these changes would likely be more linear than those predicted for the warmer and drier scenario. For example, in their analysis of the Oldman River basin, Nkemdirim and Purves (1994) estimate that a 1% increase in precipitation associated with present temperature regimes would increase streamflow by 1%. (p. 63).

Other writers have argued that precipitation changes would be amplified, such that "small changes in annual precipitation may cause disproportionately large increases in the magnitude of flood discharges." (Ashmore and Church, 2001, p.7). For example, from flood deposits in small upper Mississippi valley watersheds throughout the Holocene, Knox (1993) concluded that "modest" climatic changes of 1-2°C in mean annual temperature and 10-20% in mean annual precipitation have been capable of producing "large and sometimes abrupt adjustments in both magnitudes and frequencies of floods" (p. 432). Karl and Riebsame (1989) also concluded that "the impact [on runoff] of relatively small fluctuations in precipitation (about 10%) are often amplified by a factor of two or more" (p. 423). Their data suggest that the "amplification factor" is greatest in drier climates.

Prairie streams such as the Assiniboine, with low runoff ratios and high inherent variability, may be particularly sensitive. In their assessment of the potential effects of climate change on Canadian river regimes, Ashmore and Church (2001) concluded:

> The eastern Prairies ... seem to be an area of highly sensitive flood-flow regimes. In this region mean annual flow increases between 1920-1940 and 1940-1960 were of the order of 30% in the prairie-source streams, whereas mean annual flood increases are typically 50-100%... The upward shift in flood frequencies during wetter periods is proportionately greater in the eastern Prairies than in the mountain-source rivers of the Prairies (p. 13) ... Historical

> records in the eastern Prairies show a marked sensitivity to climatic fluctuations; with large reductions in streamflow and maximum flow during warmer and drier years...During historical warmer periods, the size of the 20 year flood has decreased by a factor of 2-4 in large prairie streams, indicating considerable climatic sensitivity.(p. 31).

The results of two studies which have used water-budget approaches to estimate mean annual runoff for a variety of climatic change scenarios in different plains environments support the arguments for an "amplified" response to climate change on the Prairies. Rowe et al. (1994) applied a Thornthwaite water-budget methodology to the Little Blue River in Nebraska and found that increases in precipitation of 10% and 20% with no change in temperature produced increases in water-year runoff of 54% and >200% respectively (Table 8).

Table 8
Percentage Change in Water-Year Discharge, Little Blue River, Fairbury, Nebraska, under Various Climatic Change Scenarios
(modified from Rowe et al., 1994)

Change in Temperature (°C)	% Change in Water-Year Discharge				
	% Change in Precipitation				
	-20	-10	0	10	20
+3°	-77	-71	-59	-34	10
+1°	-60	-48	-20	22	87
0°	-50	-30	0	54	231
-1°	-35	-15	23	90	276
-3°	-10	24	84	270	365

For changes of the magnitude suggested by Knox, with temperatures 1-3°C cooler, the estimated increases in runoff approached or exceeded 300%. Although far-removed from the Assiniboine basin, the Nebraska results may provide an analogue for the Souris and Qu'Appelle basins under cooler/wetter conditions.

Zaltsberg (1990) used Polyakov graphs to calculate evapotranspiration and runoff for Wilson Creek, a small watershed on the Manitoba Escarpment in eastern Riding Mountain Park (Table 9). For mean annual temperatures 2°C cooler and 10% greater annual precipitation, mean annual runoff was estimated to increase by 61%; for a 20% increase in precipitation, runoff would increase by 79%. Similar results were obtained from Langbein graphs relating mean annual runoff, temperature, and precipitation. Zaltsberg suggested that the cooler/wetter scenario would decrease annual streamflow variance, increase high flow periods and the incidence of flooding, and possibly increase streamflow persistence. The Wilson Creek study, if the results are even approximately correct, is particularly relevant because of its proximity to the Assiniboine basin in the Riding Mountain upland which is an important source region for flows on the upper and middle Assiniboine.

Table 9
Percentage Change in Mean Annual Runoff, Wilson Creek for Various Climatic Change Scenarios
(Zaltsberg, 1990)

Change in Temperature (°C)	% Change in Water-Year Discharge			
	% Change in Precipitation			
	-20	-10	10	20
+2°	-61(-49*)	-50 (-31*)	+11 (+12*)	+25 (+39*)
-2°	-14 (-25*)	+2 (0*)	+61 (+57*)	+79 (+90*)
(*bracketed figures calculated from Langbein graphs)				

Karl and Riebsame (1989) found changes in precipitation to be much more important in altering runoff than changes in temperature.

> [Our study] indicates that precipitation changes may be amplified one to six times in relative runoff changes. However, even 1° to 2° average temperature changes often have little effect on annual runoff. (p. 445)

However, Ashmore and Church (2001) suggested that temperature changes may have a large effect on low recurrence interval floods on the eastern Prairies but a negligible effect in other regions. Rowe et al. (1994) also argued that temperature changes are potentially as important as precipitation changes in the response of the Little Blue River to climatic change scenarios.

The climate-induced changes in runoff may be compounded by fluctuations in the effective drainage areas between wet and dry years. During sufficiently wet years, some sloughs would fill and become integrated into the stream network, increasing effective drainage area. Under very wet conditions, the contributing area may approximate the topographically-defined "gross" drainage area. In particularly dry years, areas which normally contribute runoff for some portion of the year may contract and cause effective drainage area to decrease.

> Under normal climatic conditions the smaller depressions contain water for a few months each spring. During prolonged dry periods even the large depressions and lakes disappear. On the other hand, a cycle of wet years with subsequent above-normal precipitation fills the depressions to overflowing and produces high groundwater levels. This produces conditions favourable to a high runoff and portions of a drainage basin which may be unproductive in dry years overflow and contribute materially to flows on the main stream. (Stichling and Blackwell, 1957, p. 1).

The difference in contributing basin areas under extreme wet and dry conditions can be very large. Stichling and Blackwell (1957) illustrated their paper with an example of an unidentified "typical" small basin in eastern Saskatchewan in which the dry-year area was

only 20% of that during a wet year. Campbell et al. (1994) found that the sensitivity of small Alberta lakes to short-term climatic variability is greatest in the semi-arid Parkland region where climatic conditions are comparable to those over much of the Assiniboine basin. They also cautioned that because of the steepness of the sensitivity curve for lakes in the Parkland region, "an abrupt change in the sensitivity of a lake in the past may not indicate an abrupt change in climate, but rather a crossing of this boundary." (p. 211)

These fluctuations in contributing area complicate many quantitative analyses of aspects of prairie hydrology which involve drainage area as an independent variable and the positive correlation between contributing drainage area and climate would increase the sensitivity of the region to climate change, as was noted by Ashmore and Church (2001).

CLIMATIC HISTORY OF THE SOUTHERN PRAIRIES

Early and mid-Holocene (10000 BP - 3000 BP)

From pollen stratigraphy in small lake and pond sediments across the Prairies, Ritchie (1983) recognized three climatic periods within the Holocene following the cool conditions of the late Wisconsinan. The first was a warm, dry interval from 10000 BP (or 9000 in other studies) to about 6500 BP, known as the Hypsithermal Interval or Climatic Optimum. Summer (May-August) temperatures rose rapidly to a maximum about 6500 BP when regional mean summer temperatures were 2-3°C warmer and *effective* precipitation was 10-20% lower than modern values. In the second period (6500 to 3000 BP), warm summer temperatures continued but *effective* precipitation increased sufficiently to permit a mosaic of both grassland and deciduous woodlands. The third period (3000 BP to the present) marked the establishment of the modern climate and vegetation, beginning with a sharp decline in summer temperatures to modern values, which were attained by about 2500 BP.

Ritchie's divisions provide a convenient framework for discussion of the broad climatic changes of the Holocene and have been supported by a rapidly growing body of climatic inference from other proxy data in cores from lakes across the southern Prairies, particularly in Alberta and Saskatchewan; many of these have been conducted under the umbrella of the Palliser Triangle Integrated Research Monitoring Area. The dates and precise character of the episodes differ somewhat among the studies. Some of these differences may be partly semantic but they also arise from differences in proxy indicators, the resolution of the records, the degree of dating control, the location of the sites, and (in the case of lake levels and salinity) the groundwater environment. Nevertheless, there is broad agreement with the threefold division into warmer/drier, warmer/moist, and modern intervals proposed by Ritchie. A schematic summary of the "moisture status" of the Prairies is given in Figure 11 (after Lemmen and Vance, 1999).

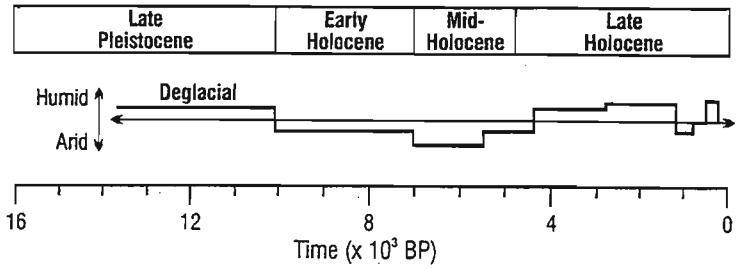

FIGURE 11: "Moisture status" of southern Prairies, Late Pleistocene to present (after Lemmen and Vance, 1999).

The following examples are representative of the changes along a transect across the southern Prairies; the results of other similar studies from Canada and the northern United States are reviewed in Sauchyn (1990), Vance et al. (1993, 1995), Xia et al. (1997), and Lemmen and Vance (1999).

- Chappice Lake, Alberta: Vance et al. (1992, 1993) used the sedimentary and paleobotanical characteristics to construct a 7000-year record of lake-level fluctuations and inferred climatic changes for Chappice Lake northeast of Medicine Hat, Alberta. Prior to about 6000 BP, the level of the lake fluctuated strongly with periodic complete drying, indicative of severe and frequent droughts, alternating with moister conditions. The most extreme and variable fluctuations in water level occurred between 7300 and 6000 BP (Vance et al., 1993). During the most severe drought episodes, other water bodies also disappeared and even major lakes such as Lake Manitoba and Devil's Lake (North Dakota) experienced low-water or dry phases (Teller and Last, 1981, 1990; Bluemle, 1991). From 6000-4400 BP, Chappice Lake was shallow but stable and perennial, suggesting a somewhat more moist climate and greater effective precipitation. After about 4400 BP, salinity gradually decreased, probably indicative of rising water levels, culminating in a prolonged high-water, low salinity phase with few droughts from 2600 to 1000 BP. In the Great Sand Hills of Saskatchewan 60 km northeast of Chappice Lake, Wolfe et al. (1995) inferred a period of dune stability between about 4800 BP and 2600 BP when the level of Chappice Lake was rising.

- Harris Lake, Saskatchewan: From the pollen and organic matter stratigraphy of Harris Lake in the Cypress Hills of southwestern Saskatchewan, Sauchyn (1990) and Sauchyn and Sauchyn (1991) inferred that the climate there was warmer and drier than present from 9100 to 5000-4500 BP, with greatest aridity from 7700 to 6800 BP. A diatom record, however, indicates that salinity increased only slightly during this period and that, in contrast to many other Prairie lakes, Harris Lake remained fresh throughout the Holocene (Wilson et al., 1997). Cooler, more moist conditions began about 5000 BP and the modern climate was established by about 3200 BP (although the period 3000-2400 BP may have been somewhat cooler).

- Kenosee Lake, Saskatchewan: Kenosee Lake in Moose Mountain, southeastern Saskatchewan, was shallow and saline from 4100 to 3100 BP but rose rapidly to approximately its modern level and area between 3100 and 2300 BP (Vance et al., 1997; Lemmen and Vance, 1998).

- Killarney Lake, Manitoba: Killarney Lake in southwestern Manitoba, which has a modern depth of 6 m, dried completely during the mid-Holocene period of maximum aridity (Lemmen and Vance, 1999). The climate history for the last 4700 years has been reconstructed by Richmond and Goldsborough (1999). As in the other lakes, the earliest phase (4700-3000 BP) suggested a shallow but gradually increasing lake depth, "recovering" from the more arid mid-Holocene climate. Deepening of the lake continued into the "modern" period reaching a maximum 1800-1500 BP and thereafter the lake has oscillated between deeper and shallower phases.

Vance et al. (1995) suggested that the change from a warm-dry "Hypsithermal" toward cooler, moister conditions may have been time-transgressive across the Prairies, appearing first about 6000-5000 BP in the mountains and foothills of western Alberta but not until 4000-3000 BP on the eastern Prairies of southern Manitoba. It is possible that some of the other transitions may have been time-transgressive as well.

The "Modern Period" (3000 - 2500 to 100 BP)

The ameliorating climate of the late mid-Holocene culminated in the establishment of "modern" vegetation and broad climatic characteristics, identified by Ritchie and others as beginning about 3000-2500 BP. Lake levels across the Prairies appear to have achieved relatively high levels during this period, suggesting a climate which was generally more humid, with greater *effective* precipitation due to a combination of cooler temperatures and greater precipitation.

The last millennium of this period, from about 1200 BP to 200 BP, contains two of the most widely-discussed climatic episodes of the Holocene - the Medieval Warm Period and the Little Ice Age. Opinion on the character and spatial extent of these episodes is not unanimous in the paleoclimate community and is subject to frequent revision as the resolution and number of proxy records improve. Nevertheless, evidence for both episodes has been identified in proxy records from the southern Prairies.

The "Medieval Warm Period" (AD 900 - 1200)

The Medieval Warm Period (MWP) was an interval when temperatures in many areas of the world (but not all) were higher than those of the preceding and following periods, particularly in summer. The most extreme interpretations have suggested that temperatures approached those of the mid-Holocene "Climatic Optimum" and were warmer than any subsequent period until the last decades of the 20th Century. The MWP is also associated with frequent and severe drought which had dramatic consequences for many indigenous plains cultures (Bryson, 1980). The temporal boundaries of the MWP vary somewhat among authors, from as broad a period as the 9th to the 14th Centuries AD (Hughes and Diaz, 1994) to the more narrow 10th to 13th Centuries . The latter is adopted

here after Lemmen and Vance (1999).

Considerable evidence exists for a dry interval on the Prairies, coinciding with the generally-recognized dates for the MWP. At Chappice Lake, low-water stands and significant drought have been identified during the interval from about 1000 to about 600 ^{14}C BP, in contrast to the apparently high water levels, fresh water and general absence of drought from about 2600 to 1000 BP (Vance et al., 1992, 1993). The sedimentary characteristics within the MWP interval suggest that droughts were more frequent, longer, and stronger than those within the 20th Century (Lemmen and Vance, 1998). Evidence for a low water level and "slightly warmer and/or drier climate" from 1000 to 900 ^{14}C BP has also been found at Redberry Lake north of Saskatoon (Van Stempvoort et al.,1993), at Pine Lake near Red Deer, Alberta (Campbell, 1998), and at Killarney Lake (Richmond and Goldsborough, 1999). Two optical dates of 950 BP and 650 BP on dune sands in the Great Sand Hills northeast of Chappice Lake indicating dune activity (and presumably aridity) approximately bracket the Chappice Lake low water interval (Wolfe et al., 1995). The most detailed record for the "modern" period comes from Moon Lake, North Dakota, where a high-resolution diatom-based salinity chronology has been constructed for the past 2300 years (Laird et al., 1996, 1998). An arid MWP is indicated by a distinct interval of very high inferred salinity from AD 1000-1200.

The Moon Lake cores, however, also suggest that in that region at least the "modern" (i.e. post-2500 BP) record was more varied than the generally continuous high water levels which have been inferred from the lower-resolution cores in lakes on the Canadian Prairies. In the Moon Lake cores, the MWP was only one (albeit the latest and most severe) of a succession of high salinity/drought episodes, each lasting for more than a century and of greater intensity than the drought of the 1930's. Laird et al. (1998) identified other prominent drought episodes at AD 750-850 and 200-370 and their salinity chronology suggests that the period prior to AD 200 also had very dry intervals. Other evidence for periodic aridity is contained in buried organic horizons commonly found in the aeolian sands on the Assiniboine Delta surface which indicate periods of renewed dune activity. In the Brandon Sand Hills generally and the "Brookdale section" of a dune north of Carberry, Manitoba, David (1971, 1993) dated paleosols at 4300, 3700, 2900, 2400, 2100, 1850, 1550, 1100, 850 and 400 ^{14}C BP. Several of these are very close to salinity maxima at Moon Lake, suggesting that they reflect regional rather than locallized effects. Laird et al. (1996) concluded that "extreme droughts of greater intensity than those during the 1930's "Dust Bowl" were more frequent prior to AD1200." (p. 161), in contrast to the earlier statement by Vance et al. (1993) that "drought was evidently not a significant element of northern Great Plains climate from 2600 to 1000 BP" (p. 117). The evidence from Laird et al. and David suggest that the MWP may have been merely the most recent of numerous dry episodes throughout the modern period, rather than a distinct climatic episode.

The "Little Ice Age" (AD 1450 - 1850)

Closely following the MWP was the Little Ice Age (LIA), another controversial interval conventionally portrayed as a distinctly cooler period during which, for example, glaciers in the Rockies advanced to post-Wisconsinan maxima (for a review of this and other evidence, see Beaudoin, 1999). The temporal boundaries of the Little Ice Age vary

considerably among studies, beginning as early as AD 1400 or before in some and as late as AD 1600 in others, and ending between 1850 and 1900. As with the MWP, the dates used here follow those suggested by Lemmen and Vance (1999).

In the Moon Lake cores, Laird et al. (1996, 1998) identified the onset of the Little Ice Age by a sudden, pronounced, and prolonged shift to lower salinities after about AD1300-1350 (650-600 BP), approximately the same time that Chappice Lake began a return to high water levels which lasted until the beginning of the historic period of the late 19th Century. Kenosee Lake was high and relatively stable with lowered salinity during this period (Vance et al., 1997) and paludification of the Moose Mountain region appears to have occurred during the LIA (Lemmen and Vance, 1998). Wolfe et al. (1995) found no evidence of dune activity in the Great Sand Hills of southwestern Saskatchewan between AD 1400 and 1770, which he felt indicated a period of dune stability and increased moisture. Sediments in Pine Lake, south-central Alberta, have been interpreted as indicating that the most "moist" climate during the 4000-year record occurred during the Little Ice Age (Campbell, 1998). Lemmen and Vance (1998) asserted

> In fact, all sites studied as part of the Palliser Triangle IMRA show relatively high water levels from the MWP to the historic period. This suggests that the LIA may have been a time of relatively abundant surface waters and infrequent drought in the southern prairies, with the caveat that high, freshwater lakes are not particularly sensitive to short term drought events. (p. 48)

Data from other studies, however, suggest that the LIA was more complex than this and not a continuously cool and wet interval. At Moon Lake, a zone of higher-salinity was observed from about AD 1620 to 1710 and David's paleosol date of 400 ^{14}C BP from the Brookdale dune suggests regional aridity of unknown duration. Clark (1988) characterized the period AD 1420-1600 at Demming Lake, northwestern Minnesota, as warm/dry, reflected in a lengthy period of relatively high charcoal abundance in lake sediments occurring between a cool/moist interval AD 1240-1420 and the onset of the LIA which he defined as beginning at AD1600. Exceptionally high "spikes" of charcoal abundance occurred at about AD 1460, 1520 and 1600. At Redberry Lake, Saskatchewan, the period AD 1450-1750 (500 to 200 BP) was interpreted as a warmer, drier interval (Van Stempvoort et al., 1993). At Coldwater Lake, North Dakota, Xia et al. (1997) found that a "sudden return of warm and dry conditions occurred during the last 600 years" (600-150 BP). Schwalb and Dean (1998) interpreted several variables in the sedimentary records in Pickerel Lake, South Dakota, and Elk Lake, Minnesota, as indicating arid conditions from 400 to 200 BP (AD 1550-1750), about the same time as a period of low lake level occurred in Devil's Lake, North Dakota (Bluemle, 1991) and high salinity occurred in Moon Lake. A pattern of increasing drought frequency until late in the LIA was inferred by Case and MacDonald (1995) from tree ring records in southwestern Alberta. From two "drought events" in the 16th Century, the frequency increased to 8 in the 17th, reached a peak of 14 in the 18th, and fell to 5 and 6 in the 19th and 20th Centuries respectively. In the century of peak frequency, the 18th, drought events were particularly closely spaced about 1720, 1760-70, and especially in the decade 1791-1800 when drought occurred in 6 of the 10 years. At Maple Creek, Saskatchewan, a tree-ring reconstruction of August-July precipitation shows three intense droughts rivalling that of the 1930's, including a severe event in the 1790's (Sauchyn and Beaudoin, 1998). Wolfe (1997) and Wolfe and Lemmen

(1999) have suggested that the last interval of regional sand dune activity on the Canadian Prairies may have been initiated by the intense droughts of the 1790's. Tree ring reconstruction of annual precipitation in the Red River Valley region indicates a long period of below-average precipitation (compared with the modern normal) during the 17th and most of the 18th Centuries (St. George and Nielsen, 2001, personal communication). However, the Red River record does not indicate severe drought in the 1790's and it may be that the droughts of that decade, inferred from data in Alberta and western Saskatchewan, did not extend as far east as Manitoba.

Late "Little Ice Age" (AD 1800 - AD 1900)

The period covered by this report (1793-1870) falls within the last 100 years of the Little Ice Age, beginning with the first written accounts from the region of the Assiniboine basin and extending to near the beginning of systematic instrumental records. The high resolution and breadth of environmental observations in the written records combined with the more abundant data from other proxy indicators and early instrumental measurements greatly increases the precision of climatic reconstruction. Most of the data suggest that much of the 19th Century had a hydroclimate which was "wetter" than the 20th Century, due to a combination of cooler temperatures and possibly higher precipitation which would have favoured higher runoff.

From 900 years of summer temperatures reconstructed from tree rings in the Columbia Icefield region of Alberta, Luckman et al. (1997) concluded that "A striking feature ... is the severity of conditions during the 19th century which contains 8 of the 10 coldest years [summers] and 4 of the 10 coldest decades" in the entire record (p. 382-383). At the Red River Settlement (modern-day Winnipeg), the Red River froze 12 days earlier on average and cleared of ice 10 days later during the 19th Century than during the 20th, suggesting mean October-November and March-April temperatures about 2-2.5°C cooler (Rannie, 1983); the change in dates occurred very rapidly at the end of the 19th Century. An almost-identical pattern was found for the ice cover changes at Lake Mendota at Madison, Wisconsin from 1855 to 1991 (Robertson et al., 1992), indicating that the change in ice cover was a broad regional phenomenon rather than a product of local changes on the Red River. Wahl and Lawson (1970) compared instrumental records from the United States for 1850-70 with 1930-60 normals. For the region of the United States contiguous to southern Manitoba and Saskatchewan, their maps (Figure 12) show that average temperatures were colder in all seasons and on an annual basis were 0.5-1.0°C colder. The greatest seasonal differences were for winter and early fall, followed by summer and late fall; the least difference was in spring. Instrumental records at Winnipeg from 1872 to 1988 indicate that the average date of first fall frost was 10 days earlier in the latter 19th Century than in the 20th, with the change occurring within the first decade of the 20th Century (Rannie, 1990). Mean annual minimum temperatures from August to October were about 1.5°C lower during the same period. Numerous reports of unusually early frosts (by 20th Century standards) in documents from the Red River Settlement suggest that these conditions were not limited to the latter part of the century (Rannie, 1992).

Evidence also exists that precipitation may have been greater in the 19th Century, or at least that wet years were more common. Wahl and Lawson's maps (Figure 12) indicate that annual precipitation on the northern Great Plains of the United States was

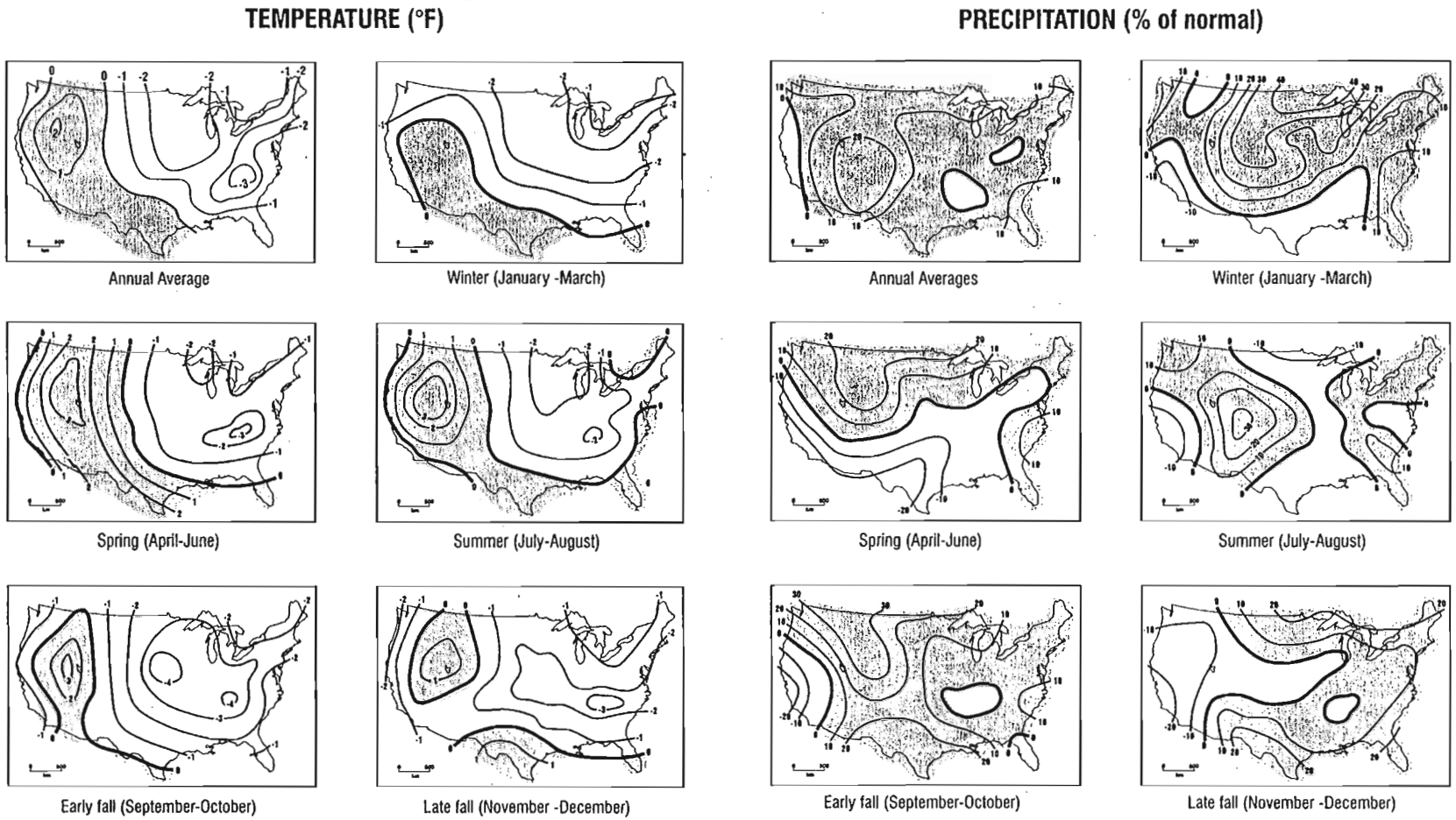

FIGURE 12: Deviations in 1850-1870 temperature (°F) and precipitation (%) from 1931-1960 normals, United States (modified from Wahl and Lawson,1970)

about 10% greater in 1850-70 than in 1930-60, with higher positive departures in all seasons except summer which showed a slight decline. The largest seasonal differences were for winter (+40%) and spring (+20%), the seasons which are the most important for runoff generation. Although Wahl and Lawson indicated slightly smaller summer precipitation, other studies have documented an unusual incidence of very wet summers in the Red River basin and high summer flows on the Red River, most notably in 1806, 1824-27, 1849-1851 and 1860 (Rannie, 1999a,b). Blair and Rannie (1994) and Rannie and Blair (1995) suggested that these summers corresponded to anomalous summer pressure patterns favouring meridional circulation which may have been more common in the 19th Century, as had been suggested earlier by Bryson (1980) and Knox (1983).

Drought occurred periodically in the early 19th Century, most notably in 1803-05, 1815-18, and the early 1820's. The 1803-05 event was particularly severe, extending over an area from Lake Superior to the Missouri River region of North Dakota (Kemp, 1982). The 1815-1818 dry period is apparent from archival records in the Red River Valley (Rannie, 1999a) and the severe drought of 1820 appears in the Maple Creek tree rings (Sauchyn and Beaudoin, 1998) and in tree rings from a broad area of the northern Great Plains of the United States (Stockton and Meko, 1983; Meko, 1992). Major fire episodes during this period were identified in Itasca State Park, northwestern Minnesota, in 1802-05, 1811-14, and 1820 (Frissell, 1973; Clark, 1990). The other notable drought in the Red River region occurred in 1863-64, one of the most extreme in the entire century (Rannie, 1999a) and probably of subcontinental extent. The event appears in tree rings from the northern Great Plains (Stockton and Meko, 1983) although it is not especially pronounced in the Maple Creek record (Sauchyn and Beaudoin, 1998), and is also reflected in extremely large fires in Itasca State Park and the Boundary Waters Canoe Area in northeastern Minnesota (Swain, 1973; Frissell, 1973; Heinselman, 1973). In both locations, the fires were among the largest in the last 300 years.

These episodes notwithstanding, the frequency of droughts was lower in the 19th Century than in the 18th and the period 1820-1863 was virtually drought-free. High resolution proxy indicators from lakes in Minnesota and North Dakota support this scenario of a cool/wet 19th Century. At Demming Lake, Minnesota, the charcoal content fell from a substantial peak in the late 1700's to low values through most of the 19th Century until another maximum about 1880 (Clark, 1990). Apart from the large fires in 1863-64, no fires of consequence occurred from 1820 to 1880, which Clark interpreted as indicative of a cool, moist interval. At Moon Lake, ND, the period 1800-1850 had the lowest absolute and average salinity in the entire 2300-year record, including a

> freshwater interval (salinity <3 g/l) during AD 1820-1835 [which] corresponds to both an episode of abruptly cold temperatures frequent in many records in the early to mid-1800's, and to a drought-free period from 1825 to 1838 inferred from tree-ring records on the periphery of the US Great Plains. (Laird et al., 1996, p. 553)

The Moon Lake record is in accord with evidence from Devil's Lake which lies in a 9870 km^2 closed basin in north-central North Dakota. The lake level was high (438.5 m asl) at the beginning of surveyed records in 1867 and Upham (1895) concluded that the lake had been somewhat higher (439.3 m) in 1830. In contrast, after 1867, the level fell almost continuously to a minimum of 427.1 m in 1940 and then rose to 433.7 in 1992; the spectacular recent rise in the lake level to 441.3 m by 2001 following a succession of high

spring and summer runoff years shows the extraordinary sensitivity of the lake to changes in effective precipitation. Wiche et al. (1997) presented arguments that the lake level was high during most of the 19th Century prior to 1867, in agreement with the Moon Lake record. Although Fritz et al. (1994) constructed an alternative salinity record for the lake from diatoms which showed relatively high salinity and by implication low lake levels from 1800 to 1850, the Moon Lake record and the balance of other evidence favours the argument for high levels and high effective precipitation. From a simulated water balance Vecchia and Wiche (1997) concluded

> The small changes in precipitation values..., on the order of a few tenths of an inch, are accompanied by large changes in inflow to Devil's Lake. Thus, small variations in climatic conditions can cause large fluctuations in lake level...The overall pattern...indicates that the most likely scenario is normal (compared to more recent data) precipitation and inflow in the 1830's, 1840's, and 1870's, above-normal precipitation and inflow in the 1850's and 1860's, and below-normal precipitation and inflow in the 1880's. (p.44)

From subjective estimates of runoff conditions in the Red River Valley, Rannie (1999a) recognized three time periods from 1793 to 1870:

> 1793/94 to 1827/28: A period of great variation and high frequency of extremes. Floods and high runoff years occurred throughout the period, particularly the years 1824-28 which included the largest known flood on the river (1826) and probably had the highest total runoff in the entire record. Periods of drought and low runoff also occurred, notably in 1803-05 and 1816-18.
>
> 1828/29 to 1846/47: A period of comparative stability with no floods or significantly above-normal runoff, no droughts and only two years of moderately low runoff.
>
> 1847/48 to 1869/70: A period of generally high or very high runoff, with three large and several smaller floods, and "normal" runoff in most other years. The largest flood, in 1852, was the second largest historical flood and was approximately equal to the extreme 1997 event. Exceptional summer rainfall occurred in several years in the late 1840's and early 1850's and flooding occurred in four consecutive years from 1849 to 1852. Nevertheless, the drought from 1862-64 was one of the most severe in the entire record.

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PART THREE

FLOODS AND HIGH WATER EVENTS, 1793-1870

INTRODUCTION

The objective of this chapter is to identify all years for which there is the evidence of either flooding or at least high water conditions, using archival materials from the vicinity of the Assiniboine watershed from 1793 to 1870. The entries for each year follow the format used in the comparable Red River report (Rannie, 1999), beginning with the chronology of the event using the original accounts, followed by a description of the antecedent conditions from the previous fall and freezeup period through to the spring breakup and the beginning of the 'flood' event. Inclusion of a year in this section does not imply that actual flooding occurred, but merely that there is some indication that high water conditions may have occurred and that flooding along some portion of the river was possible.

Most observations come from five localities (Figure 13).

- Red River Settlement - The Red River Settlement was located in the vicinity of, and downstream of the "Forks" at the confluence of the Red and Assiniboine Rivers (the site of modern Winnipeg);

- Brandon House - Beginning in 1793, several Brandon House posts were situated on the north bank (and for a time on the south bank) of the Assiniboine River above the confluence with the Souris.

- Fort Ellice - This region includes a number of posts in the vicinity of the confluence of the Qu'Appelle and Assiniboine Rivers (near present St. Lazare, Manitoba). The earliest was on the Qu'Appelle about 15 km upstream from the Assiniboine, another (after 1817) was on the Assiniboine about 2 km south of the confluence. In 1871, Fort Ellice I was established on Beaver Creek 4 km south of the confluence and in 1862-64, Fort Ellice II was built on the western rim of the Assiniboine Valley about 2 km east of Fort Ellice I (Johnson, 1952).

- Upper Assiniboine - Observations from this region come from a number of posts in the upper basin near the "Elbow" of the Assiniboine about 25 km northwest of modern Kamsack, Saskatchewan. These included Marlborough House, Carlton House, Hibernia I and II, and Fort Pelly. The latter was established in 1824 and moved back from the river slightly in 1856-57, probably because of occasional flooding at the original site. Morton (1942) has summarized the locations and early history of the upper Assiniboine posts; for descriptions of the site and activities of Fort Pelly, see Klaus (1961) and Klimko (1983).

- Swan River region - Swan River House was located on the Swan River above its outlet into Swan Lake. A short-lived post, Somerset House, was also located on the Swan River about 30 km upstream from Swan River House. Although neither of these posts was within the Assiniboine watershed, the Swan River drains the Duck Mountains and conditions there would reflect those over an important contributing area to the upper Assiniboine and probably over Riding Mountain as well.

These primary sites are supplemented by periodic accounts from some other vantage points within and near the watershed (eg. Fort Dauphin), from travellers, and from regions outside the Assiniboine watershed, most importantly from the Red River basin to the southeast.

A reconstruction such as this presents numerous problems beyond those which are normally encountered in the interpretation of historical documents. Some of the difficulties arise from spatial and temporal gaps in the record. Although the posts were located along virtually the entire river length, not all posts were occupied continuously or simultaneously. Thus in years when the Fort Pelly region in the upper Assiniboine basin was the principal source of observations, no information would be available for the crucial contributions from the Qu'Appelle, Souris and Riding/Duck Mountain tributaries. Furthermore, for much of their existence, posts in the Fort Pelly region were operated on a seasonal basis, being vacated in the spring (early May) and not re-occupied until September. Thus even in years when excellent records are available, the rainy season of late May and early June may have gone unrecorded. Observations from the Fort Ellice region would "capture" flow from the Qu'Appelle and some of the Riding/Duck Mountain tributaries, but Fort Ellice itself wasn't constructed until1831 and records from other posts in the region prior to 1831 are sparse. Other gaps arise because records have not been preserved or because some observers were not inclined to record environmental conditions- in some periods, virtually daily entries make little mention of weather or river conditions and in others, journal entries were only occasional and sporadic despite continuous occupation of the post. One reason why observers might have paid frustratingly little attention to the river involves the lack of serious consequences of flooding. Throughout its entire length, relatively few people lived along the river and even today, the number of people who would be displaced or suffer damage from a very large flood is relatively small. Thus, although the river was an important travel artery, flooding was not an important concern; rather, there was more reason to comment on unusually low water which would inhibit travel.

The most abundant observations come from the Red River Settlement, particularly after 1820. While its location at the mouth of the river would seem to make it an ideal vantage point to observe the Assiniboine, this is not necessarily the case. Despite the remarkable quantity of commentary, frequently by multiple observers, the Settlement was far-removed from the sources of runoff and had climatic characteristics which were not necessarily reflective of conditions over much of the Assiniboine basin, the center of which lay about 400 km to the west. In addition, observations of the Assiniboine in the vicinity of the Forks are compromised because the height of the Assiniboine there is controlled by the stage of the Red during high water on the latter. Because all observations of the Assiniboine in the Red River Settlement were made from within the backwater effect of the

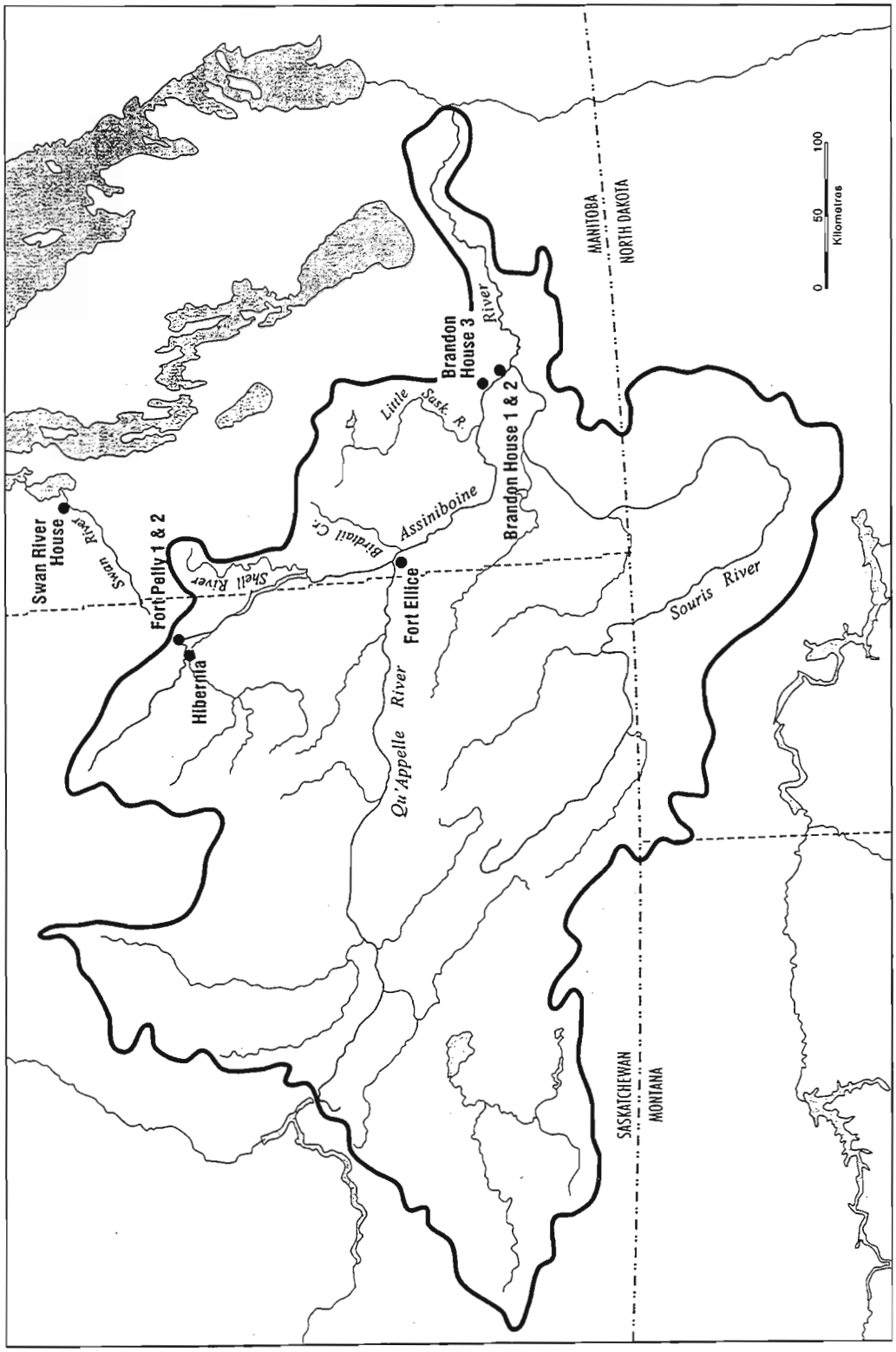

FIGURE 13: Location of principal observation sites.

Red, a comment that the Assiniboine was "very high" during a flood on the Red cannot be interpreted to indicate with certainty that the Assiniboine also had large discharge. In addition, as was noted in PART ONE, during large Assiniboine floods a significant portion of the overbank flow escapes northward to Lake Manitoba or southward into the La Salle and the Red via paleochannels in the vicinity of Portage la Prairie. Both routes bypass the lower Assiniboine altogether, although under these conditions, flow in the river downstream of Portage la Prairie would still have been very high. The ideal observation site would be Portage la Prairie but unfortunately records at this location are rare and transient.

For these reasons, descriptions of river conditions are less abundant and often less useful than for the Red River and it has been necessary to rely more heavily on observations of such phenomena as accumulated snowpack, precipitation during the freshet, rainfall in May and June, etc. For some years (eg. 1849, 1850, 1851), direct information from within the Assiniboine basin is scanty or non-existent and the possible state of the river has been inferred from conditions in the Red River basin.

The historical materials are given in as much detail as is practical to enable others to evaluate the "data". All commentary which casts light on the actual floods and runoff conditions have been included. Other comments are given to provide some continuity. Despite the abundance of citations, however, it must be emphasized that only a small proportion of the total volume of commentary has been included. Materials from the Hudson's Bay collection are prefixed by HBCA, followed by the archival reference number; materials from the Provincial Archives of Manitoba are prefixed by PAM. The Hudson's Bay Company references follow the format of entries in the archival catalogues, i.e. post name, post number, and file number. It is important to note that the post name in this system does not always signify the specific post but rather the region. Thus, for example, many journals for the region of the "Elbow" on the upper Assiniboine are catalogued as Fort Pelly, the longest continuous post in the area, even though Fort Pelly proper was not constructed until 1824. Similarly, some journals catalogued as Fort Ellice predate the actual Fort Ellice and come from earlier posts in the vicinity. Furthermore, for some years at some posts, portions of the record were kept at other locations or while travelling to or from the primary location. Thus, for example, some upper Assiniboine summer records were written while the observer was at Swan River.

No attempt has been made to estimate actual discharge from the archival descriptions as was done for the historical floods on the Red River (Rannie, 1999). In the Red River valley, the very gentle slopes of the valley permit floodwaters to spread widely and the inundated area offers a possible surrogate for discharge. This is not possible on the Assiniboine, however, because of the geomorphology of the floodplain which is entirely confined between steep valley walls above Portage la Prairie. Once a flood covers the valley floor, further increase in discharge may deepen the overbank flow but there is no increase in inundated area.

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1795

DESCRIPTION

This year seems to have had two phases of high water with possible flooding in the upper basin- a freshet peak and a second peak produced by abundant rain in June.

Despite an apparently very dry winter, the first mention of water levels refers to high water at Brandon House, probably a response to late March-early April snowfall in the upper basin (see Antecedent Conditions below).

> April 11: the water rises high in the River, the small Creek opposite the House open. (Brandon House Journal, HBCA B.22/a/2 1794/95)

> April 19: the water on the River rises very high. (Brandon House Journal, HBCA B.22/a/2 1794/95)

April was dry at Brandon House with rain mentioned on only 2 days until the end of the month when it was reported from April 29- May 2. At both Somerset House on the upper Swan River adjacent to the Assiniboine basin and Shell River, considerable precipitation was reported throughout April. At Somerset House, it snowed "all day" April 14, 15 and16 and at Shell River, John Sutherland reported

> April 14: a very bad day of snow (Shell River Journal, HBCA B.199/a/1 1794/1985)

> April 15: weather the same as Yesterday. I really believe it fell as much snow Yesterday and the Day as it did this Season before. (Shell River Journal, HBCA B.199/a/1 1794/1985)

May and June were also relatively dry at Brandon House with only occasional rain ("heavy" on June 2). On June 13, however, the river was reported as "rising high" again.

> June 13: rain the water rises high in the River. (Brandon House Journal, HBCA B.22/a/2 1794/95)

The cause of this rise was abundant rainfall in the upper Assiniboine basin, as indicated by the record at Somerset House/Swan River (Somerset House Post Journal [Swan River], HBCA B.203/a/2 1795-96).

May 25	rain all Day	June 8	the same as yesterday	June 16	rain at times
May 30	rain & Thunder at times	June 9	rain all Day	June 17	the same as yesterday
June 2	at 4 PM a violent Storm arose from the SWest with Thunder Lightning & rain	June 10	rain all Day	June 24	rain at times
June 5	Rain at times	June 12	rain all Day	June 29	rain at times
June 6	rain all Day	June 13	the same as yesterday	June 30	Thunder, Lightning & heavy rain
June 7	rain at times	June 14	rain at times		

During this period, the weather on 7 other days was described as "Inclinable to rain".

The Swan River rose rapidly after June 9 and was high at least until early July (Somerset House Post Journal [Swan River], HBCA B.203/a/2 1795-96).

June 9: the Water in the River rose to 7 feet.

June 10: the river still rising.

June 11: at 7 AM the Water came over the river bank & overflowed the Plantation, people employed keeping the Water out of the House.

June 12: the Water in the river Decreasing.

June 13: the Water in the river being so high there is no possibility of setting a net.

June 16: the Water in the River rising.

June 17: the River still rising.

July 1: the Water in the River rose to [?] Feet.

July 5: the Water in the River Decreasing.

Observations at Brandon House during the rest of the summer were unremarkable but abundant rain continued in the Swan River region (Somerset House Post Journal [Swan River], HBCA B.203/a/2 1795-96).

July 4	Thunder Lightning & heavy rain	August 5	Thunder Lightning heavy rain
July 6	Thunder Lightning & rain	August 7	rain at times
July 8	Thunder Lightning & heavy rain	August 12	rain at times
July 11	Thunder Lightning & rain	August 14	rain at times
July 26	heavy rain	August 18	rain at times
July 27	the same as yesterday	August 21	small rain all Day
July 30	Thunder Lightning & heavy rain	August 23	rain at times
August 2	Thunder Lightning heavy rain	August 28	small rain all Day
August 4	Thunder Lightning heavy rain		

As in June, the weather in July and August was reported as "Inclinable to rain" on an additional 11 days.

The brigade to the upper Assiniboine encountered heavy rain in late August (27 and 28) near Headingley as it ascended the Assiniboine but only periodically after that to the end of September. At Swan River, precipitation was reported on 7 days in September with "Inclinable to rain" comments on 6 other days.

Neither the upper Assiniboine nor Brandon House Journals mention the state of the river as they moved upstream in August and September and it can only be concluded that

there was sufficient water not to present difficulties, in contrast to most years when it would be commonly reported as shallow in some reaches at least.

ANTECEDENT CONDITIONS

October, 1794, was dry, with no precipitation reported at Brandon House or Somerset House until October 27-31. Temperatures were moderate. Ice was forming at Brandon House on October 20 but freezeup did not occur until November 12.

November was cold with more snow at Brandon House on October 31, November 4, 9, 10, 22, 24, 25, 30 and December 1, and "all day" at Somerset House on November 3, 8, 17, 23, 26, and December 1.

December was much milder with no precipitation reported at Brandon House until snow fell on the 30th and on only one day at Somerset House.

The weather was cold and dry for the first half of January, and then milder and dry from January 17 to February 14. Thereafter cold and milder conditions alternated to the end of March.

The winter, then, appears to have been exceptionally dry at Brandon House at least. Snow was mentioned on only 2 days between January 1 and April 11. Only 3 days with snow were reported at Somerset House from December 23 to March 22. However, at Somerset, it snowed "all day" on March 23, 28, and April 1. At Shell River post, snow was reported on only 3 days from December 27 to March 14 and then on 4 days between March 15 and April 2. Mild weather began at Somerset House on April 5 and the melting of this snow from the upper basin may have produced the rise on water observed at Brandon House on April 11.

DISCUSSION

The virtual absence of recorded snowfalls in daily entries at Brandon House during most of the winter is difficult to reconcile with the mentions of high water in April. It is possible that the observers were unreliable in recording precipitation (although other features were entered on a daily basis) or that conditions were different upstream. The latter seems likely, especially given the somewhat heavier late-winter snowfall observed at Somerset House and very different conditions between the upper basin and Brandon House which produced the second rise in June.

The floods of 1902, 1954 and 1955 provide possible analogues for this year.

1797

DESCRIPTION

After a late breakup at both Brandon House and the upper Assiniboine post, the river was reported as very high in May, 1797, in the Brandon House Journal.

> April 27: ...water rising fast in the [Assiniboine] river and the ice breaking away in small pieces. (Brandon House Journal, HBCA B.22/a/4 1796/97)
>
> April 30: fine weather the [Assiniboine] river open water very high. (Brandon House Journal, HBCA B.22/a/4 1796/97)
>
> May 1: the [Assiniboine] River took a shove the day which gives me hopes that she will be soon open, she was open 18 days before this time last year. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796-97)
>
> May 5: a gale of wind with a little rain, [Assiniboine] River driving with Ice. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796-97)
>
> May 7: ...the water is higher in the [Assiniboine] river than ever any man of the oldest time has seen it...[it has risen] 10 feet perpendicular where there was not one drop last year. (Brandon House Journal, HBCA B.22/a/4 1796/97)
>
> May 18: Cannot get the Boats repaired and all the houses filling with water. (Brandon House Journal, HBCA B.22/a/4 1796/97)

The May 7 report of very high water on the upper Assiniboine is supported by conditions on the nearby Swan River.

> April 30: warm weather the water in the [Swan] river rising very fast and the Ice Blown up in several places from the bottom. (Carlton House Journal, HBCA B.28/a/3 1796-1797)
>
> May 1: thunder and rain... the river still rising & the Ice all broke up. (Carlton House Journal, HBCA B.28/a/3 1796-1797)
>
> May 5: heavy rain at times & thick Snow in the evening...three men on watch as the river is very dangerous. (Carlton House Journal, HBCA B.28/a/3 1796-1797)
>
> May 6: the river still dangerous as the water is even with the bank. (Carlton House Journal, HBCA B.28/a/3 1796-1797)
>
> May 7: the river took away this morning but stopped short below the french house at 11 PM went down lower and stopped the Water came over the Bank at the Canadian House & all round their stockades. (Carlton House Journal, HBCA B.28/a/3 1796-1797)
>
> May 8: the river got under way and made a great deal of Ice & water come over the bank below our House & above kept all hands employed making a dike to keep the water from the House. (Carlton House Journal, HBCA B.28/a/3 1796-1797)

Despite the apparently severe conditions indicated in these comments, there is no further mention of the state of the rivers from that date until August 8 when Swan River was

reported to be (still or again?) high.

> August 8: they could not get across Swan River the water being high. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/4 1797-98)

ANTECEDENT CONDITIONS

The Brandon House and Fort Pelly [Indian Elbow] journals contain references to low water in the Assiniboine in the fall of 1796, beginning at the Forks and continuing as the observers proceeded upstream.

> August 30: Clear fine weather...found water low in the [Assiniboine at the Forks]. (Brandon House Journal, HBCA B.22.a.4 1796/97)

> September 8: leading almost all day, hard work, water low making the Journey very disagreeable. (Brandon House Journal, HBCA B.22.a.4 1796/97)

At Brandon House, the weather was described as "fine", "hot sultry", "pleasant" with occasional rain until mid-October when winter appears to have set in relatively early, with initial freezeup between Brandon House and the upper Assiniboine occurring on October 22-24.

> October 15: Cloudy cold weather for the season with a hard frost in the evening. (Brandon House Journal, HBCA B.22.a.4 1796/97)

> October 20: the Batteaux was Stopt by Ice and the Shallowness of the Water in the [Assiniboine] river. Sharp Cloudy weather. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796-97)

> October 21: It snowed and froze so much Last night that it set the [Assiniboine] River fast. (Fort Pelly Journal, HBCA B.159/a/3 1796-97)

Considerable snow fell in late October ("a foot deep" at Brandon House on October 23), melted with warmer weather in early November, then returned with several heavy falls and refreezing of the river by mid-November.

> November 9: a heavy fall of snow this morning. (Brandon House Journal, HBCA B.22.a.4 1796/97)

> November 10: Cold weather with much snow on the ground. (Brandon House Journal, HBCA B.22.a.4 1796/97)

> November 12: ...am sorry you had such a troublesome Journey in the fall, owing to the early setting in of the [Assiniboine] River She filled with Ice here [Brandon House] the 24th of Oct. but was not totally set fast before the 12th of Nov. since which time we have had much snow and very severe weather. (letter, James Sutherland [Brandon House] to John Sutherland [upper Assiniboine], dated Jan. 3, 1797, Brandon House Journal, HBCA B.22.a.4 1796/97)

Daily records in both Brandon House and upper Assiniboine journals report numerous heavy snowfalls throughout the winter, particularly in February and early March.

At Carlton House on the upper Assiniboine, snow fell on 9 days from January 7 to February 10, all but one described as "heavy", "thick" and/or "all day" (Carlton House Journal, HBCA B.28/a/3 1796-1797). Temperatures in January fluctuated between "cold and sharp" and "mild, fine and pleasant" but February was reported as more uniformly cold.

> December 19: Severe sharp weather. Sharper and colder than ever I saw it down country I suppose on account of the heavy gale of wind. (Brandon House Journal, HBCA B.22.a.4 1796/97)
>
> February 9: a heavy fall of snow last night. (Brandon House Journal, HBCA B.22.a.4 1796/97)
>
> February 11: Cold sharp weather and a deep fall of snow last night. (Brandon House Journal, HBCA B.22.a.4 1796/97)
>
> February 16: Snowy weather all day. (Brandon House Journal, HBCA B.22.a.4 1796/97)
>
> February 23: Severe cold weather with a Storm of wind at N.W. (Brandon House Journal, HBCA B.22.a.4 1796/97)
>
> March 3: Snowey weather all day. (Brandon House Journal, HBCA B.22.a.4 1796/97)
>
> March 3: bad Day of snow. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796/97)
>
> March 7: heavy Snow and Drift all Day. (Carlton House Journal, HBCA B.28/a/3 1796-1797)

Persistent thawing began in mid-March. On March 12, Brandon House reported "much snow gone these 2 days" and rain and sleet fell in the upper Assiniboine region. However more snow fell at both posts on several days in the last half of March.

> March 14: Snowy day. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796-97)
>
> March 17: a bad day of snow and drift. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796-97)
>
> March 23: Stormy weather with Snow and Sleet. (Brandon House Journal, HBCA B.22/a/4 1796/97)
>
> March 25: Snowy Day. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796-97)

Periodic snow and thawing temperatures occurred in early April and the Assiniboine River began to rise at Brandon House on April 13.

> April 13: clear pleasant weather... Water rising fast in the [Assiniboine] River. (Brandon House Journal, HBCA B.22/a/4 1796/97)

Heavy snow and periodic rain fell in the last two weeks of April after the water began rising and continued into the flood period:

> April 14: snow all day. (Brandon House Journal, HBCA B.22/a/4 1796/97)
>
> April 15: As bad a day as ever was seen in this or any other Country...it fell more than a foot of snow. (Brandon House Journal, HBCA B.22/a/4 1796/97)

April 16: heavy snow till noon, snow 18 inches deep in the yard. (Brandon House Journal, HBCA B.22/a/4 1796/97)

April 18: More snow in the afternoon, cold disagreeable weather, the earth loaded with snow, no sign of the Rivers braking. (Brandon House Journal, HBCA B.22/a/4 1796/97)

April 19: Snowy Day...I left this place this day 12 months [ago] to go down to Brandon House, the [Assiniboine] River being open six Days befor, but no sign of her opening this year yet. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/3 1796-97)

April 21: Rainy weather all day. (Brandon House Journal, HBCA B.22/a/4 1796/97)

April 22: heavy rain all day.(Brandon House Journal, HBCA B.22/a/4 1796/97)

April 23: Very cold weather with snow last night, scarcely thaw'd on the height of the day. (Brandon House Journal, HBCA B.22/a/4 1796/97)

At Swan River, the Carlton House party reported considerable snowfall in the last week of April and the river began to rise rapidly on April 30 (see above).

April 23: Snow and drift all Day. (Carlton House Journal [at Swan River], HBCA B.28/a/3 1796-1797)

April 24: Snow all day. (Carlton House Journal [at Swan River], HBCA B.28/a/3 1796-1797)

April 25: cold weather with Snow at times. (Carlton House Journal [at Swan River], HBCA B.28/a/3 1796-1797)

April 29: thick Snow. (Carlton House Journal [at Swan River], HBCA B.28/a/3 1796-1797)

Cold weather continued through the first three weeks of May, becoming generally "fine" thereafter.

May 10: hard frost with Snow all Day. (Carlton House Journal [at Swan River], HBCA B.28/a/3 1796-1797)

May 13: cold weather with Snow at times. (Carlton House Journal [at Swan River], HBCA B.28/a/3 1796-1797)

May 15: Snow at times... [men] obliged to leave the Battoe for so much Ice in the swamps. (Carlton House Journal [at Swan River], HBCA B.28/a/3 1796-1797)

1801

DESCRIPTION

Overbank conditions in May were reported from several locations in and near the upper Assiniboine basin. Breakup was normal or slightly early and according to McLeod, the upper Assiniboine was high in mid-April. Abundant rain fell in late April-early May.

> April 13: ...fine weather...Ice driving in the [Assiniboine] River. (Brandon House Journal, HBCA B.22/a/8 1800-01

> April 16: the [Assiniboine] river is quite free from ice here & the water seems to be high. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 173)

> April 26: Cold, & Snowing...Blows amazingly hard for these many days past, freezes hard tonight. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 175-176)

> April 27: ... blows fresh with Snow all day. (Brandon House Journal, HBCA B.22/a/8 1800-01)

> April 28: This has been a most stormy, boisterous, day. None of the Snow melted. Owing to the extreme coldness of the weather. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 176)

> May 2: A Rainy boisterous day, it rained incessantly all night. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 177)

Rain or snow was reported on May 3, 5, 8,and 9 by McLeod and on May 2, 6, and 9 in the Brandon House Journal. From McLeod's description, the upper Assiniboine was overbank on May 10 and continued so for at least two weeks.

> May 9: ...blows fresh it rained all night. (Brandon House Journal, HBCA B.22/a/8 1800-01)

> May 10: Still raining, & cold the water [in the upper Assiniboine] is remarkably high, & all the low ground hereabout is entirely deluged. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 179)

> May 11: Still very bad weather, the water rising very fast, snowed today. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 179)

> May 12: A Cold cloudy day, Snowed & rained a little all day...the water [in the upper Assiniboine] is extremely high, and far from decreasing it still increases. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 179)

> May 13: A fine day...In the evening it rained & got cold weather. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 180)

May 14: ...Jacco...Red Deer...reports the water is so excessively high that all the plains & in particular those bordering on Lakes and rivers are overflowed which is far from being favourable for the beaver hunt, the water has risen 3 feet perpendicular since yesterday...the Rivers are so high they could not cross them. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 180)

May 16: Raining until half Past ten. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 180)

May 17: We sett off as soon as it was light to follow the people who could not cross at the usual crossing place of the S. River the water being so extremely high that all the points were entirely under water, & never did I see such heavy roads...it rained, thundered, & lightened at a terrible rate until noon when...the weather cleared up. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 180-181)

May 18: A very boisterous morning...before noon, when the weather got very fine...by the Height of the water & badness of the Canoe they could get no higher up the place called the Drap rouge. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 181)

May 19: ...the men tell me the Houses at Swan River had two feet water on their floors, when the water rose, & that they had not a Dry bit of ground, within three or four leagues of the Fort all around the overflowing of the River having laid all underwater [on upper Assiniboine]. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p.182).

May 20: ...the [Assiniboine] River still overflows the banks, & there is water on the House floor as yet. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 182)

May 21: A finer day than usual...the evening brought us rain & high wind the constant act from which it blows is the North. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 182)

May 22: ...sent people to fish. tho' the water is so high that they have very little success, rained again this evening not A fair day from one end to the other have we. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p.182)

Frequent and heavy rain continued until the first week of June. There was no further mention of the state of the rivers but they must have remained high for some time.

May 23: Rained most part of this night... (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 182)

May 26: Thunder, & Lightening, with prodigious downpours of Hail & Rain, all night... (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 183)

May 27: Rained all this day, & night... (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 183)

May 28: Cold, raining, & very disagreeable day. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 183)

May 29: Raining in the morning...Rained in the evening, with thunder & lightening. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 183)

May 30: Cold morning...came on to rain. Very heavily from noon until midnight without intermission. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 184)

June 2: ...it rained all this night, with Thunder & lightening. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 185)

June 2: ...Weather hot...severe storm at night. (Brandon House Journal, HBCA B.22/a/9 1801-02)

June 3: Raining and blowing all day, we could not stir. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 185)

There is some evidence that stages on the Red were also high (although apparently not overbank). Entries by Alexander Henry at Pembina in 1802 suggest that stages had been notably high the previous year:

May 9, 1802: It required 90 fathoms of net to cross the [Red] river as the water is high, and the strong current forms a great bend. (Alexander Henry in Coues, I. ed., 1965. The Manuscript journals of Alexander Henry and of David Thompson. Ross & Haines Inc., Minneapolis, p. 197)

May 11, 1802: Water falling it had risen almost as high as last year. (Alexander Henry in Coues, I. ed., 1965. The Manuscript journals of Alexander Henry and of David Thompson. Ross & Haines Inc., Minneapolis, p. 197)

ANTECEDENT CONDITIONS:

The fall of 1800 began early with cold and snow in October and an early initial freezeup at Brandon House but subsequent milder weather seems to have delayed permanent freezeup until mid-November.:

Oct. 14: sharp weather [Assiniboine] river full of driving ice. (Brandon House Journal, HBCA B.22/a/8 1800-01)

November 13: Ice in the [Assiniboine] River. (Brandon House Journal, HBCA B.22/a/8 1800-01)

These mild conditions continued from late November throughout most of December and January.

November 25: A very mild day, the most of the Snow melted today. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 133)

December 7: The weather seems bent on continuing both mild and Cloudy, always clearing up once in the 24 hours tho' for a Short time, every day it has all the appearance of snowing, but it disappoints us continually, I really begin to fear we shall starve this winter. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 138)

Heavy snow fell on the upper Assiniboine region in late January-early February but was melted with subsequent warm weather.

January 17: ...it snowed most part of the day which made the roads heavy. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 153)

January 17: ...the latter [part of the day] continued thick snow as bad a day as I have seen this season. (Brandon House Journal, HBCA B.22/a/8 1800-01)

January 22: ...the Buffaloe are going further off very fast owing to the extraordinary mildness of the weather, people go days journeys without mittens so very fine is the weather. I took a ride on horseback today of upwards of an hour without gloves & felt not the least cold. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 154)

February 4: This is still a worse day than the Day before yesterday, Snowing, Blowing, Drifting & Cold nearly a foot of snow has fallen between these two Days [on upper Assiniboine]. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 156)

February 6: A very boisterous day, Cold, Snowy, Blowing & Drifting furiously...the roads are excessively bad owing to the great fall of Snow lately. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 157)

March 5: A Beautiful day, thaws prodigiously. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 162)

March 7: As fine a day as the two preceding. all the Ice & Snow is entirely melted in the Fort [upper Assiniboine]. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 162)

March 8: A very charming day. The snow melts very fast. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 162)

March 13: ...the snow unfortunately for us melts very fast. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 164)

March 14: As fine a day as yesterday...the snow is absolutely quite gone the other side of Mr. Perignes' Fort [on upper Assiniboine]. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 164)

March 18: ... the Snow is so totally gone off. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 165)

Rain and snow fell on several days in late March and a change to colder weather caused it to begin to accumulate again.

> March 30: Snowed constantly from ten oClock A.M. until the evening when it ceased & the weather became much colder [on upper Assiniboine]. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 168)

> April 7: Not so cold as usual. Blew fresh, a good deal of snow thawed today. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 170)

> April 8: Far from being a warm day...the snow about here I believe is determined to remain with us, whilest all the Country round us has not a single spot remaining. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 170-1)

> April 11: A very fine day...there is a great deal of water on the Ice in the [Assiniboine] river. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 171)

> April 12: A Beautiful fine day, very little snow remaining. (Archibald McLeod in Gates, C.M. ed., 1965. Five Fur Traders in the Northwest. Minnesota Historical Society, Saint Paul, p. 171)

The elevation of the upper Assiniboine to flood stage seems to have been the result of frequent and significant precipitation in the second half of April and the first weeks of May. McLeod reported rain or snow on 7 days from April 15 to April 30 and on 14 days from May 1 to May 18.

1810

DESCRIPTION

The only evidence for this event comes from a few entries in the Brandon House Journal.

> April 19: its not possible to burn Charcoal as the Bluff is overflowed with water. (Brandon House Journal, HBCA B.22/a/17 1809-1810)

> April 23: the Water [in the Assiniboine] is extremely high. (Brandon House Journal, HBCA B.22/a/17 1809-1810)

There are indications that breakup of the Assiniboine upstream of Brandon House was rather late.

> April 28: the Ice driving down from above. (Brandon House Journal, HBCA B.22/a/17 1809-1810)

In late May and early June, very high water was reported in the Souris River.

> May 26: Sent John Easter and Thomas Favil to the Sourie to dart Sturgeon they returned in the Evening and say's the Water is too high. (Brandon House Journal, HBCA B.22/a/17 1809-1810)

> June 1: they returned and complains of the Water [in the Souris] being yet too high for darting [sturgeon]. (Brandon House Journal, HBCA B.22/a/17 1809-1810)

There are no further entries in the Brandon House Journal until November.

ANTECEDENT CONDITIONS

Little information exists about conditions in the basin during the fall and winter preceding the high water described above. Freezeup of the Assiniboine in 1809 seems to have been delayed until late November.

> November 18: the [Assiniboine] River is upon the brink of setting fast. (Brandon House Journal, HBCA B.22/a/17 1809-1810

The only other information is not particularly illuminating- that the weather on November 23 was "very mild", that it was "very cold and continually snowing" on January 5, and that the snow was "very soft" on April 5.

1812

DESCRIPTION

Two comments in the Brandon House Journal indicate that the Souris had very high discharge at the end of May and flooding appears to have occurred on the lower Assiniboine in early June.

Breakup of the Assiniboine at Brandon House was late and the weather at the end of April and early May was cold.

April 28: The River ice gave away. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

April 29: very Cold weather. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

On May 21, the Souris River was reported to be very high.

May 21: people [sent to Souris River the day before to fish] from the Souris arrived...without success owing to the great flush of water. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

Two weeks later, the lower Assiniboine above the Forks may also have been at flood stage.

June 4: I returned up the [Red] river toward [the Forks] with two men in a canoe to look after our men who were coming down with the horses. We found them 3 points above when we stopped and learned from them that the water was so deep in the plains that they could not take them further down in consequence I sent 4 men down with the canoe & I returned to the fort, with our man & the horses to leave them in the care of some freemen till the water abates...very heavy rain. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

High water on the Red in the spring is confirmed by a comment in October.

October 6: no post down there [near the mouth of the Red River] is perfectly able to support itself unless they have an opportunity of catching a great number of fish in the fall-which the very high water of this year forbids me to expect. (Pembina Journal of Occurrences, HBCA B.160/a/4 1812/13)

ANTECEDENT CONDITIONS

Winter conditions began early at Brandon House.

October 2: Cold Snowy weather. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

October 11: the weather continues so Cold that I'm afraid a good many of [the Indians] is injured by the frost. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

October 12: Nasty Snowy Weather. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

October 17: A very cold Day intense frost. (Brandon House Journal, HBCA B.22/a/18b

1811/12)

October 18: The weather still very cold a good deal of Ice driving in the River. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

October 22: The Ice in [the Assiniboine] River set fast strong enough to cross with Horses. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

Milder weather occurred at the end of October but heavy snow fell on November 12 -15 and the river set fast again on November 15.

October 25: The weather begins to get milder. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

November 12: A very Cold day drift and Snow. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

November 14: A very heavy fall of snow. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

November 15: Cold snowy weather the River set fast. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

Heavy snow was reported again on November 22 and December 15.

November 22: A heavy fall of snow. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

December 15: Thick snowey weather. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

Scattered entries in the Brandon House Journal in January and early February indicate very cold weather on those days at least (eg. -32°F on January 20). Cold weather continued through March and the first 3 weeks of April with several snowfalls.

March 13: A very bad day, drift & Snow. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

March 18: Weather very severe for this season of the year. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

March 27: Very cold weather. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

April 3: Wind drift & snow. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

April 4: Weather very Cold with drift & Snow. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

April 10: Very Cold weather, drift & Snow. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

April 12: Weather very cold. 15 below. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

April 18: Weather remarkably cold for this season of the year. (Brandon House Journal, HBCA B.22/a/18b 1811/12)

1825

DESCRIPTION

Rannie (1999) identified this year as one of the larger Red River floods during the 19th Century. Peak discharge may have been similar to that of 1950 and unusually high water extended beyond the normal spring freshet into the summer. Comparable conditions appear to have occurred in the Assiniboine basin. The emphasis here is upon the Assiniboine but conditions in the Red River will be described where appropriate.

Breakup on both the Assiniboine and Red Rivers appears to have occurred at a normal, or even slightly early, date and high water was reported immediately after breakup.

> April 12: About noon the Red River broke up and the ice continued drifting without interruption during the remainder of the day. (Red River Journal, HBCA B.235/a/6 1824/1825)
>
> April 13: There is now a scarcity of provisions in many parts now owing to the failure of the Sturgeon fishery; this is owing to the continuance of high water. (David Jones Journal, 1824-1825, PAM CMS 18 A92)
>
> April 13: Very little snow is to be seen and all Creeks are open. The weather rainy... (Fort Pelly Journal, HBCA B.159/a/8 1824-25)
>
> April 15: The ice in the Assiniboine River broke up and continued drifting down with great velocity during the day-The water in both Rivers rises very fast. (Red River Journal, HBCA B.235/a/6 1824/1825)
>
> April 16: The weather dark, raining for the greatest part of the day... (Fort Pelly Journal, HBCA B.159/a/8 1824-25)
>
> April 16: The Assiniboine River continued full of drifting ice, and the water in both Rivers rises very fast, so much so, as to overflow their banks in several places. (Red River Journal, HBCA B.235/a/6 1824/1825)

From April 16, the weather was described as warm and generally clear with numerous mosquitoes at both Fort Pelly on the upper Assiniboine and in the Red River Settlement until about April 26 when rain began at both locations. Water levels in the vicinity of the upper Assiniboine basin were high and becoming alarming on the lower Assiniboine in the Red River Settlement..

> April 25: [loaded boats for Swan River House] whilst the River is sufficiently high yet... The weather in the fore part of the day very warm, evening cloudy and rainy. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)
>
> April 26: The [Red] river is rising to a formidable height this year; the houses at Pembina are all overflowed; and several between us and Lake Winnipeg will be under water to morrow. (David Jones Journal, 1824-25, PAM CMS 18 A92)
>
> April 26: Rained all night, but cleared up a little...at 2 p.m....rain and snow prevented us from

going any further [toward Swan River House]. The weather continued snowing for the remainder of the day, cold. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

April 26: Rained heavily all day...The water is so high in both Rivers, as to cause them to overflow their banks, in consequence of which, many of the settlers have been obliged to abandon their houses. In several of the fields, which were sown with wheat some days ago, the owners have set their nets, and procured therefrom, abundance of fish; so extraordinarily high is the water this year. (Red River Journal, HBCA B.235/a/6 1824/1825)

Rain and snow were reported at both Red River and/or Fort Pelly on April 27-30 and May 3-7. The Swan River (adjacent to the upper Assiniboine basin) was very high on May 6 and the Red rose until mid-May, apparently overbank in the vicinity of the Settlement.

April 30: The water in both Rivers [at Red River] continues to rise very fast. (Red River Journal, HBCA B.235/a/6 1824/1825)

May 2: The Rivers still continue rising and the Settlers, whose fields are greatly inundated, are consequently much retarded in their labours. (Red River Journal, HBCA B.235/a/6 1824/1825)

May 3: [Rafting of logs and firewood] proved unsuccessful...owing to the extraordinary inundation of the river [which carried the wood] back from the banks of the River, where it lay, into the woods where it is now floating about. (Red River Journal, HBCA B.235/a/6 1824/1825)

May 6: We did not get any fish from our fishery as yet, the water being too high. (Fort Pelly Journal at Swan River House, HBCA B.159/a/8 1824-25)

May 14: The inundation begins to subside. (Red River Journal, HBCA B.235/a/6 1824/1825)

May 17: The Rivers are falling very fast. (Red River Journal, HBCA B.235/a/6 1824/1825)

As the rivers began to recede from the snowmelt peak, heavy, frequent, and apparently widespread rainfall produced a second rise. Several observations of conditions along the entire length of the Assiniboine are given by George Simpson as he travelled to the Red River Settlement.

May 18: Weather very unfavourable, bitterly cold for the Season, blowing hard and occasional hail Showers... [near headwaters of Assiniboine in Saskatchewan]. (George Simpson in Merk, F. (ed.), 1968. Fur Trade and Empire: George Simpson's Journal with Related Documents. The Belknap Press of Harvard University Press, Cambridge, Massachusetts, p. 158)

May 19: Severe weather, a little Snow on the ground & freezing hard with strong N.W. Wind. [Simpson on Assiniboine above junction with Qu'Appelle]. (Simpson in Merk, F. (ed.), 1968. Fur Trade and Empire: George Simpson's Journal with Related Documents. The Belknap Press of Harvard University Press, Cambridge, Massachusetts, p. 158)

May 22: Made several ineffectual attempts to cross the Assiniboine River [near junction with Qu'Appelle] owing to its high state & the Depth of Mud at its edges...(Simpson in Merk, F. (ed.), 1968. Fur Trade and Empire: George Simpson's Journal with Related Documents. The Belknap Press of Harvard University Press, Cambridge, Massachusetts, p. 161)

May 24: The Weather fine and the Track generally good except where intersected by streams which either great or small give us a vast deal of trouble owing to their muddy banks and rendering it necessary for us to haul the Horses out of the Mire with Cords. (Simpson on

Assiniboine above Brandon, in Merk, F. (ed.), 1968. Fur Trade and Empire: George Simpson's Journal with Related Documents. The Belknap Press of Harvard University Press, Cambridge, Massachusetts, p. 161)

May 26: Incessant rain throughout the Day... (Simpson near Pine Fort, in Merk, F. (ed.), 1968. Fur Trade and Empire: George Simpson's Journal with Related Documents. The Belknap Press of Harvard University Press, Cambridge, Massachusetts, p. 162)

May 27: Passed a dismal Night, soaked with continual Rain... (Simpson between Pine Fort and Portage la Prairie, in Merk, F. (ed.), 1968. Fur Trade and Empire: George Simpson's Journal with Related Documents. The Belknap Press of Harvard University Press, Cambridge, Massachusetts, p. 162)

May 28: I should push on ahead on foot in hopes of reaching the White Horse plain but we had not gone far when we found the low Grounds near Long Lake inundated we had therefore to pass through a Swamp of 9 Miles in length frequently up to the Waist in Mud and Water.... (Simpson east of Portage la Prairie, in Merk, F. (ed.), 1968. Fur Trade and Empire: George Simpson's Journal with Related Documents. The Belknap Press of Harvard University Press, Cambridge, Massachusetts, p. 162)

The same conditions were reported at Swan River House.

May 29: ... it rained all day, the [Swan] River rising rapidly owing to the Recent rains. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 8: ...rained incessantly all day...the rain fell in such torrents. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 10: Cloudy with intermitting rains, the State of the [Assiniboine] River is Such as to become alarming to a degree having already overflowed its banks, and entirely deluged our Gardens. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 11: ...the water continues to rise Slowly. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 13: the water has fallen a little Since Yesterday. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 14: [we learned] that our horses were Safe and though up to their Bellies in water were Still in good order, it must be observed that there is not a foot of dry ground within 2 miles of them-the water has fallen much since last Evening. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 15: ...the River is nearly within its original bed. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 17: The water has fallen considerably...we had a little rain this morning. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 18: ...all our first Crop [of potatoes was] destroyed by the flood, we had a Shower of Rain, Misquotoes numerous, water falling rapidly. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

June 24: [sent men] to the Crossing Place to See if our Carts had not been carried off with the late great floods. Found them safe-The weather fine. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

Flooding or high water continued on both the Red and Assiniboine, and at Swan River House, throughout the entire summer.

> June 20: Contracted with [a man] to raft down some firewood; which has remained on the banks of the river since last Winter, and is now in danger of being carried off by the extraordinary inundation of the [Red] river, caused by the late continued heavy rains. (Red River Journal, HBCA B.235/a/6 1824/25)

> June 21: Very few fish have been caught this season in the River, owing to the unusual height of the waters; nor can any improvement be expected in the way of fishing, until the floods abate. (Red River Journal, HBCA B.235/a/6 1824/25)

> June 29: The floods increase at the rate of one foot perpendicular, every twenty-four hours; whereby the fishery in the Rivers is entirely interrupted. (Red River Journal, HBCA B.235/a/6 1824/25)

> June 30: ...went to the crossing place- to see if there was any possibility of barring the river with a view of catching fish- but...found it impossible the water being far too Strong. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

> July 11: The floods in the River continue high and fishing unsuccessful- Rainy weather. (Red River Journal, HBCA B.235/a/6 1824/25)

> July 15: The Rivers continue much swelled, but invariably rise or fall as the weather is wet or dry. (Red River Journal, HBCA B.235/a/6 1824/25)

> July 18: The floods in the Rivers begin to subside... (Red River Journal, HBCA B.235/a/6 1824/25)

> July 29: The fisheries in the Rivers improve as the waters abate... (Red River Journal, HBCA B.235/a/6 1824/25)

> July 30: ...we are not as yet able to get the rafts unloaded the beach being still covered with twelve feet water. (Red River Journal, HBCA B.235/a/6 1824/25)

> July 30: ...rained all day & night the River considerably swollen. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

> August 1: ...the river rising rapidly. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

> August 3: the River falling off. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

Rain was reported at Swan River on five days from August 3-8 but not again until the 25th when "much rain" fell. September also began with rain in the upper Assiniboine (4 days by September 11) and then at both Fort Pelly and Red River from September 19-22. The latter must have been widespread and heavy because both the Assiniboine and Red Rivers were rising again on September 23.

> September 23: ...owing to the late heavy rains, both Rivers have risen considerably. (Red River Journal, HBCA B.235/a/6 1824-25)

Unfortunately, the Fort Pelly Journal was kept at Swan River House during the summer of 1825 and thus there are no direct observations or even second-hand reports

of summer flooding on the upper Assiniboine. However, new buildings were constructed in the fall of 1825 and a letter written in January, 1826, stated that buildings were destroyed by flooding during the summer.

> The very high water in Summer destroyed all our Crops of Potatoes and Barley and carried off one half of our establishment. (Letter, W.A. McDonell to Governor, Chief Factors and Chief Traders, Northern Department, dated Fort Pelly, 14 January, 1826, Correspondence Book Inwards, 1824-1826, HBCA D4/119, p. 58)

ANTECEDENT CONDITIONS

The summer and fall of 1824 were extremely wet. Rain described as "excessive" and "heavy" was reported from both Swan River (northeast of Fort Pelly) and Red River on numerous occasions from July 27 through mid-August, and then virtually daily until early September.

> August 4: At noon a heavy rain. The meadows being so full of water, it is a difficult job to get the hay dried. (Fort Pelly [Swan River House] Journal, HBCA B.159/a/8 1824-25)

> August 15: The weather overcast raining for the greatest part of the day. Continued rains for some time past made the waters of the River rise five feet above the usual height. (Fort Pelly Journal [Swan River House], HBCA B.159/a/8 1824-25)

> August 18: The weather overcast, some rain at intervals and the waters of the river continue rising so much, that they nearly reach the top of the bank, which is far from being low. (Fort Pelly Journal at Swan River House, HBCA B.159/a/9 1825-26)

Fort Pelly appears to have been less affected than the Red River Settlement and the rivers in the vicinity of the upper Assiniboine basin were reported falling from August 22 to the end of the month, although the Red was rising again in early September.

> September 2: The weather continues wet, which has caused the [Red] River to raise considerably. (Red River Journal, HBCA B.235/a/6 1824/25).

Rain was reported at Red River (but generally not in the Fort Pelly Journal) on 11 days between September 1 and September 16, most commonly described as "heavy". After a month of generally "fine" and "mild" weather (but with periodic rain), winter conditions began in mid-October. Snow was reported in the Fort Pelly Journal on 7 days between October 15 and the end of the month and the lower Assiniboine was frozen over by October 28 at Red River.

> October 16: The snow that fell last night remained, and the weather continued cloudy and cold. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

> October 28: The Red River runs full of drifting ice, and the Assiniboine set fast last night.- Cold weather. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

In November, temperatures alternated between "cold" and "mild". Snow in significant quantities (and occasionally rain) fell on numerous days in November and December and began to accumulate in significant quantities in mid-January.

January 12: Last night had a great fall of snow which continued the whole day...The weather continued snowing, in such a manner that it fell better than a foot deep. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

January 16: The snow accumulated very much it having snowed the whole night. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

January 16: Snowed and drifted during last night and the greater part of this day. (Red River Journal, HBCA B.235/a/6 1824-25)

During most of January and February, cold weather and snow alternated with mild thawing conditions. The latter became common in late February and early March and spring appears to have set in early, especially at Red River.

February 26: Last night fell a great deal of snow...The weather cloudy, very mild the snow melting very fast. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

March 6: The people of the fort employed for a short time in the Morning draining the water caused by the melting of the snow out of the yard. (Red River Journal, HBCA B.235/a/6 1824-25)

March 7: Owing to the late warm Weather a great portion of the snow on the ground is melted, and the Creeks are now all in consequence, running full of water. (Red River Journal, HBCA B.235/a/6 1824-25)

March 10: Mr. Hargrave returned from Bas de la Riviere...by whom we are informed that several parts of the [Red] River is broken up. (Red River Journal, HBCA B.235/a/6 1824-25)

March 15: ...the track was so extremely bad that I was obliged to leave my horse and Cariole at a Settler's house, and wade through water...on the surface of the ice [probably on the Red] to the depth of eighteen inches during the last three miles. (David Jones Journal, 1824-25, PAM CMS 18 A92)

The last week of March was somewhat colder but thawing conditions returned in early April.

April 3: Numerous flocks of ducks and geese were seen this day flying northerly-Warm weather-Wind South. (Red River Journal, HBCA B.235/a/6 1824-25)

April 7: Swans and Geese are passing flies are numerous and the snow melting fast. The weather clear very mild and calm. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

April 10: The ice in the [Red] river is now so weak as to render it dangerous to walk upon it...The greater part of the snow is melted off the plains and the cattle can consequently now easily provide for themselves out of doors. (Red River Journal, HBCA B.235/a/6 1824-25)

Mild or even "very warm" weather continued at both the upper Assiniboine and Red River until breakup when the rivers began to rise (see Description of Peak Flow above).

1826

DESCRIPTION

This year marked the greatest flood known in the Red River valley, much larger than even the 1997 event. The sequence of events there is well-known and available in several publications (eg. Canada Department of Resources and Development, 1953; Rannie, 1999). Descriptions of conditions in the Red River will be omitted from this report except as they bear on the Assiniboine.

The only direct observations of the Assiniboine come from the Red River Settlement and from Fort Pelly in the uppermost part of the basin. Because of the interest in the 1826 event on the Red River, conditions at Fort Pelly will be described in detail.

Breakup occurred very late on both the Assiniboine and Red Rivers.

April 24: Rivers much Swollen the water running on the Ice which has not moved yet. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

April 29: ...the Ice in the Red [Assiniboine] River beginning to move the River much Swollen. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

May 1: the Ice Still strong in Red [Assiniboine] River. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

May 1: ...showers of snow, sleet and rain throughout the day-The ice in the Rivers begins to rise in consequence of the flush of waters pouring into them from the plains and mountains, caused by the melting of the snow [the plural of rivers implies that the observation includes the Assiniboine as well as Red]. (Red River Journal, HBCA B.235/a/7 1825/26)

May 3: The ice in the Rivers [Red and Assiniboine] has attained the height that the floods reached at the highest pitch last summer, and the water in several places has overflowed the banks and many houses are surrounded thereby. (Red River Journal, HBCA B.235/a/7 1825/26)

May 3: Snow all day. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

May 4: the Snow disappeared to day and the weather cleared up. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

May 4: The water in the Rivers [Red and Assiniboine] rose about 5 feet perpendicular during the last twenty-four hours, and the ice is now on a level with the highest banks, but it is still so thick and strong that even the present flush of waters have not sufficient force to break it up-Sleet rain and snow. (Red River Journal, HBCA B.235/a/7 1825/26)

May 7: About 4 A.M. the ice in the Assiniboine River broke up, and the waters therein rose as high as those of the Red River. The immense discharge of ice poured in from the former, into the latter mentioned rivers, made the scene as destructive as terrific. The whole population were again in motion, flying to such situations as might afford them a temporary security, leaving in many instances their cattle to perish, and most of their other effects to be swept away; happy in escaping with their lives, Wind variable, with thunder lightning and rain.

(Red River Journal, HBCA B.235/a/7 1825/26)

May 8: The rivers [Red and Assiniboine] have become almost clear of ice, but the waters increase apace. (Red River Journal, HBCA B.235/a/7 1825/26)

As the flood on the Red River grew to epic proportions after May 4, the Fort Pelly Journal was silent on the state of the upper Assiniboine. Daily entries from May 4 to May 13 contain only brief and benign routine weather observations with no attention to the river:

May 4: the Snow disappeared to day and the weather Cleared up.
May 5: A fine day the wind northerly.
May 7: The weather rather Cloudy much appearance of rain the wind S.E.
May 8: The wind S.W. rather warm
May 9: the weather still very cold
May 10: Rained a little in the afternoon the weather much milder than hitherto
May 12: very fine weather refreshing Showers alternately all Day.

The first mention of high water came from reports from Swan River House on May 14, and then on May 17 when the Assiniboine near Fort Pelly was described as unusually high, sufficiently so to present an obstacle in hunting buffalo. However, there was no indication of flooding as severe as was being experienced on the Red River.

May 14: ...the [Swan] River has overflowed its banks and [the men there] are under great apprehension for the safety of the property. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

May 17: Stormy weather the wind blew from all points of the compass-some thunder and rain...[Buffalo are] now within two Days march of us but the water is so high that it is impossible to get to them some rain in the after noon. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

Entries for Fort Pelly after May 17 are also routine weather observations.

May 20: much rain, the wind has blowed from all points [of] the compass in the course of the Day.
May 21: the wind blowing fresh from the south
May 22: Exceeding fine weather
May 23: warm weather the wind north

On May 28, the party left for Swan River House 90 km to the northeast where they did encounter evidence of severe flooding.

May 28: rained much all day [en route to Swan River]. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

May 29: fine weather to day...the roads are impassable the carts are often aflote & the water & mud continually up to the knees [en route to Swan River]. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

May 30: march very slow owing to the high state of the water...Rained very much all Day the weather most stormy [en route to Swan River]. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

May 31: [Swan] River...[was] a most dismal looking place the water having washed away all the [houses]...rained much all Day. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

There are no further references in the Fort Pelly Journal after the May 31 comment.

A much later comment (from 1830) supports the impression gained from the Fort Pelly Journal that the level of the upper Assiniboine in the vicinity of Fort Pelly was not nearly as extreme as in the Red River

> May 14, 1830: Keen frost in the night...The country in our vicinity all overflowed the Red River [meaning Assiniboine] not known to be so Hi in this quarter for many years, it did not overflow its banks Here the Year the Colony was overflowed. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

This impression, however, is at odds with other reports which suggest that conditions on at least some parts of the Assiniboine upstream of the Settlement were in fact as severe as those on the Red.

> May 17: This morning I was conversing with an old Indian whose tent joined ours when I asked him if he had seen such a flood as this before, he said "No my father, I once saw the site of the Company's Fort an island, but that was nothing to this...Intelligence has just arrived from Brandon House which states that the country is all a sea between the sources of The Assiniboine and The Missouri; and that the waters of the latter are now passing by us to the Lake Winnipeg. (David Jones Journal, PAM CMS 18 A92 1825-26)

> May 20: Some freemen arrived from the upper part of [the Assiniboine] river, and report that the waters in that quarter are as high as with us. The Missouri River it appears by their accounts, has overflowed its banks, so as to drive part of its waters this way. They also say that a number of the natives of that quarter have been drowned in consequence. The waters continue rising... (Red River Journal, HBCA B.235/a/7 1825/26)

> August 21: Since my last we have received further accounts of the recent flood and I very much fear for the safety of the American Settlements on the lower parts of the Missouri and St. Peter's Rivers. Report says that some of their military posts have been overwhelmed and many soldiers drowned. We are also informed that several Indian villages have fallen victims to these destructive waters. It is now clearly ascertained that they flowed from the Rocky Mountains and passing over the banks of the Missouri (their usual channel to the Gulf of Mexico) overflowed the adjacent country; and were conducted here by the Riviere a La Souris which falls into the Assiniboine River about one hundred miles from this place. (extract from a letter by John Pritchard of the Red River Settlement cited by his grandson [S.P. Matheson] in Matheson, S.P., 1947. Floods at Red River, Transactions, Manitoba Historical Society, Series III, No. 3, 5-13.

This apparent discrepancy and the implication of these comments will be discussed further below.

ANTECEDENT CONDITIONS

In the Red River watershed, the 1826 flood exhibited most of the classic preconditions which typically lead to large floods. As Alexander Ross wrote in his classic description of the flood:

> The previous year had been usually wet; the country was thoroughly saturated. The lakes, swamps, and rivers at the fall of the year were full of water; and a large quantity of snow had fallen in the proceeding winter (Ross, Alexander, 1856 (reprinted 1972), The Red River Settlement, Its Rise, Progress, and Present State, Ross and Haines, Inc., Minneapolis, Minnesota, p. 106).

The heavy rainfall in August and September of 1825 (see 1825 above) saturated the ground and in late September, both the Assiniboine and Red Rivers were rising:

> September 23: ...owing to the late heavy rains, both Rivers have risen considerably. (Red River Journal, HBCA B.235/a/6 1824/25)

The weather at the end of September and the first week of October was warm and dry - at Fort Pelly it was described as "fine" on every day from September 24 to October - but wet weather returned on October 8. Rain fell all that day at Fort Pelly and continued until October 11 when snow and cold weather began..

> October 11: this day we had the first fall of Snow. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)
>
> October 12: Very Cold. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)
>
> October 13: Severe frost. Snow all day. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)
>
> October 14: Snowing. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

After several days of clear, cold weather, more snow and rain fell after October 18, particularly from October 24-26.

> October 24: Much snow the wind from the E. the Snow continued all day. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)
>
> October 25: A Stormy day...towards Evening it Seased Snowing, blowing fresh from the N.E. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)
>
> October 26: Very cold much Snow- the winter has Set in fairly... (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

Subsequent mild weather melted the ice and much of the snow.

> October 30: The wind S. much of the Snow disappeared. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)
>
> October 31: This day Equally as mild as yesterday little or no Snow remaining. (Fort Pelly Journal, HBCA B.159/a/9 1825-26)

It is likely that despite the lack of snow cover by the end of October, the Fort Pelly region was saturated and effective drainage area would have been at a maximum.

The daily weather entries at Fort Pelly from November 1, 1825, to April 23, 1826, given below, do not suggest especially severe or abnormal winter weather conditions in the region of the upper basin. Intense cold certainly occurred but was broken by periods of more moderate temperatures. Snow or rain was reported on 24 days from November 1 to March 31, about two-thirds of the observations indicating light amounts. This is a modest total in comparison with the modern climate Normals for stations in the region which indicate an average of more than 35 days with snow from November to March. Several apparently heavy falls in late February, mid-March, and on April 7 would have provided the

potential for high runoff (especially given the saturated state of the basin in the autumn) but thawing conditions began in early April and, after a cold interval, became general by mid-April.

WEATHER ENTRIES FOR FORT PELLY, NOVEMBER 1,1825, APRIL 23, 1826

November, 1825

1 - A fine day
2 - a little rain in the Evening
3 - Cloudy and mild
4 - The weather fine-we had a light fall of Snow during the night.
5 - A fine day
6 - Rather Sharp
7 - Boisterous
8 - very Cold and Clear
9 - A fine day
10- A fine day
11- A fine day
12- we had a Considerable fall of Snow last night
13- A fine clear day
15- This day it Snowed all day
16- Very cold
17- Fine weather
18- Fine weather
19- Fine clear weather
20- Fine weather
22- fine weather
23- The weather fine
24- Thaw
25- Fine warm weather
26- Fine day
27- Fine Cold weather
28- Fine weather
29- The weather the Same
30- The weather much colder than usual

December, 1825

1 - The weather cold
2 - Not so cold as yesterday
3 - A fine day the wind from the W. blowing fresh
4 - The weather the same
5 - A fine day the wind the Same blowing fresh
6 - The weather cold
7 - The weather very cold
8 - Severely cold
9 - The weather the same
10- very cold
11- very cold a little Snow
12- very Cold
13 - Mild weather
14 - Mild & Cloudy the wind Southerly
15 - A fine day
16 - A fine day
17 - A fine day
18 - very cold wind N
19 - very cold
20 - very cold
21 - Still cold
22 - not quite So cold as yesterday
23 - The weather much milder, a little snow
24 - The weather cold
25 - very cold & Clear
26 - very boisterous & Severely cold
27 - very Cold, with Snow, which continued till late in the Evening
28 - very cold
29 - Not so cold as yesterday
30 - not so cold
31 - The weather the same

January, 1826

2 - Fine weather for this time of year
5 - The weather very Cold the wind North
6 - Rather milder-we had Some Snow last night
7 - much milder than yesterday
8 - Not very cold a little Snow
9 - Fine clear weather
10 - The weather fine & Clear not very cold
11 - The weather fine & clear, the wind North & cold
12 - The weather much the Same the wind North...the weather is ...very calm
13 - very cold the wind due North, and great appearance of Snow
14 - The weather the Same
16 - Mild and quite calm, a little Snow in the morning
17 - Cloudy weather there fell a little Snow last night
18 - The weather the Same the wind North [then] South
19 - The wind Still South blowing fresh accompanied with Snow in the morning
20 - very fine weather the wind South...Some Showers of hail
21 - Colder than yesterday the wind North
22 - very cold
23 - very Cold
24 - Not so cold
25 - Fine weather
26 - Fine weather
27 - A fine day
28 - Fine Clear weather Cold
29 - very Cold
30 - very Cold
31 - very Cold it continued Snowing the most part of this day

February, 1826

1 - Cold wind north
2 - The weather Clear & Cold
3 - The weather the Same
4 - Great change in the weather it is to day the very reverse of what it was yesterday, the wind S.W.
5 - very mild the wind S
6 - Cloudy Snowed all day
7 - The weather clear
8 - Snow this morning, the wind from the S.
9 - A fine day the wind from the S.W.
10 - Cloudy & boisterous with a little Snow this Evening we had a copious showr of Rain rather a novel thing this time of Year
11 - very boisterous-the quantity of Rain last night was very great, So much So that it has formed a very Strong crust on the Snow
12 - very cold
13 - very cold the wind North
14 - Still very cold
15 - not quite So cold today as yesterday, the weather Cloudy
16 - The weather clear & moderate
17 - Fine day the wind Southerly...the weather calm
18 - The weather the Same

19 - The weather the Same
20 - Cloudy
21 - Cloudy the wind Southerly blowing a Gale
22 - We had Snow this afternoon
23 - Cloudy the wind Easterly
24 - very cold much Snow
25 - very cold & clear
26 - very cold
27 - The weather the Same
28 - very Cold

March, 1826

1 - very Cold
2 - The wind S.W. & cold
3 - The weather the Same
4 - The wind N.E. boisterous and cold
5 - A Stormy day-Snow wind & drift
6 - Cloudy & Cold the wind N.E.
7 - Severely cold
8 - Cold
9 - Not So cold to day as usual
10- The weather clear not so cold
11- very boisterous-Snow & high wind
12- A fine day the wind Southerly
13- very Stormey
14- Still boisterous not cold
15- A Stormey day
16- A cold day...it Snowed a little to day
17- the Snow continued to day and all this night
18- A Great fall of Snow
19- A fine day cold wind N.W.
20- A Stormey day
21- The weather bad
22- The weather Stormey
23- A fine day
24- A fine day thawed a little
25- A fine day
26- The weather the same as yesterday
27- The weather the Same
28- Cloudy the wind Southerly
29- The weather the Same
30- A fine Clear day the wind N.W.
31- A Little snow

April, 1826

1 - A fine day...the late heavy fall of Snow has made the road bad
2 - Cold the wind S.E.
3 - A fine day thawed a little to day
4 - The weather fine rather warm
5 - Rather cold very Clear
6 - A fine day no thaw
7 - Cloudy a little Snow wind S. in the evening wind north much snow
8 - very Cold
9 - Cold the wind north
10- Boisterous & Cold the wind S.E.
11- The wind S. blowing a Gale, rather cold
12- The wind S. blowing fresh-rain & Sleet in the morning afternoon fine & warm
13- The wind S.W. much thaw-two swans were Seen this Evening
14- great and General thaw to day the Snow melting rapidly
15- Much thaw
16- cloudy appearance of Snow
17- the wind North Cold
18- The wind north blowing [fresh] & cold
19- The weather the same
20- The wind Southerly Considerable numbers of Geese & ducks Seen passing to the Northward
21- The weather the Same...Geese & ducks passed to day towards the north
22- The wind Easterly and brought both Snow & rain
23- Cloudy the wind N.W. & blowing fresh, a little Snow

In summary, while the Fort Pelly data provide some support for moderately high spring runoff, there is little in the record from the upper Assiniboine which would indicate spring conditions of the magnitude experienced in the Red River Valley.

DISCUSSION

In the report on historical floods on the Red River, Rannie (1999) concluded that "the Assiniboine basin was as severely affected as the Red" in 1826. More detailed examination, however, suggests that this statement was only partially correct and that there were significant differences between the two. The Fort Pelly Journal did describe the Assiniboine as "swollen" in late April (24 and 29) and "high" on May 17 but the lack of mention of the river during most of the severe flood period on the Red is striking and the 1830 comment reported above indicates that the river at Fort Pelly did not exceed bankfull. It seems likely, then, that runoff there was high but not at all comparable in severity to the conditions in the Red River Valley. The reports of high Assiniboine water from the Red

River Settlement are not definitive because of the back-water effect of the Red but the second-hand reports of May 17 and May 20 do indicate very severe conditions elsewhere along the river, at least as far upstream as Brandon House.

Both these conclusions may be correct. Fort Pelly was located in the upper basin whereas the reports of extreme conditions came from Brandon House near the junction with the Souris and refer to the region between the Assiniboine and the Missouri (i.e. in the region drained by the Souris) and John Pritchett's letter of August 21 is explicit with respect to the extreme condition of the Souris. All three comments attributed the high flow of the Souris to overflow from the Missouri, suggesting that the information came from a single source. A Missouri source is not possible on topographic grounds, as Hind noted in 1858.

> The passage of the waters of the Missouri down the Valley of the Little Souris into the Assiniboine has been a favourite theory among the half-breeds, one however which is not tenable, as the Little Souris does not approach the Missouri nearer than forty miles and no valley or coulee exists between them which would admit of the waters of the Missouri flowing across the Grand Coteau... (Hind, H.Y., 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858, vol. II [reprinted 1969], Greenwood Press Publishers, N.Y., p. 395)

Such an impression may have been created by widespread flooding along the loop of the Souris closest to the Missouri combined with extensive inundation of the land surface and filling of depressions by overland runoff. In any case, an exceptionally high discharge in the Souris seems beyond doubt.

As was noted in PART ONE, the largest gauged floods on the Assiniboine (1974 and 1976) have been associated with very large flows from the Souris basin. In addition, the Qu'Appelle enters the Assiniboine about 150 km downstream of the site of Fort Pelly and has on occasion made significant contributions to Assiniboine peaks downstream (as in 1955). Moreover, most of the tributaries from the Riding/Duck Mountain sector enter the Assiniboine downstream of Fort Pelly. From the descriptions of conditions at Swan River House, that region experienced very severe flooding in 1826.

Thus it is concluded that while the flow of the upper Assiniboine in the spring of 1826 may have been large, the main sources of the high waters on the Assiniboine reported at the Red River Settlement and in second-hand sources were from the Souris and Riding/Duck Mountain sectors. The contribution of the Qu'Appelle is unknown but the strong correlation between the Souris and Qu'Appelle peak flows ($r = 0.83$, Table 7) suggests that it would probably have been significant.

A possible model for this pattern is offered by the 1969 event (Table 5b). In that year, the peak in the upper Assiniboine at Kamsack was only 10% of that at Portage la Prairie and the Qu'Appelle was only slightly higher, whereas the Souris peak was the 3rd highest since 1913 and the Riding/Duck Mountain streams were also very high. The simple sum of the Souris and Riding/Duck Mountain tributary peaks accounted for 75% of the Portage la Prairie peak in 1969 and both of these sources are capable of producing much larger flows than occurred in 1969 (as in 1974 and 1976).

DESCRIPTION OF PEAK

This was a minor event with conflicting descriptions of spring runoff, reported as high by some entries while others express concern that the water would be too low for travelling. It can only be concluded that the freshet was not particularly unusual but it is included here because some entries suggest high water in some regions.

> April 9: The small river overflowing its banks...Snow and Sleet during the night and most part of the day. (Fort Pelly Journal, HBCA B.159/a/10 1828-29)
>
> April 14: Swan River by the men's report High...weather cold wind SW. (Fort Pelly Journal, HBCA B.159/a/10 1828-29)
>
> April 14: The ice in the [Assiniboine] river broke up-crossed a party of Cree Indians in the evening. (New Brandon House Journal, HBCA B.22/a/22 1828/29)
>
> April 18: the men returned from Swan River they say the water is High...Snow during the last night weather raw and cold during the day with partial Showers of Snow... (Fort Pelly Journal, HBCA B.159/a/10 1828-29)

The journals at New Brandon House and Fort Pelly present quite different descriptions of the Assiniboine's water levels in late April-May. At New Brandon House, the river was reported as falling and its level presented concerns for the outgoing canoes whereas at Fort Pelly, the earlier reports of high water continue into early May.

> April 25: The weather until this day has continued frosty, whereby our ploughing, which operation we commenced on the 20th was at times interrupted...The [Assiniboine] River falls off rapidly, and we are using every effort to...get away before the navigation becomes like difficult as some former year, from the shallowness of the water. (New Brandon House, HBCA B.22/a/22 1828/29)
>
> April 26: The [Assiniboine] River pretty high... (Fort Pelly Journal, HBCA B.159/a/10 1828-29)
>
> May 5: Owing to the falling off of the water...we are this morning...embarked. (New Brandon House, HBCA B.22/a/22 1828/29)
>
> May 7: the [Assiniboine] River is high. (Fort Pelly Journal, HBCA B.159/a/10 1828-29)

The weather throughout most of May was generally "fine" and warm with only periodic rain. In late May, however, the weather turned wet with frequent rain reported in the Red River Journal after May 27.

> May 27: Had a shower of Rain last Night to day Cloudy in the Evening had a very heavy Shower accompanied with Thunder & Lightning. (Red River Journal, HBCA B.235/a/12 1828/29)
>
> May 29: Last Night had a heavy Shower of Rain accompanied by Thunder & Lightning... (Red River Journal, HBCA B.235/a/12 1828/29)

May 30: in the Evening had a very heavy Shower of Rain. (Red River Journal, HBCA B.235/a/12 1828/29)

June 4: ...in the Evening we had a very heavy shower of Rain which lasted all night. (Red River Journal, HBCA B.235/a/12 1828/29)

June 6: The morning Rainy...in the afternoon it Blew a Gale & continued part of the night with intermitting showers of rain. (Red River Journal, HBCA B.235/a/12 1828/29)

June 11: ...in the Evening we had Thunder & Lightning accompanied by a heavy shower of rain. (Red River Journal, HBCA B.235/a/12 1828/29)

These reports are from the Red River Settlement and unfortunately no information exists about conditions over the Assiniboine basin. It is assumed, however, that the rains were widespread (and possibly heavier) in the Assiniboine basin, since by June 12 the Assiniboine in the Settlement was being described as high.

June 12: The morning fine in the afternoon had a Shower of Rain with Thunder owing to the frequent & heavy Rains of late the Assiniboine River is very high and has overflowed the Points... (Red River Journal, HBCA B.235/a/12 1828/29)

June 17: The weather very windy in the course of the day it Rain'd a little the water is still very high owing to which the People take very few fish. (Red River Journal, HBCA B.235/a/12 1828/29)

Rain continued to be reported about every other day until the end of June when the stage of the river began to fall.

June 28: The weather fine & the water beginning to fall. (Red River Journal, HBCA B.235/a/12 1828/29)

July 9: The weather very warm, & the water falling very much. (Red River Journal, HBCA B.235/a/12 1828/29)

ANTECEDENT CONDITIONS

Despite generally dry weather, water levels in the Assiniboine and Rapid Rivers were reported as high throughout October, 1828.

October 7: Want of food induced our people to make several attempts at erecting fish weirs in the Rapid River, which unfortunately proved unsuccessful owing to the unusual height of the waters-The same result followed similar attempts in the Assiniboine River...Fine warm weather. (New Brandon House Journal, HBCA B.22/a/22 1828-29)

October 19: The weather continues dry & windy and the plains burn incessantly...We have made two more fruitless attempts at weir making in the Rapid River, which abounds with fish-We failed owing to the force of water therein. (New Brandon House Journal, HBCA B.22/a/22 1828-29)

Warm, generally dry weather, and large grass fires continued at New Brandon House and Fort Pelly until early November when snow and the beginning of freezeup was reported at Fort Pelly, New Brandon House and Red River from November 6-9. High

waters continued in the Rapid River.

> November 4: [the weir on the Rapid River] had scarcely been completed, when it was swept away by the violence of the current. (New Brandon House Journal, HBCA B.22/a/22 1828-29)

> November 9: Snowed for the first time this season the Small Lakes are set fast. (Fort Pelly Journal, HBCA B.159/a/10 1828-29)

> November 10: The weather Cold the Ice drifting down the Assiniboine River. (Red River Journal, HBCA B.235/a/12 1828/29)

Final freezeup of the Assiniboine at New Brandon House, however, was quite late.

> November 23: The Assiniboine River set fast- The small lakes have been so for some time back. (New Brandon House Journal, HBCA B.22/a/22 1828-29)

The observer at New Brandon House reported that considerable snow fell there in November (although there is little confirmation of this from scattered daily entries from Brandon House or Fort Pelly).

> November 30: The weather since the 6th Inst. Has been very unpleasant having snowed almost every second day, with constant North Easterly Wind... (New Brandon House Journal, HBCA B.22/a/22 1828-29)

Snow was reported periodically during December and in early January, 1829, the New Brandon House Journal reported:

> January 2: Since the 8th Ult. the weather has been in general very cold, snowy and windy... (New Brandon House Journal, HBCA B.22/a/22 1828-29)

Unusually mild temperatures occurred at Fort Pelly and New Brandon House from about January 11 until January 25 when extreme cold returned (temperatures of -34° to -42°F were reported at Red River from January 30 to February 9). Although the temperatures moderated somewhat during February, little snow was reported and with mild temperatures in early March, the apparently small snow cover was rapidly depleted.

> March 2: Weather remarkably fine snow disappearing fast. (Fort Pelly Journal, HBCA B.159/a/10 1828-29.)

> March 2: we have had a slight thaw today for the first time and it only requires a slight one, indeed, to render the plains, which have burned in Autumn, impassable with sleds; there being on such grounds scarcely any snow during the winter. The weather since the 15th ult. has been changeable sometimes tolerable, at others, cold, windy and snowy-This day, however, has brightened the scene, and afforded us a glimpse of spring. (New Brandon House Journal, HBCA B.22/a/22 1828-29)

Thawing conditions continued during the first 10 days of March but the weather became colder for most of the rest of the month. Several heavy falls of snow occurred in the last week of March but were quickly melted by mild temperatures in the first week of April. Spring arrived very early.

March 30: Thawed considerably this day. (Fort Pelly Journal, HBCA B.159/a/10 1828-29.)

March 31: Snow leaving us fast. (Fort Pelly Journal, HBCA B.159/a/10 1828-29)

April 1: a rapid thaw and snow fast disappearing... (Fort Pelly Journal, HBCA B.159/a/10 1828-29)

April 6: Except in drifts the Snow is at length melted, and the ground bare- The weather continues spring-like. (New Brandon House, HBCA B.22/a/22 1828/29)

April 7: They left their loads on the way for want of snow...Snowed last night. (Fort Pelly Journal, HBCA B.159/a/10 1828-29)

April 8: The first Geese and ducks seen of the Season. (New Brandon House, HBCA B.22/a/22 1828/29)

1830

DESCRIPTION

This event began as a normal snowmelt freshet but was increased by heavy rain and snow in late April and May.

Several heavy snowfalls occurred at Fort Pelly and Brandon House in the week before breakup (see Antecedent Conditions below).

> April 16: fine Weather snow fast diminishing a considerable quantity of water on the ice. (Brandon House Journal, HBCA B.22/a/23 1829/30)
>
> April 18: Weather extremely warm the snow has entirely disappeared as if by Majic [sic] and the [Assiniboine] River broke some distance below. (Brandon House Journal, HBCA B.22/a/23 1829/30)
>
> April 18: Weather the Same with little frost in the night a Heavy fall of Snow after midday and rain. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)
>
> April 20: Stormy weather with rain the [Assiniboine] River nearly clear of ice. (Brandon House Journal, HBCA B.22/a/23 1829/30)
>
> April 20: Rained last night & part of the day, the ice is Drifting down the Assiniboine very thick. (Red River Journal, HBCA B.235/a/13 1829/30)
>
> April 22: The weather fine but Cold Wind North the Assiniboine is now clear of ice. (Red River Journal, HBCA B.235/a/13 1829/30)
>
> April 24: Weather cold wind northly...[the roads] being at this date blocked up in several places with large drifts of snow. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

By April 25, the water level of the Assiniboine was rising rapidly at Brandon House and downstream at Red River by the 28th. Much snow remained in the upper basin in the vicinity of Fort Pelly and melt was delayed somewhat but rising waters were also reported there by April 28.

> April 25: Cold Weather the [Assiniboine] River has since morning risen upwards of three feet. (Brandon House Journal, HBCA B.22/a/23 1829/30)
>
> April 26: Stormy weather with Snow...[Assiniboine] River still rising upwards of six feet since yesterday. (Brandon House Journal, HBCA B.22/a/23 1829/30)
>
> April 26: the Road in Several places is not clear of drifts. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)
>
> April 27: the weather fine but Cold the wind North. The Assiniboine River is very high and overflowed some of the Points. (Red River Journal, HBCA B.235/a/13 1829/30)
>
> April 28: Weather mild wind South...The [men] returned in the evening from the High state of the watters we Launched the Boat. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 4: [A man] returned this evening and reports that Swan River is high. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 5: the watters being to[o] High...Weather warm and sultry. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 6: we Had a Heavy fall of rain after 12 noon for the remaining part of the day. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 7: watter raising daily. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 8: The High state of the [Assiniboine] River has prevented many of the Indians from coming to the Fort. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 10: Heavy fall of rain during the night...the whole country there [Swan River area] is inundated. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

Rain was also reported at Brandon House and Red River on May 11-13 and at Fort Pelly on the 15th resulting in very high waters in the upper basin and Riding /Duck Mountain region.

May 14: Keen frost in the night...The country in our vicinity all overflowed the Red River [Assiniboine] not known to be so Hi in this quarter for many years, it did not overflow its banks Here the Year the Colony was overflowed. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 16: Weather fine and mild...[A man from Swan River] says the watter is spreading all over the Country. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

May 17: fine Weather...an Indian came in from Shell River Says the Waters are unusually high. (Brandon House Journal, HBCA B.22/a/23 1829/30)

May 24: They report that the watter Has fallen several feet [in Swan River]. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

This is the final reference to the state of the river. In the Red River valley region at least, the very wet spring of April and May were followed by a severe drought in late June and July.

July 29: This Spring the whole of the people in my neighbourhood have suffered severely from the heavy rains which fell in May. In the beginning of May, the rain fell in such abundance that the whole surface of the plains was a sheet of water. This obstructed every kind of Agriculture for upwards of ten days. As soon as the land was so dry as to bear cultivation, the people commenced sowing. The seed time lasted for 20 days, the weather being so dry as to allow us to work upon the ground. After we had sown the wheat and planted the potatoes, the rain fell in such profusion that the ground was perfectly deluged. This continued till it destroyed a large portion of the wheat and most of the potatoes. This is a general calamity in my neighbourhood; about 10 miles further up it has been partially felt. Since the 15th of June, we have had only one slight shower. The ground is now parched with the long continuation of dry weather. (Letter, Rev. W. Cochran to Secretaries, Church Missionary Society, London, PAM MG7 B2 CMS A77, p. 395)

ANTECEDENT CONDITIONS

The late summer and early fall of 1829 were dry and the level of the Red was reported to be "low" on September 9 and "very low" on the 25th. From early October, however, rain and snow fell frequently and in significant amounts throughout the winter. The fall and winter precipitation observations at Fort Pelly are summarized below.

PRECIPITATION OBSERVATIONS AT FORT PELLY
OCTOBER, 1829 -FEBRUARY, 1830
(Fort Pelly Journal, HBCA B.159/a/11 1829-30)

OCTOBER
6: Heavy rain during the preceding night.
9: Heavy fall of rain in the night and for the greatest part of the day.
17: Snowed considerably last night and all morning.
22: Snowed all night.
23: partial showers of snow during the day.
24: Heavy fall of snow in the night and for the greatest part of the day.
25: Snowed in the night and all morning...

NOVEMBER
3: Heavy fall of snow after 12 noon which continued without intermission for the remaining part of the day.
4: Heavy fall of snow during the night.
5: Weather warm mild rain in the night.
12: Snowed in the night.
17: Snow and drift all morning.
24: Weather intensely cold drift and snow all morning.

DECEMBER
3: Cloudy and Cold, Snow in the evening.
4: Snowed in the night and all morning.
5: Heavy fall of Snow in the night and for the most part of the day.
12: Some snow in the evening...
15: Snowed in the night.
17: Snowed in the night.
19: Heavy fall of snow in the night.
21: Snowed during the night.
22: Snow and drift in the night and all morning.
29: A Heavy fall of Snow in the morning it cleared up by the midday...weather mild.

January
6: Snow in the night.
9: Snowed in the night Weather rather milder.
11: weather Cold, Showers of Snow.
12: Weather remarkably cold flying showers of Snow.
14: weather mild wind east a fall of snow during the last night.
17: Stiff gale from the South west, snow and drift for the most part of the day.
21: Weather mild, Heavy fall of snow in the night stiff gale with drift all day.
29: Stiff breeze from the South and Heavy fall of snow and drift
30: Deep fall of Snow in the night Wind west and drifting for the greatest part of the day.

FEBRUARY
2: Snowed in the night Wind Nwest and Drift and Snow for most part of the day...the Snow being too deep to Haul [logs] to the Fort.
17: Mild Weather, Heavy fall of Snow in the morning.
21: Snowed for the most part of the day.
22: Snowed all day.
23: Heavy fall of snow in the night...Showers of Snow thro' the day.
24: Snowed during the preceding night.
28: ...Snow in the evening.

New Brandon House also experienced many days of snow (and occasionally rain), although fewer than at Fort Pelly. By the end of October, the Assiniboine was reported as "high" at New Brandon House.

> October 27: ...the man I sent to attend the fishing weir returned the high water having carried it away in the evening. (New Brandon House, HBCA B.22/a/23 1829/30)

At both posts, mild weather periodically reduced or removed the snow cover which had accumulated. For example,

> November 27: Weather extremely mild which has reduced the Snow considerably. (New Brandon House, HBCA B.22/a/23 1829/30)

> December 23: Weather particularly Mild Snow diminishing. (New Brandon House, HBCA B.22/a/23 1829/30)

> December 24: walking ankle deep in water in the Fort an unusual thing at this season of the year. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

January was more consistently cold but periodic thawing returned in February.

February 14: Weather particularly Mild Thawing the greatest part of the day. (New Brandon House, HBCA B.22/a/23 1829/30)

February 14: Weather mild and cloudy wind South and thawing about the doors. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

February 15: constant thaw, Snow fast diminishing. (New Brandon House, HBCA B.22/a/23 1829/30)

The first half of March was generally mild with some snow but particularly frequent and heavy falls occurred at both Fort Pelly and Brandon House in the third week and, from the comment at Fort Pelly on the 22nd, caused a deep accumulated snowpack.

MARCH

16: Stormy Weather with Snow. (New Brandon House, HBCA B.22/a/23 1829/30)
17: Snowed in the night. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)
18: Stormy Weather with Snow. (New Brandon House, HBCA B.22/a/23 1829/30)
19: Snowing greatest part of the day. (New Brandon House, HBCA B.22/a/23 1829/30)
20: Heavy fall of snow in the night... (Fort Pelly Journal, HBCA B.159/a/11 1829-30)
21: We experienced one of the heaviest falls of snow for the winter in Course of last night and all this day...Weather mild. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)
22: [A man] ran down & killed on snow shoe a Cross Fox and Wolf such is the depth of snow in that quarter...Weather as yesterday. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

Strong thawing conditions set in on March 24 and continued to the breakup period in early April. During this period, further snowfalls and/or rain occurred; some of these may have added significantly to the moisture status of the basin.

March 26: Little or no frost in the night...we had a fall of rain and thunder about noon which continued until 4 p.m. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

March 30: Heavy fall of snow in course of the last night. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

April 2: Snow in the evening. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

April 11: Heavy fall of snow in the night and for most of this day. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

April 13: Stormy Weather Snowing & drifting. (Brandon House Journal, HBCA B.22/a/23 1829/30)

April 13: Cold wind north. Heavy fall of snow and Drift from noon until evening.(Fort Pelly Journal, HBCA B.159/a/11 1829-30)

April 14: Heavy fall of snow in the night. (Fort Pelly Journal, HBCA B.159/a/11 1829-30)

1831

DESCRIPTION

The upper Assiniboine broke up on April 24-25 but was very low due to the light snow cover and gradual melt.

> April 24: Blowing a strong gale from the NW and making a rapid thaw The [Assiniboine] Broke open to day but no ice drifting. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> April 25, 1831: ...It is rather Singular that the ice in both the Rivers have dissolved (notwithstanding the Weather has been cold) and the Rivers ran clear all at once without any Ice drifting. But this may be accounted for [by] their Shoalness last autumn and the principal Substance was Snow in place of Ice. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

After a short period of rise, the Assiniboine and other rivers began falling and temperatures remained very cool.

> April 27: fine Clear weather all the Snow is nearly off the Ground...an Indian...informs us that the Ice is drifting down the Rivers, Which appears to be rising fast. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> April 28: Snowing this morning and continued at intervals most of the day. Blowing fresh from the NE...we are told that the rivers are rising. Commenced ploughing but could not continue as the ground is too much frozen. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> April 29: Hard frost...[a man] reports that the rivers are falling owing we imagine to the cold weather. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> April 30: [some men experienced] Some difficulty in getting down the Serpent River which they Say has fallen considerably...Alexander states that the river is very shoal. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> May 10: Clear weather & frost in the morning...[some people] state that the River has fallen off considerably. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> May 20: the Spring is most backward Northerly winds month after month and little or no appearance of Vegetation. Lake Winnipeg is as solid as in the Depth of Winter and McMillan says that he is ploughing through Ice instead of Soil. (George Simpson to John McTavish [Moose Factory], dated Red River Settlement, May 20, 1831, HBCA B.135/c/2, p. 66)

By mid-May, however, the weather had turned hot and continued dry.

> May 15: dry Scorching Weather...Richards opinion is that it will be difficult to get the Boats floated down the Rapids light...the river being So very Shoal. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> May 17: In consequence of the dry scorching weather and frosts during the night, vegetation appears to come on very Slow. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

Rain and snow began to fall at Fort Pelly on May 29 and for several days thereafter. A "heavy fall of snow" occurred on May 29. On June 5-6, significant rain fell and the river began rising.

> June 5: Raining most of the day...Garden...coming on very Slowly by reason of the cold weather. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 6: Much the Same weather as yesterday the river has rose a little with[in] its banks. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 7: Weather became more Settled the water continues rising; our Hay Ground of Last year is one complete Lake. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

These observations in early June begin a great change in weather, with remarkably abundant rainfall and high water for the next 3 months.

> June 8: ...the River is too High for Crossing either on foot or on Horseback. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 12: Weather Cloudy raining at times. The River Still rising all the low Ground Covered with water. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 13: Rained heavily all night with loud Thunder & lightning. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 15: Heavy rain during the night. A Great quantity of water in our cellars. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 17: Rained most of the night very warm to day...Millar went to the Crossing place...and Says the River has rose about 4 feet and thinks from the Height of Water that the Gardens at Lower fort is all overflowed. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 18: Heavy rain and loud thunder during the night. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 20: a fine warm day...[a man] says that a great part of Crops below [the road] inundated. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 25: from the immense height of the water I considered it a risk to Send the Bull... (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> June 28: ...nearly all the Gardens below are destroyed by the high waters. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> July 2: heavy rain during the night...the Ground is so completely drenched with Water that nothing can be done to [the potatoes] the Hay Ground is also covered with water. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> July 7: Fine weather the river continues to rise. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> July 9: [A man] Says that the Rivers are So high that he had difficulty to Cross (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

After nine days with no rain, the river began falling on July 13 but rains began again on July 17 and the water continued to be high.

> July 19: all the former hay ground is covered with water. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> July 23: Blowing fresh this is a remarkable summer for rain. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> July 24: Raining most of the day, was not the River So High we might be able to obtain a livelyhood on fish but there is no possibility of making a Barrier. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> July 26: heavy Rain all the forenoon. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

Rain fell every day from July 27 to August 1 but less frequently in most of August until late in the month.

> August 20: the rest of us Carrying the Hay that was lately cut to dry Ground as the Late rains has almost Set it afloat. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> August 27: Loud thunder and heavy rain all the fore noon. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> August 29: Raining a little most of the day. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

Little rain fell in September except on two days in mid-month, including a very early snowfall.

> September 17: Rained heavily all night. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

> September 18: The Ground was covered with Snow this morning which melted away in the course of the day. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

ANTECEDENT CONDITIONS

October was relatively warm until the end of the month when the ponds were frozen. Rain was reported at Fort Pelly on 8 days but total amounts appear to have been modest. The first snow fell on October 26.

Mild weather continued to be reported through most of November and the ponds reopened. Snow fell on 8 days but amounts appear to have been small.

Snow fell on 8 of the first 9 days in December at Fort Pelly. Temperatures there were colder but not severe and at Red River the Red River wasn't completely frozen by December 18.

> December 18: The weather has been uncommonly fine so far, no snow, little frost & the river not yet all fast. (Alexander Ross to James Hargrave, Dec. 18, 1830, in The Hargrave Correspondence, 1821-1843. Greenwood Press, N.Y., 1968, p. 61)

Colder weather occurred at Fort Pelly in late December but became milder with some thawing by mid-January and continued until the end of the month. Snow fell periodically but not heavily.

> January 12: A Continuance of the Same mild Weather. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> January 17: Weather mild thawing in the middle of the day about the doors. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

Cold and mild conditions alternated throughout February at Fort Pelly. Snow fell on 4 days but again there is no indication of large amounts. By February 21, very mild temperatures were reported and the snow was thawing.

> February 23: Thawing on the Middle of the day from the tops of the houses. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> February 26: Weather mild and thawing a little on the middle of the day. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

March was also very mild throughout at Fort Pelly with only one colder interval in mid-month. Snow fell on several days and somewhat more heavily than earlier in the winter.

> March 10: Snowing all the forenoon and the Weather appears to be colder. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> March 14: Snowed all night and continues so all the forenoon. Which is completely filled up all roads. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

Strong thawing conditions began in late-March.

> March 25: the usual mild weather Puddles of water Standing about the doors. Still the mildness has scarcely affected the roads. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

Despite the mild conditions of March, cool temperatures prevailed at Fort Pelly in early April and the arrival of spring was late.

> April 7: ...Snowed a little-thawing none appearances of being a late Spring. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> April 15: the weather cold for the Season thawing none. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

> April 23: Thawing a little on the height of the day...appearance of it being a late Spring and it is much to be feared the Swan River will be very Shallow as the portion of Snow already Melted is entirely dried up with the frost. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

1849

There is no direct evidence for flooding or high water in the Assiniboine basin in this year but remarkably heavy late spring and summer precipitation over a very wide area of the central Great Plains and the Red River basin produced exceptional summer flows on streams from Nebraska, through Minnesota and in the Red River, with minor flooding at Pembina. The meteorologic and hydrologic conditions during this summer have been described in detail in a number of papers, beginning in the Missouri-Kansas-Nebraska region where Parker (1964) and Lawson (1974, 1975) analyzed the accounts left by gold rush migrants on the Oregon Trail.

Parker, W., 1964. Wading to California: The influence of the Forty-Niners on the notion of the Great American Desert. Great Plains Journal, v. 3, 35-43.

Lawson, M.P., 1974. The Climate of the Great American Desert. University of Nebraska Press, Lincoln, Nebraska.

Lawson, M.P., 1975. Meteorological experiences of the Forty-Niners crossing the Great American Desert. Weatherwise, v. 28, 250-53, 271.

These writers showed that the spring of 1849 near St. Louis was unusually cold and late and marked by exceptional rainstorms in May which inundated the plains and greatly swelled the rivers. Rainfall in April and May at Fort Kearny (south-central Nebraska) had exceedence probabilities of only about 1%; at Saint Louis Arsenal and other eastern Oregon Trail sites, precipitation exceedence probabilities were 1% or less from June through August and most stations recorded 200-300% normal precipitation in at least one of these months.

These analyses were extended 1000 km northward into the Red River basin by Blair and Rannie (1994) and Rannie and Blair (1995), based on the accounts of the Woods/Pope Expedition from Fort Snelling (Minneapolis/St. Paul) to Pembina and archival sources from the Red River Settlement.

Blair, D. and W.F.Rannie, 1994. "Wading to Pembina": Spring and summer weather in the valley of the Red River of the North and some climatic implications. Great Plains Research, v. 4 (1), 3-26.

Rannie, W.F. and D. Blair, 1995. Historic and recent analogues for the extreme 1993 summer precipitation in the North American mid-continent. Weather, v. 50 (6), 193-200.

The sequence of events in the Red River basin was described in Rannie (1999) and will be repeated here because of its potential relevance to the Assiniboine basin.

Rannie, W.F., 1999. A Survey of Hydroclimate, flooding, and runoff in the Red River Basin Prior to 1970. Geological Survey of Canada, Open-file Report 3705, Ottawa.

DESCRIPTION

Spring was late in the Red River Settlement and the ice in the Red River did not break up until May 7.

> April 18: At present there is no appearance of the ice going. Horses and oxen, as well as people, still cross the river upon the ice. It may be two or three weeks before the river is open. (J. Smithhurst Journal [at Indian Settlement], PAM MG7 B2 CMS A97)

> April 25: It has been snowing and drifting all day and everything looks...much like winter... (J. Smithhurst Journal [at Indian Settlement], PAM MG7 B2 CMS A97)

> April 30: today, tho' the last day of April, was like one from January...The Ice is still upon the River, not the voice of one singing bird is heard. (Robert James Journal, PAM MG7 B2 CMS A92)

> May 7: Ice first began to drift out so that we at length see open water and canoes crossing the river... (J. Smithhurst Journal [at Indian Settlement], PAM MG7 B2 CMS A97)

The weather improved markedly for the first two weeks of May but deteriorated again in late May.

> May 21: The ground is again covered with snow... (J. Smithhurst Journal [at Indian Settlement], PAM MG7 B2 CMS A97)

> May 22: Still snow. (J. Smithhurst Journal [at Indian Settlement], PAM MG7 B2 CMS A97)

Temperatures rose soon after but June (and the rest of the summer) were remarkably wet. The most detailed accounts are provided by the diaries of Captain Samuel Woods and Lieutenant John Pope on the Woods Expedition from Fort Snelling to Pembina. The company left Fort Snelling on June 6 and was immediately confronted by widespread, almost continuous, and frequently heavy, rainfall.

> June 6-11: Our starting was unpropitious; the rains commencing on the 4th continued intermittingly until our arrival at Sunk Rapids on the 11th... The rains having fallen so steadily and for so many days. the earth was so saturated with water, that the thickly-matted turf of the prairie would not support the weight of the wagons... The [Sauk River] was much swollen by the heavy rains, and was wide and deep. (Woods, 1850. Report of Major Wood [sic] relative to his expedition to Pembina Settlement and the condition of affairs on the North-Western frontier of the Territory of Minnesota. United States House of Representatives Executive Document No. 51, 31st Congress, 1st Session, p. 10)

> June 20: Having awaited the drying of the prairies until the 16th of June, we determined on that day to commence our march for the Red River...we reached a small lake tributary to the Crow River on the 20th of June. The rain falling incessantly... (Pope, J., 1850. The report of an exploration of the Territory of Minnesota. United States Senate Executive Document No. 42, 31st Congress, 1st Session, p. 18)

> June 27-July 3: The heavy and incessant rains since the 4th of June had so saturated the prairies... that it was found absolutely necessary to halt for a few days...From...the continuous heavy rains for several weeks previous, the rich black soil of the prairies had become perfectly saturated and many were under the impression that the whole country was swampy, but I was informed by the guides that such a season had not been known for 20 years, and that they had never seen the country in such condition before. (Pope, J., 1850. The report

of an exploration of the Territory of Minnesota. United States Senate Executive Document No. 42, 31st Congress, 1st Session, p. 18-19)

July 6: We resumed our march on the 6th of July, but found the prairies so bad from the drenching rains that had just fallen, we were scarcely able to get along. Little drains that usually contain no water, were now almost swimming, and these occurring every mile or two, with the miry conditions of the ground, rendered our march slow and exhausting to our trains. (Woods, S., 1850. Report of Major Wood [sic] relative to his expedition to Pembina Settlement and the condition of affairs on the North-Western frontier of the Territory of Minnesota. United States House of Representatives Executive Document No. 51, 31st Congress, 1st Session, p. 13)

July 15: The high waters in these rivers [Maple, Rush, Sheyenne] compelled us to depart greatly from the Red River, and we had thus approached very near the dividing ridge between the Red River and Upper Sheyenne. (Pope, J., 1850. The report of an exploration of the Territory of Minnesota. United States Senate Executive Document No. 42, 31st Congress, 1st Session, p. 24)

July 17: Starting at 12 M, over a level prairie on which the water stood from two inches to two feet deep almost the entire way, and after going about fourteen miles, we reached Maple river, which Mr. Kittson had bridged; but the water being much higher now than when he crossed it, the bridge had disappeared... There had been such torrents of rain about this time that the little branches that ordinarily furnish barely a sufficiency of water to allay the thirst of a travelling train were now swimming...About eight miles from Rush river we came upon a little prairie stream much swollen and deep. (Woods, S., 1850. Report of Major Wood [sic] relative to his expedition to Pembina Settlement and the condition of affairs on the North-Western frontier of the Territory of Minnesota. United States House of Representatives Executive Document No. 51, 31st Congress, 1st Session, p. 16)

Reverend Alonzo Bernard described identical conditions travelling northward from Fort Snelling to Red Lake Mission in mid-June.

[The roads] were inundated at frequent intervals by floods resulting from the melting snow, farther north and the recent heavy showers...the team becoming mired in the deep mud, an unavoidable delay was caused; and a situation ensued which the rain, now descending in torrents, was not well calculated to relieve. (Schell, Rev. J.P., 1911. In the Ojibway Country. A Story of Early Missions on the Minnesota Frontier. Chas. E. Lee, Publisher, Walhalla, N.D., p. 110)

When the Woods Expedition reached Pembina on August 1, they found the Red River apparently out of its banks.

August 1: ...having been out since the 6th of June, -we arrived at Pembina, and found the Red river and the Pembina river with about twenty feet rise in them, and overflowing their banks. (Woods, 1850. Report of Major Wood [sic] relative to his expedition to Pembina Settlement and the condition of affairs on the North-Western frontier of the Territory of Minnesota. United States House of Representatives Executive Document No. 51, 31st Congress, 1st Session, p. 18)

High water and the possibility of flooding had been a source of concern since mid-June.

June 17: The water of the [Red] river [at Pembina], which is rising rapidly, makes us fearful; a part of the seed put in the low ground is going to be ruined. (Belcourt, G.A. Letter to Reverend C.F.Cazeau, Secretaire de l'Archeveque de Quebec, date Pimbina [sic], Riv.

Rouge, Territoire de Minnesota, 17 juin, 1849. Belcourt Papers, Correspondence 1846-1857, p.1,328, Minnesota Historical Society, Minneapolis)

June 26: The water is extraordinarily high...all the rivers are inundated, they say that Pembina is drowned and it is believable from the height of the water here. there is already grain in the water and it doesn't seem to have decided to lower yet...it rains often and without doubt much more copiously upstream than here. (Msg. J.N.Provencher, Bishop of the Northwest, to Msg. I. Bourget, Bishop of Montreal, dated St. Boniface, 26 June, 1949, PAM MG7 D1)

June 27: The convoy has left and the water is extremely high. They say that Pembina is drowned; it is not possible to ride on the prairie and the water rises continually. Much wheat perishes because it rains often...M. Belcourt writes me that the wheat [at Pembina] is almost drowned and the soldiers are stopped by the water he thinks...It is very difficult to communicate except by canoe. (J.N.Provencher, Bishop of the North-West, St. Boniface, Red River, to Monseigneur P.-F. Turgeon, Bishop of Sidyme, Quebec, 27 June, 1849, in Lettres de Monseigneur Joseph-Norbert Provencher, Premier Eveque de Saint-Boniface, Bulletin de la Societe Historique de Saint-Boniface, vol.III, 1913, Imprimerie du Manitoba, Saint-Boniface, Manitoba, p. 271)

The heavy rains appear to have continued through much of August.

August 8: The ground [around the fort] was one swamp with the incessant rains. (Robert James Journal, PAM MG7 B2 CMS A92)

August 15: The almost incessant rains and the condition of the country prevented us from responding to this politeness [an invitation to visit Fort Garry from Pembina]. (Woods, (Woods, S., 1850. Report of Major Wood [sic] relative to his expedition to Pembina Settlement and the condition of affairs on the North-Western frontier of the Territory of Minnesota. United States House of Representatives Executive Document No. 51, 31st Congress, 1st Session, p. 20)

Unable to travel from Pembina to Fort Garry, Woods set out to explore Pembina Mountain, 50 km to the west.

August 14: ...travelled nearly due west for about 8 miles and found the prairie so horribly bad that I turned back...I had a guide who has lived in this country thirty-four years...[who] said, after seeing the condition of this route, it would be useless to attempt any other. Our horses mired over nearly the whole of the distance. (Woods, S., 1850. Report of Major Wood [sic] relative to his expedition to Pembina Settlement and the condition of affairs on the North-Western frontier of the Territory of Minnesota. United States House of Representatives Executive Document No. 51, 31st Congress, 1st Session, p, 19)

August 26: I waited [at Pembina] from the 1st to the 26th of August hoping the country would dry sufficiently for me to pass over it, but was disappointed. The improvement of the prairie by a few successive clear days, a hard rain would restore to their previous impassable condition. (Woods, S., 1850. Report of Major Wood [sic] relative to his expedition to Pembina Settlement and the condition of affairs on the North-Western frontier of the Territory of Minnesota. United States House of Representatives Executive Document No. 51, 31st Congress, 1st Session, p. 19)

At the end of August, Provencher wrote

The water has been so high all summer that there was no way to communicate with Pembina except by water...A company [Woods' Dragoons] visited his [Belcourt's] post and they had to leave because there was no appearance of a harvest at Pembina; the water covered the fields. (Letter from J.N.Provencher to Monseigneur I. Bourget, Bishop of Montreal, dated St.

Boniface, June 26, 1849, PAM MG7 D1)

The flood ended in the latter half of August.

August 26: When the expedition first reached Pembina [August 1], the incessant rains for weeks previous had caused all the rivers to overflow their banks; but when I embarked to ascend the Red River [August 26], it had subsided into its usual channel. (Pope, J., 1850. The report of an exploration of the Territory of Minnesota. United States Senate Executive Document No. 42, 31st Congress, 1st Session, p. 34-35)

ANTECEDENT CONDITIONS:

This flood was produced by excessive rainfall after the snowmelt period. The preceding winter seems to have been unremarkable and the breakup, although very late, seems not to have produced unusual water levels in the Red River.

DISCUSSION

Flooding of the Red River in July or August as far downstream as Pembina or below is a highly unusual occurrence- the modern (1916-1990) discharge record at Emerson indicates that bankfull discharge in these months has a 20th Century exceedance probability of less than 1%.

Despite the lack of direct evidence, it seems likely that the unusual summer rainfall extended into the Assiniboine basin since similar conditions were reported over the entire area from St. Louis to Fort Snelling, throughout the Red River Valley from its southern end through Pembina and Red River, and as far north as Norway House on Lake Winnipeg (Blair and Rannie, 1994). The western tributaries of the Red were very high, including the Pembina River whose basin borders that of the Souris.

1850

As in 1849, there is no information from the Assiniboine basin and thus no direct evidence for high water there but significant summer flooding occurred on the Red and it seems likely that these conditions extended to the Assiniboine basin as well.

DESCRIPTION

The description of conditions in the Red River basin and valley given below is taken from Rannie (1999) and is repeated here to demonstrate the magnitude of the event and the unusual nature of the summer weather, which was very similar to that of 1849, beginning with a very late spring followed by heavy rainfall and flooding in June and July.

April 30: We have now got to the end of April and the river still solid and snow upon the ground. (Journal of J. Smithhurst [at Indian Settlement], PAM MG7 B2 CMS A97)

April 30: The River began to clear. (Robert James' Journal, PAM MG7 B2 CMS A92)

May 4: This day the ice in the river broke. (Journal of J. Smithhurst [at Indian Settlement], PAM MG7 B2 CMS A97)

May 24: The rain poured down in torrents for several hours last night and it has rained more or less all day so that the plains are deluged with water. The river is also excessively high and the current strong. (Journal of J. Smithhurst [at Indian Settlement], PAM MG7 B2 CMS A97)

May 25: I took my small boat and four strong men [to the Fort] but such was the force of the current that we did not get the 8 miles till near 1 o'clock [from 8 o'clock]. Had we not turned out of the main river occasionally and gone up creeks and over the overflowed plains and in one instance dragging the Boat over a point of land we should have been much longer. (Journal of J. Smithhurst [at Indian Settlement], PAM MG7 B2 CMS A97)

June 15: Great crops last year [1849] there will be none [this year] in consequence of high water. The water got in to my kitchen garden and M.? was obliged to leave his house all Pembina under water. (Letter, Andrew McDermot, Red River to G.M.Cary, London, Ontario, dated June 15, 1850, in Cary Papers, PAM MG2 C3)

July 4: Je voulais aller aussitot apres le careme au lac Rouge, mais une abondance d.eau extraordinaire a forme entre le lac Rouge et Pembina une barriere infranchissable... Mais ce deluge a mis obstacle aux resolutions qu'avoient prises les habitants de Pembina de semer beaucoup, car tous leur champs ont ete submerges et le sont encore. La maison d'ecole, le'eglise et le presbytere sont les seules batisses ou l'eau ne soit pas entre...[at Pembina]. (Letter, G.A.Belcourt to Messire Chs. F. Cazeau, Secret. de l'Archev. de Quebec, dated St. Joseph de la Montagne de Pembina, Territoire de Minnesota, E.U., 4 juillet 1850, Belcourt (Georges Antoine) Papers, Correspondence 1846-1857, Minnesota Historical Society, 1328.

July 17: L'eau a fait du dommage, elle a submerge toutes les terres un peu basses, des champs ensemenses ont ete noyes, d'autres n'ont pas etes semes par la crainte d'une pareil sort; l'eau a monte jusqu'a la fin de mai...Je n'ai rien perdu par l'eau ainsi que les Soeurs. Mr. Belcourt n'a pas ete noye dans sa maison, mais le pays l'a ete, pas un grain a ete seme. (Letter, J.N.Provencher, Ev. du Nord-Ouest, to Monsieur C.F. Cazeau, Secretaire du Diocese de Quebec, dated St. Boniface, 17 juillet 1850, in Belcourt (George Antoine) Papers,

Correspondence 1846-1857, p. 1328, Minnesota Historical Society)

August 7: Harvest will be unknown among the Canadian Settlers...their fields being overflowed in the spring. (Letter, Robert James to the Secretary of the Church Missionary Society, London, dated Aug. 7, 1850, at Grand Rapids, Red River, in Robert James' Journal, PAM MG7 B2 CMS A92)

September 17: From the extraordinary height of the waters of the Red River last spring many of the most fertile fields were overflowing and the inundation having been more extensive in that District of the Settlement occupied by the Hunters than [here] farms have, in many instances, been nearly unproductive. (Letter, John Black [Fort Garry] to Arch. Barclay [London], dated Fort Garry, Red River, 17 Sept. 1850, in HBCA London Correspondence from Winnipeg A11/95 1829-1853 #368)

The waters remained high into September, although they had fallen below flood stage.

Late September: There had been a flood that summer, but the waters had gone before the time we came across the plains. It was late in September we arrived in St. Boniface. (Sister Laurent quoted in Healey, W.J., 1923. Women of Red River. The Women's Club, Winnipeg, Manitoba, p.110)

A particularly useful account which illustrates the magnitude of the flood was given by Harriet Cowan in an interview many years later. Mrs. Cowan travelled north to the Red River Settlement in June (the precise date isn't given).

In coming from St. Louis in the spring of 1850 James Sinclair brought a number of wagons and heavy horses to be used in crossing the plains from Red River to Oregon. "I remember that on the way from Galesboro," said Mrs. Cowan, in telling of that journey, "we saw at Galena in Illinois a railway track which had just been built-the first I ever saw...As we came northward through Minnesota we found a great deal of the country flooded, and we had to come by a different route from the one we had travelled two years before. At Red Lake River, and again and again in order to cross other rivers and streams, rafts had to be made with branches of trees and the wheels of the Red River carts tied together...At Pembina the water extended two miles out from the hill where Mr. Kittson had built his house. We stayed there four days, and then Mr. Kittson sent us in boats to Fort Garry. The expanse of water over which we voyaged from Pembina was in places eight miles wide. At night we had to tie up the boats to the trees...On account of the flood in 1850 James Sinclair had to give up his plan of taking his family to Oregon that year. The start could not be made early enough." (Harriet Cowan quoted in Healey, W.J., 1923. Women of Red River. The Women's Club, Winnipeg, Manitoba, p. 29-30)

ANTECEDENT CONDITIONS:

Water levels were still very high late in the previous summer (1849) and it is assumed that the antecedent moisture status of the basin at freezeup was extremely high. Winter began in mid-November and seems not to have been remarkable, although few entries have survived from November to April. As was noted at the beginning of the flood description, spring was late.

DISCUSSION:

The great magnitude of this Red River flood is indicated by Harriet Cowan's description of the expanse of water as being "in places eight miles wide", by Provencher's description of the "impassable barrier" of water between the Red River Settlement and Pembina, and by the reports of flooding of fields in the vicinity of the Settlement. The widening of the flooded area south of the Forks, characteristic of 1950-magnitude floods, is indicated by Provencher's statement and John Black's comment that "inundation (was) more extensive in that District of the Settlement occupied by the Hunters than (in the vicinities of the Forks and downstream)," and by James' opinion that "harvest will be unknown among the Canadian settlers..."

This flood, then, seems to have been at least as great as that of 1950.

Statements in subsequent years confirm the extreme nature of this flood.

> September 12, 1851: ...no farming whatever being done [at Pembina in 1851] on account of the annual floods in the valley of the Red River, for three years past [1849, 1850, 1851]- the waters having risen to the height of thirty-one and thirty-three feet above low-water mark, flooding all the country, and inundating the houses at this place [Pembina] to the depth of two and three feet. Mr. Kittson was obliged to leave the post at this place last spring [1850], and take up his residence for a month upon the surrounding highlands. These floods, should they continue, will prove a serious drawback to the settlement of this valley, the half-breeds being loath to be swept off annually. Mr. Kittson had some six thousand rails swept off from his place last year. (Bond, J. Wesley, 1857. Minnesota and its Resources to which are appended Camp-Fire Sketches. Keen & Lee, Chicago, p. 276)

During the great flood of 1852, Dr. William Cowan used the 1850 flood as a reference point during the rising phase.

> May 5, 1852: River has risen same as night before nearly 2 7/8. boat from Pembina reported very high water higher than in spring 1850... (Diaries of Dr. Willam Cowan, PAM MG2 C15 M154)

Despite the lack of direct evidence from the Assiniboine basin, it seems likely that high water conditions existed there as well.

1851

For the third summer in succession, high water with some flooding occurred on the Red River although its magnitude seems to have been somewhat smaller than in 1850. Again, there are no direct observations from the Assiniboine basin but unlike in 1849 and 1850, an indirect comment (July 21) suggests that high water occurred in the Assiniboine basin as well as in the Red.

DESCRIPTION:

The following description of conditions in the Red River basin is taken from Rannie (1999). In contrast to the two previous years, spring arrived early at Red River.

> March 31: I started [to the Bishop's] but was compelled again to return. The water was covered by a thin ice, not sufficient to bear the horse & he was in danger of cutting his legs at every step. (Robert James Journal, PAM MG7 B2 A92)

> April 2: The River broke this evening & again we saw open water. It was feared the spring had come too early to continue, & today the weather became much colder. The ground was again covered with snow after being clear some time. ((Robert James Journal, PAM MG7 B2 A92)

The first mention of high water follows apparently heavy rain in July.

> July 15: voila bientot quinze jours qu'il pleut, l'eau monte et montera, la recolte qui est probablement trop belle n'est pas avancee, et sansdoute que cette abondance d'eau va lui nuire beaucoup... (Letter, Bishop Provencher, Bishop of the Northwest, to Msg. I. Bourget, Bishop of Montreal, dated St. Boniface of the Red River, 15 July, 1851, PAM MG7 D1)

> July 21: Les pluies abondantes ont fait dommage aux grains. L'eau monte toujours et pourrait detruire la recolte dans les terres peu elevees; deja c'est la cas a la Prairie du Cheval Blanc. (Letter, J.N. Provencher, Eveque du Nord-Ouest, St. Boniface de la Riviere Rouge, to L'Archeveque du Quebec, 21 Juillet, 1851, in Lettres de Monseigneur Joseph-Noerbert Provencher, Premier Eveque de Saint-Boniface, Bulletin de la Societe Historique de Saint-Boniface, vol. III, 1913, Imprimerie du Manitoba, Saint-Boniface, Manitoba, p. 279)

Most of the other evidence for high water and flood is indirect or after-the-fact. Perhaps the strongest indications of a remarkably wet summer come from reports of exceptional floods in the valley of the Minnesota River, southwest of the upper Red River basin.

> May 25: Left St. Louis in the steamer Diana Vernon for Tully but on arriving at Hannibal discovered that the water had risen to an unprecedented height having overflowed its banks & spreading over the praries [sic] & bottom lands had in some places swelled to fifteen miles in width where it usually is but one. (Frank B. Mayer in Heilbron, B.L. [ed.], 1932. With Pen and Pencil on the Frontier in 1851: The Diary and Sketches of Frank Blackwell Mayer. The Minnesota Historical Society, Saint Paul, p.76)

> July 7: This is an unusually rainy season & we are almost daily visited by storms of wind & rain, the severest came at midnight and broke our dreams by its terrific howl. For two hours the lightning flashed continuously...torrents of rain...The accumulated streams descended from

the hills...[on the lower Minnesota near Traverse de Sioux, date approximate]. (Frank B. Mayer in Heilbron, B.L. [ed.], 1932. With Pen and Pencil on the Frontier in 1851: The Diary and Sketches of Frank Blackwell Mayer. The Minnesota Historical Society, Saint Paul, p.174,177)

July 14: Our progress being up stream & in opposition to a strong current our arms were fully employed, what with polling, paddling & portaging, wading thro' sloughs & pushing the canoe thro the tangled bushes & grape vines, for we passed thro forests which are usually ten feet above the river bank, we had a fair example of voyaging by the time we arrived at the foot of the opposite bluffs...The river enlarged to ten times its natural size & covering meadows & skirts of timber usually high above its banks, extended to the foot of the hills on the opposite side [on lower Minnesota River]. ((Frank B. Mayer in Heilbron, B.L. [ed.], 1932. With Pen and Pencil on the Frontier in 1851: The Diary and Sketches of Frank Blackwell Mayer. The Minnesota Historical Society, Saint Paul, p.185-186)

Mid-July: The [Minnesota] river was then higher than it has been for years. ((Frank B. Mayer in Heilbron, B.L. [ed.], 1932. With Pen and Pencil on the Frontier in 1851: The Diary and Sketches of Frank Blackwell Mayer. The Minnesota Historical Society, Saint Paul, p.190)

August 30: ...the great floods of the west have reached the valley of the Minnesota River...The valley of the Minnesota has been overflowed three times in succession since last spring. tradition gives no account of such an event. Four bands of the Sioux planted in the valley of the Minnesota river; their corn-fields were all swept away; a fifth lost part of their corn-fields. (Parker, D.D. The Recollections of Philander Prescott, Frontiersman of the Old Northwest 1819-1862. University of Nebraska Press, Lincoln, Nebraska, p. 216)

August 31: The summer of 1851 came, which brought great changes and prepared the way for others. It was one of the very wet summers in Minnesota, when the streams were flooded all the summer through. In making our trip for provisions in the spring, we were detained at the crossing of one stream for almost a week...The Minnesota was very high, spreading its waters over all the low bottom contiguous to the mission premises [Lac qui Parle]. (Riggs, S.R., 1880. Mary and I: Forty Years with the Sioux. Congregational House, Boston, p. 139)

More direct observations about the state of the Red River conditions are given by late-summer visits to Pembina by John Black and J. Wesley Bond.

September 11: Arrived at Pembina...we came to a halt and reconnoitred, standing almost glued fast in the stickly, tenacious mud caused by the rains and overflow of the Red and Pembina Rivers for three years past. (John Black in Bryce, G., 1898. John Black, The Apostle of Red River. William Briggs, Toronto, p. 39)

September 17: After Sunday was past for two days the weather was bad, but on Wednesday, 17th, the day was fine...[They set off]...Everywhere were to be seen traces of the high water which had prevailed for several years, and marks upon the trees thirty feet above the water were seen where in spring the freshets had reached. ((John Black in Bryce, G., 1898. John Black, The Apostle of Red River. William Briggs, Toronto, p. 40)

September 12: ...no farming whatever being done [at Pembina], on account of the annual floods in the valley of the Red River, for three years past [1849, 1850, 1851] - the waters having risen to the height of thirty-one and thirty-three feet above low-water mark, flooding all the country, and inundating the houses at this place to the depth of two and three feet. Mr. Kittson was obliged to leave the post at this place last spring, and take up his residence for a month upon the surrounding highlands. These floods, should they continue, will prove a serious drawback to the settlement of this valley, the half-breeds being loath to put in crops when they are liable to be swept off annually. Mr. Kittson had some six thousand rails swept off from his place last year. (Bond, J. Wesley, 1857. Minnesota and Its Resources to which

are appended Camp-Fire Sketches. Keen & Lee, Chicago, p. 276)

September 25: [Harvest] usually takes place here [Pembina] about the 20th August, and is a full month later this year than common, the season having been very cold and wet up to the 17th August, up to which time fears were entertained for the loss of the whole crops. The weather fortunately changed, and for a month was very warm and fine. (Bond, J. Wesley, 1857. Minnesota and Its Resources to which are appended Camp-Fire Sketches. Keen & Lee, Chicago, p. 325)

ANTECEDENT CONDITIONS

As in the 1850 flood, it can be assumed that the moisture status of the basin at freezeup in the previous fall (1850) was extremely high. Autumn seems not to have been particularly severe, nor the winter early. The rivers did not freeze over until the third week of November, somewhat later than usual.

November 18: The ice is drifting down the River in large pieces denoting the intensity of the frost. It will be fast in a few days. (Robert James Journal, PAM MG7 B2 A92)

Little information is available for the winter period but again there is no indication of particularly severe conditions. James reported mild weather beginning in early March, with a strong thaw in mid-March and an early beginning to breakup.

March 16: A lovely day. The roads almost impassable from the rapid thaw. (Robert James Journal, PAM MG7 B2 A92)

March 19: ...to my surprise I found the Plains with so little snow upon them that after wretched travelling [in the cariole] I did not reach the cottage. (Robert James Journal, PAM MG7 B2 A92)

March 20: Had intended to see the Bishop today, but was informed of the unsafe state of the River, large openings have appeared in several places. ((Robert James Journal, PAM MG7 B2 A92)

March 24: Mounted my horse to visit the Bishop. I expected the plains would be one pool & found both snow & water deep. I persevered at walking pace beyond Middle Church when a tremendous drift crossing the road interrupted my progress. (Robert James Journal, PAM MG7 B2 A92)

The subsequent breakup is noted at the beginning of the flood description above.

DISCUSSION:

There are no direct references from observers in the Assiniboine basin but the July 21 comment by Provencher (repeated below) implies that the White Horse Plain was flooded.

July 21: L'eau monte toujours et pourrait detruire la recolte dans les terres peu elevees; deja c'est la cas a la Prairie du Cheval Blanc. ((Letter, J.N. Provencher, Eveque du Nord-Ouest, St. Boniface de la Riviere Rouge, to L'Archeveque du Quebec, 21 Juillet, 1851, in Lettres de

Monseigneur Joseph-Noerbert Provencher, Premier Eveque de Saint-Boniface, Bulletin de la Societe Historique de Saint-Boniface, vol. III, 1913, Imprimerie du Manitoba, Saint-Boniface, Manitoba, p. 279)

It is possible that the "flooding" of the prairie at White Horse Plain was due to local runoff and heavy rain but the wording suggests that the water came from the river.

1852

DESCRIPTION

This year marked the second-largest historic flood in the Red River Valley. Its characteristics have been described in detail in a number of studies.

> Canada, Department of Resources and Development, 1953. Report into measures for the Reduction of the Flood Hazard in the Greater Winnipeg Area: Appendix B, History of Floods on the Red River. Red River Basin Investigation, Water Resources Division.
>
> Rannie, W.F., 1999. A Survey of Hydroclimate, Flooding, and Runoff in the Red River Basin Prior to 1970. Geological Survey of Canada, Open-file Report 3705, Ottawa.

The causes of the flood in the Red River basin are summarized as follows: very heavy snowfall in March with cool temperatures during much of April, a late breakup (April 26-27), a rapid transition to warm temperatures, and rain during the rising phase.

Unfortunately, there are no observations of weather from the Assiniboine basin during the winter and there is no way of knowing whether similar conditions occurred there.

In the vicinity of the Red River Settlement, the great majority of comments referred to the Red River but the Assiniboine was included in a number of observations.

> April 24: ...river rose last night about 2 inches ice unmoved...Ice has moved this evening in both rivers... (Diaries of Dr. William Cowan, PAM MG2 C15 M154)
>
> April 26: Ice unmoved on main river started about ½ past 8, and clear water as far as visible up and down. Assiniboine fast... (Diaries of Dr. William Cowan, PAM MG2 C15 M154)
>
> April 27: both rivers pretty clear of ice. Small river has fallen a little. (Diaries of Dr. William Cowan,PAM MG2 C15 M154)
>
> April 28: River has risen more than a foot during the night...Ice commenced to run about 10 o'clock in the Assiniboine & still continues. river rising very fast... (Diaries of Dr. William Cowan, PAM MG2 C15 M154)
>
> May 19: ...The water gained upon us all day... a rise in the Assiniboine of 5 ½ inches during the night... (Anderson, D., 1852. Notes of the Flood at Red River 1852 by the Bishop of Rupert's Land. PAM MG7 B2 CMS A83)

None of these comments directly indicate that the Assiniboine itself was high since the backwater effect of the very high water on the Red would have caused it to rise in the vicinity of the Settlement regardless of its own discharge.

Confirmation that the river was extremely high comes, however, from three comments by Abraham Cowley as he canoed down the lower Assiniboine at the time the Red was reaching its peak and beginning to fall.

> May 22: Reached Portage la Prairie; Here the people have been flooded out of their houses & we learn that the RR Settlement is also overflowed. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)
>
> May 24: Left Portage la Prairie & descended the river till nearly sun set when finding a favourable place we encamped. It has become difficult to land when one wishes the banks being overflowed. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)
>
> May 25: reached White Horse Plain much of it is overflowed learned more particulars of R. River flood it is I fear very extensive and destructive. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

When Henry Youle Hind explored the region in 1858, he made several comments which indicate the severity of conditions in the Assiniboine basin. Particularly interesting are his comments which indicate exceptional flooding of both the Souris and Qu'Appelle Rivers.

> Leaving Prairie Portage ... we took the trail leading to the Bad Woods, a name given to a wooded district about thirty miles long, by the buffalo hunters in 1852, who, in consequence of the floods of that year, could not pass to their crossing place at the Grand Rapids of the Assiniboine by the Plain or Prairie Road... [and were] compelled to cut a road through the forest of small aspens which forms the Bad Woods, to enable them to reach the high prairies. (Hind, H.Y., 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858. reprinted, 1969, Greenwood Press Publishers, New York, p. 283-84)
>
> The country [adjacent to the Souris River near the HBC Sand Hills post] becomes very low after passing the last sand-hills, and over a large extent of prairie south of them, drift timber is distributed, showing the extraordinary rise in the waters of the [Souris] river during the floods of 1852. (Hind, H.Y., 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858. reprinted, 1969, Greenwood Press Publishers, New York, p. 295)
>
> In 1852... the Indians represent the Qu'appelle Valley as filled with a mighty river throughout its entire length...(Hind, H.Y., 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858. reprinted, 1969, Greenwood Press Publishers, New York, p.329)

Although no information is available for the upper basin, there is no reason to think it would have been less-affected than the Qu'Appelle, Souris, or Red Rivers.

At Portage la Prairie and for about 60 km downstream, the Assiniboine flows within an alluvial ridge which elevates the channel above the adjacent land to the north and south. During high flows, overbank water would flow away from the channel northward toward Lake Manitoba and southward toward the La Salle River (which flows into the Red at St. Norbert). By both routes, a significant proportion of the overbank flow would have bypassed the lower Assiniboine altogether. This phenomenon has been observed in other historic floods, most particularly in 1882 (see PART ONE). For flooding to cover a significant area to a notable depth as far downstream as White Horse Plain, discharge must have been greatly in excess of the natural channel capacity (340-425 cms) and it is reasonable to assume a discharge of 1974 -1976 proportions (900 -1460 cms). If it were the latter, as seems likely from Hind's comments, the Assiniboine may have accounted for as much as 30% of the calculated combined flow of the Red and Assiniboine at the Forks.

1854

DESCRIPTION

Spring weather began with strong melting in the first week of April at both Red River and Fort Pelly, and evidently even earlier in the southern Red River basin since the Red was rising well before the ice cover left.

> March 31: Clear and cold. But, owing no doubt to there having been mild weather, in the Upper Country, the water in the river is rising... (Winnipeg Journal, HBCA B.235/a/15 1851-54)

> April 8: ...snow going away rapidly only occasional patches remaining [at Red River]. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

> April 9: Wind South & fine mild day-it was cold during the night...we had a bad trip [from Touchwood Hills] as the snow was nearly all off the ground beyond Devil's Creek. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

> April 12: ...Excepting the deeper drifts, all the snow disappeared from the Plains. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

The upper Assiniboine began to rise in mid-April and both it and Swan River were reported as high.

> April 14: ...a good deal of water is now over the Ice of the Assiniboine River the ground is pretty clear of snow now... (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

> April 16: Ice commenced to drive in the Assiniboine River-water high. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

> April 17: ...Swan River open water very High. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

> April 18: ice running on little [Assiniboine] river main [Red] river clear. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

> April 20: ...the water still high in the Assiniboine. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

The Assiniboine began to fall on April 26 but the Swan River continued to be relatively high.

> April 26: ...the water in the Assiniboine fell a good deal to-day. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

> April 29: ...the water in the Swan River is still good. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

The weather in May was cool and considerable rain fell, particularly at Red River.

The summer at Fort Pelly was very wet. From mid-June to mid-August, rain was reported in the Fort Pelly Journal on 24 days (summarized in the table below).

Reports of Rain at Fort Pelly June 16-August 24, 1854
(Fort Pelly Journal, HBCA B.159/a/18 1853-54)

June 16	raining in Slight Showers all day	July 23	raining the most part of the day
June 17	raining all day	July 24	raining in Slight Showrs all day
June 20	...raining all day	July 27	raining in the evening and lasted all night
June 24	Thundering and raining in Showrs	July 30	Raining a grate part of the night
June 25	raining the whole day	July 31	raining in Slight Showrs all day
June 27	has rained during night	August 2	in the after noon began to rain
July 4	rainy weather	August 4	it began to rain in the after noon
July 6	raining the most part of the night and all this day	August 8	began to rain late this evening
July 7	raining in Showrs through the day	August 9	began to rain late this evening and continued raining all night
July 9	raining in Showrs all day	August 10	Raining in Showrs through the day
July 12	Raining a heavy Showr this morning	August 11	in the after noon began to rain very heavy Showr
July 15	Raining all day	August 18	raining in Slight Showrs
July 16	raining in Slight Showrs through the day	August 22	rainey weather
July 17	rainey Weather	August 24	an occasional shower of rain

The precipitation in June, July and August was concentrated in the Assiniboine basin, however, since during the same period, rain fell at Red River on only 8 days.

The upper Assiniboine River was unusually high near the beginning of this period

> June 22: ... Getting no fish from the Basket owing to the River been so high. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

Charles Pratt encountered high water in several streams as he travelled west from Red River to Fort Pelly from late June to late July.

> June 28: I [tried] to cross the (Whitemud) river [west of Portage la Prairie] but I could not, the water so high. I was afraid that we should drown... (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

> June 30: Reached the rat creek, with great difficulty we got over all safe... (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

Charles Hillyer reported the same conditions travelling westward from Portage la Prairie on July 11.

> July 11: the road is very swampy, the late rains having increased its naturally bad state [going west from Portage la Prairie]. (Journal of Rev. Charles Hillyer, PAM MG7 B2 CMS)

When Pratt reached the Assiniboine, he found it high and overbank in places.

July 18: a fine Day. reached the forks of the Assiniboine river & Call river [Qu'Appelle], the rivers very high. By the providence of the Almighty we found a canoe which was a mercy for us we got over...with great difficulty... (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

July 21: came to the white mud river it being high... [this White Mud River is a different one to the one he encountered on June 28]. (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

July 22: ...Mackay was kind enough to assist us in getting over the Assiniboine river it was so high that it overflowed its banks in some places [south of Fort Pelly]. (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

There are no further reports of river conditions but as the table above indicates, rain continued at Fort Pelly throughout August and Charles Pratt reported rain at Fort Pelly from August 29 to September 4 (Journal of Charles Pratt, PAM MG7 B2 CMS A95). It is assumed that river levels remained high.

Considerable rain fell at Red River in September (summarized in the table below).

Reports of Rain at Red River, September, 1854
(Journal of Abraham Cowley, PAM MG7 B2 CMS A86;Diary of Dr. W. Cowan,PAM MG7 B2 CMS A92)

September 3	...before school time such heavy rain came on & continued with little intermission all day...seldom have I seen such a storm of rain. (Cowley)	September 17	...has rained heavily all night. (Cowan)
September 4	On the way a heavy storm fell & made me very wet... (Cowley)	September 18	...raining heavily this evening. (Cowan)
September 9	...we have been trying to carry home the wheat but the frequent storms of rain have prevented us... (Cowley)	September 20	...has rained a little during night. (Cowan)
September 10	...sharp thunder storm about 4 o'clock & heavy shower (Cowan)	September 29	...storm during night thunder hail & rain bright lightening (Cowan)
September 13	The morning very stormy the afternoon fairer (Cowley)		

ANTECEDENT CONDITIONS

The Assiniboine began to freeze at Fort Pelly on October 26 and was frozen at both Fort Pelly and Red River by November 2. Snow fell in varying amounts at Fort Pelly on 11 days in November and by the end of the month had accumulated to a considerable depth.

November 2: the Assiniboine River is now completely set fast. (Fort Pelly Journal Section B [copy], HBCA 1852-53)

November 27: ...there is now a great depth of snow on the Ground. (Fort Pelly Journal Section B [copy], HBCA 1852-53)

December temperatures were generally moderate at Fort Pelly, becoming intensely cold in January until late in the month. Snow continued to accumulate.

January 3: A very bad day blowing a Gale with snow & drift-the snow is very deep now and

will be much against our tripping. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

January 27: ...the snow is too deep for oxen or Horses. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

Cold and very mild conditions alternated in February with several heavy falls of snow at both Fort Pelly and Red River.

March 3: Fort very full of snow, some drifts reaching to the gallery, and almost over the wall. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

March 6: Snow to the westward very deep [toward Fort Ellice and Swan River]. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

March 16: A gale of snow in the evening with very thick drifts. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

March 17: ...cold weather no thaw as yet-such a severe winter has not been Known here. (Fort Pelly Journal, HBCA B.159/a/18 1853-54)

March 26: Clear and still very cold. Therm. -13°...the feeling there has not been a colder day this winter-The continuance of this cold weather up to so late a date, will likely give us a very sudden thaw when it begins. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

Thawing began in late March and the subsequent freshet and spring conditions are given above.

DISCUSSION

There is no mention of spring flooding but from the apparently abnormally heavy snow cover in late March, the additional snow and rain and snow in April, and the relatively rapid thaw, it is a distinct possibility. After a period of recession in late April and May, water levels in the Assiniboine and Swan Rivers were described as (again or still) high in late June as a result of rainfall which subsequently fell in even greater amounts, and the river was overbank near Fort Pelly in late July at least. There can be little question that discharge was high all summer and possibly into the fall. This pattern is reminiscent of the floods in 1902, 1927, and particularly 1954, all of which produced very large floods in the reach above Brandon, with the principal source of water being rainfall over the upper basin.

1856

DESCRIPTION

This flood, reported from both the upper Assiniboine and especially the Qu'Appelle, was the result of heavy rain in late May, June and parts of July, August and September.

May was warm at Fort Pelly and considerable rain fell at Fort Pelly on 6 days after May 19. The level of the river there was reported as high.

> May 22: Wind South and Raining hard terrible night of Thunder & lightning. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)
>
> May 25: Wind South & Raining hard with Thunder & lightning. (Fort Pelly Journal, Section B [copy]1855-57 mfm 475)
>
> May 26: ...no fish from the Barrier owing to the high water. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)
>
> May 26: ... four inches rain fell on the 26th. (D. Gunn's Record at Lower Settlement, quoted in Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.)

Rain fell at Fort Pelly in early June (5 days from June 1-12) and the Assiniboine was still high. Continuing unusually high water along the Assiniboine until at least June 22 is implied in the June 22 comment below.

> June 11: ...Raining all day...I am much afraid this is going to be a wet Summer. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)
>
> June 12: ...Raining...The Rivers are very high owing to this continual Rain. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)
>
> June 22: ...raining...Mr. MacKay arrived from RRS...They had to come on this side of the River all the way. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)

July was relatively dry until the 28th when rain fell at Fort Pelly on 7 of the 9 days from July 28 to August 5. In late July, Rev. Charles Pratt was travelling from Fort Pelly to the Qu'Appelle River. On July 29, he reported "a heavy storm of rain mingled with hail" south of Fort Pelly (Journal of Charles Pratt, PAM MG7 B2 CMS A95). On July 30, he reported:

> July 30: We reached the little white mud river which gave us no little trouble for its waters being high. (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

Pratt reached the Qu'Appelle River on August 11 and found it to be in flood which continued at least until the 16th.

August 11: ...reached the Quappelle river...to our surprise we found the river over flowing its first banks. (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

August 16: [we couldn't commence building] the waters being so high. (Journal of Charles Pratt, PAM MG7 B2 CMS A95)

There are no further reports of the state of the rivers but wet conditions continued at Fort Pelly. "Heavy" rain fell on August 16 and August 20-23. September was also wet with 6 days of rain from September 3-11 and 9 days overall during the month.

ANTECEDENT CONDITIONS

Little information is available for October-November, other than that the Red froze November 12 and, according to Gunn's record at Red River, 7 inches of snow fell in November (D. Gunn's Record at Lower Settlement, quoted in Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.)

December at Fort Pelly was very cold with only short mild intervals. Little snow was reported in the Fort Pelly Journal (small amounts on only 3 days) but Gunn reported 8" at Red River.

January began intensely cold until the 11th when mild weather began, lasting until the 23rd at Fort Pelly. Little snow fell at Fort Pelly and according to Gunn's registry, only 5" at Red River.

January 10: This winter, so far, has been the coldest ever experienced by the oldest settlers, for the last month the temperatures ranged from 40° to 49° below zero... (William Ross, Red River Settlement, to James Ross, Toronto, PAM RFC 159)

Mild temperatures prevailed at Fort Pelly from late January through February. Again snowfall was only moderate (6" at Red River).

In March, temperatures were moderate with a strong thaw at Fort Pelly March 18-21. Gunn reported 6 ½" of snow at Red River but "much of the snow melted during the month". The same condition was reported at Fort Pelly on April 5.

April 5: Wind South & fine weather most of the snow has melted today, another day's thaw and not a paricle will be seen... (Fort Pelly Journal, Section B [copy], 1855-57 mfm 475)

April was generally mild to warm. Heavy snow fell at Fort Pelly on April 8. The Red broke up April 16-20 and although Gunn reported significant rain and snow at Red River, less seems to have fallen at Fort Pelly.

The freshet flow of the Assiniboine, then, seems to have been at least normal but unremarkable.

1861

DESCRIPTION OF RED RIVER VALLEY FLOOD

The 1861 flood in the Red River Valley was the third largest of the well-known historical floods, with a discharge estimated by the Red River Basin Investigation to have been 125,000 cfs (3540 cms). Because less is known about the state of the Assiniboine, the nature of the Red River flood will be described in some detail

The events leading up to the peak at Red River are summarized below.

> [April] 1st rather a rainy day...5th plenty of water on the ground...6th plenty of water...and raining a little mostly all day we have not seen the sun this two or 3 days back...7th very soft and snowing thick, some geese seen up at the Rapids...[9th] found the water so deep that we had to just come back [from cutting fencing]...it began to snow thick soon after dinner on the 13th...the 14th was a fine clear day wind N.N.W. all day...the River began to break up in the evening of...the 15th but soon stopped over the night...19th a pretty day...20th a fine day...21st a fine warm day wind south...25th–the water is high now and plenty of wood going down every day, and many people left their houses now owing to the high-water. Water is still rising this 30th...a very wet rainy spring the like has not been seen this many years back. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

> May 1: The general flood which is overspreading the country will necessitate a temporary suspension in the publication of The Nor' Wester. If the waters continue to rise any longer, we shall be compelled to migrate with the multitude to distant ridges and enjoy the red man's life for some weeks. Should they recede we shall continue uninterruptedly, but there may be difficulty in the delivery as nearly all the bridges are swept away. (Nor' Wester Newspaper, May 1, 1861)

The Report on Investigations Into Measures for the Reduction of the Flood Hazard in the Greater Winnipeg Area contained the following extract from the Nor' Wester:

> As we write, the waters of the Red River have almost rolled in at our doors; and there is every indication that we are on the eve of a great flood...The unusally large quantity of snow which fell during the winter has entirely disappeared within the past fortnight. The creeks have all swollen to the size of rivers; and the main river has received from this source and from its numerous larger tributaries such copious supplies that since ever the ice commenced to break up, the channel has been constantly widening and deepening until the waters have all but overlapped even the highest portion of the banks....As early as a fortnight ago, the main river broke bounds at many points in this Settlement and elsewhere. At Georgetown, it completely inundated the inhabitants–greatly deranging the plans and workshops of the enterprising owners of the Anson Northrup, and floating the pioneer craft herself a long distance into the woods, where she got entangled with some twenty feet of water under her. In the Company's warehouse, there were, on the 14th inst., three feet of water; but, fortunately, the goods were all saved from damage. The water was not rising so quickly at this date; but, according to accounts forwarded to Governor Mactavish by Mr. A.H.Murray, no dry land was visible from that place, except a small ridge, on which the Company's cattle were feeding. From Breckinridge to Georgetown, the whole country was reported to be submerged; and between the latter place and this settlement, the land was fast disappearing. The water in the Company's store at Pembina was two feet deep on the 23rd ult. Ten miles this side Pembina, Mr. Hugh Cameron...had been driven from home by the waters; and at last accounts, the

house itself had floated off. (Nor'Wester Newspaper, May 1, 1861)

On June 1, the Nor'Wester added the following information.

In our last, we mentioned that a general flood was imminent. We can now say that it has come and gone. It fell far short of former floods in quantity of water and consequent destructiveness, but was still sufficient to cause much loss of property and much suffering. The upper part of the Settlement extending from around Fort Garry, along the Red River to Pointe Coupe suffered the most. That district being generally of a lower level than the parts below Fort Garry (if we except Point Douglas) was therefore under a greater depth of water...

Point Douglas has been all but rendered worthless. Bouvette lost two buildings, and two of the three left are upset. The two additions to Gaudrie's dwelling were torn off: the main building is much shattered...When we add that all the fencing is away, and that the best of the soil has been washed off by a terrible cross-current it will be admitted that Point Douglas is hopelessly thrown back. The current which sweeps across its base is so irresistable that we verily believe if a drain had been dug from Neil MacDonald's to Klynes just before the flood, the historic Point Douglas would now be an island. The eastern corner of Fort Garry was in water. The Convent and College of St. Boniface were in water a foot deep. The flooding extended downwards to about St. Paul's Church, and showed how remarkably level was the intervening district up to Fort Garry. There was not at most a foot or two difference betwen any two points...

There was a steady rise of water until ...the 8th of May, when the first pause was observed...the very next day, a fall of one-inch marked its ebb. In a week, it once more slipped into the customary channel, and stray parties could then be seen every day wending their way back from distant ridges... (Nor'Wester Newspaper, June 1, 1861)

The combination of the flood and rain in June left large amounts of surface water standing on the prairie long after the flood itself was over.

July 1: We have had very rainy weather during the past three weeks...We have had but very little warm weather, so far. The spring has been a long, raw, and disagreeable one. Very few will be able to commence haymaking at the usual date, July 20, on account of the immense lakes still covering the back pastures. (Nor'Wester Newspaper, July 1, 1861)

STATE OF THE ASSINIBOINE

The only mention of the state of the Assiniboine was in the Fort Pelly Journal which indicated that it was open there on April 14 and "very high" by the 17th.

April 14: ...in the morning [some men arrived and] were crossed over the river in a canoe. (Fort Pelly Journal, HBCA Sect. B, 1861-62 mfm 475)

April 17: ... the water in the river very high. (Fort Pelly Journal, HBCA Sect. B, 1861-62 mfm 475)

There is no further reference to the river in the Fort Pelly Journal. Considerable precipitation fell on 5 days in the first half of May but apparently none thereafter. However, June and early July were wet, with rain on 14 days from June 1 to July 7. The heaviest of these falls are summarized in the table below (Fort Pelly Journal, HBCA Sect. B, 1861-62 mfm 475).

June 1	Raining hard all day.	July 1	A heavy thunder storm in the evening.
June 7	Thunder & rain	July 2	Thunderstorm in the evening.
June 8	Thunder & rain	July 3	Thunderstorm in the evening.
June 13	Rain & Thunder.	July 6	rained heavily in the afternoon.
June 14	Raining hard the whole day.	July 7	Rained heavily the most part of the day.
June 23	Raining hard with Thunder the whole day.		

The are no weather records at Fort Pelly from July 11-26 but thunderstorms were reported on July 26 and 31.

The only other indication of the state of the Assiniboine is contained in a comment by Upham in his brief discussion of the 1882 Assiniboine flood contained in his report on Glacial Lake Agassiz.

> The highest floods of the Assiniboine at Portage la Prairie and along a considerable distance eastward rise only twelve to fifteen feet above its lowest stage, but they then attain a height of only a few feet below the highest portions of the adjoining country, much of which is submerged. At this extreme height, which the river reached and maintained from the 3rd to the 15th of May, 1882, ***the only time of such high water since 1860 or 1861***, it overflowed near the former site of the fort of the Hudson's Bay Company two miles southwest of Portage la prairie, and a portion of its flood passed north in shallow, winding water-courses to Lake Manitoba... [emphasis added]. (Upham, W., 1890. Report of Exploration of the Glacial Lake Agassiz in Manitoba. Geological and Natural History Survey of Canada, William Foster Brown & Co., pp. 23-24)

Upham's information was second or third hand obtained nearly three decades after the fact. There is no indication that the level of the Assiniboine was high in 1860 and it is a reasonable assumption that the event remembered by his sources occurred in 1861. The 1882 flood was estimated by PFRA at 1218 cms at Brandon (PART ONE) and inundated the Portage la Prairie region with a significant portion of the water flowing northward to Lake Manitoba. To be compared in severity with the 1882 flood, the 1861 flow must have been very high, perhaps approaching the 1976 record discharge.

ANTECEDENT CONDITIONS IN THE RED RIVER BASIN

The previous summer had been very wet, causing the Red River to rise in June and July. Rainy weather continued into the early fall and it is likely that the basin was well-saturated at the onset of freezing temperatures which began early in November.

> November 15: Indian summer is gone. Not the slightest trace or resemblance remaining of that lovely season. It lasted eighteen days. October closed delightfully and right auspicious was the first of November; but, how different the second! Dark, cloudy, and cold, with pelting rain all day, followed by snow which fell unremittingly for 24 hours! The wind was north and piercing enough for December or January. The cold weather which thus set in, as it were, in a day has continued ever since. The ice set fast, partially on the morning of Guy Fawkes' day. The ground is entirely covered with snow... (Nor'Wester Newspaper, November 15, 1861)

Milder temperatures in November removed this snowfall and delayed complete freezeup of the river until November 19. Accumulation of significant snowpack did not begin until a heavy snowfall on November 28.

Cold and mild conditions alternated for the remainder of the winter and snow was frequent, particularly in March. According to Samuel Taylor and The Nor'Wester Newspaper, the snowpack was deep by the beginning of the melt season. There must have been some apprehension of a serious potential for flooding because the April 15 edition of the Nor' Wester also contained a description of the 1826 flood.

> March: ...6th a fine day...snowing thick upon the 12th there is now a great quantity of snow upon the ground...16th a cold windy day clear...17th was a cold day south wind...18th snowing thick and south wind, snowing thick on the 19th...22nd cold windy weather...24th snowing it is as winter like yet as it was any time in winter, and the snow is very deep...31st...a fine day soft walking...30th was the beginning of the first soft weather. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

> April 15: ...this last winter has been more than average in length and in quantity of snow, but not in severity...The roads are in a dreadful state at present and very few people are to be seen moving about. The abundant snow has resulted in lakes and swamps the whole country over. Vegetation is just beginning to sprout, ducks and geese are being welcomed on all hands; creeks are pouring their volumes into the river, and the signs of the times generally make us feel that spring is upon us. (Nor'Wester Newspaper, April 15, 1861)

Despite the Nor' Wester's comment about the length of winter, however, spring was not especially late. Thawing conditions began at the end of March and the snowmelt water was augmented by much precipitation in April, as the water was beginning to rise.

> April: 1st rather a rainy day...5th plenty of water on the ground...6th plenty of water...and raining a little mostly all day we have not seen the sun this two or 3 days back...7th very soft and snowing thick...it began to snow thick soon after dinner on the 13th...Water still rising this 30th...a very wet rainy spring the like has not been seen this many years back. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

> April 8: ...la glace commenca a partir, l'eau monta rapidement. (Manuscript Chronicles of the Grey Nuns, PAM MG7 D2 M219, p. 73)

A further indication that rain prior to and during the flood was a significant factor is the comment by Governor Mactavish after the peak:

> May 16: ...Many...have lost heavily and will yet suffer more as it will be late in the season before they can sow their lands, up to this time in this respect those whose lands were flooded are not much behind those whose lands were above water as the spring has been so wet and inclement that there has been very little farming done. (Letter, W. Mactavish, Acting Governor of Rupert's Land, to Thomas Fraser, Secretary of Hudson's Bay Company, dated at Fort Garry, May 16, 1861, HBCA A.11/96, fo. 569d)

ANTECEDENT CONDITIONS IN THE ASSINIBOINE BASIN

Little information is available from sources in the Assiniboine basin until mid-February at Fort Pelly. There, the weather was very mild from February 10 to the end of the month, with thawing reported February 27-28.

March began mild but was cold from the 17th to the 28th, when thawing conditions returned. Snow or rain fell on 6 days, particularly on March 31.

> March 31: The weather mild but cloudy the whole Day we had rain and plenty of snow last night and about noone it began to snow. (Fort Pelly Journal, HBCA Sect. B, 1861-62 mfm 475)

April also began very mild with strong thawing and these conditions continued with little interruption to the end of the month. Considerable rain fell on April 3-5 and small amounts of snow fell on the 13th and 15th. Overall, however, the amount of precipitation in April at Fort Pelly was small after the 5th.

> April 3: the weather very fine and rain to day. the snow is reducing away very quick. (Fort Pelly Mission Journal Extracts, PAM MG7 B2 CMS A95)

> April 4: A very heavy rain...the whole of the place is all water, it is thawing and raining the rain is wasting away the snow very quick. (Fort Pelly Mission Journal Extracts, PAM MG7 B2 CMS A95)

> April 4: Raining hard all day. (Fort Pelly Journal, HBCA Sect. B, 1861-62 mfm 475)

> April 5: very bad unpleasant weather with rain and snow alternatively. (Fort Pelly Journal, HBCA Sect. B, 1861-62 mfm 475)

The Assiniboine was open at Fort Pelly on April 14 and the river was reported "very high" on April 17 (see above).

PART FOUR

ANNUAL RUNOFF CONDITIONS 1793/94 TO 1869/70

INTRODUCTION

In this section, the historical materials are used subjectively to characterize overall runoff conditions within each water year (October-September) from 1793/94 to 1869/70, using a methodology similar to that employed in the report on Red River flooding and runoff (Rannie, 1999). For all water-years with sufficient information, runoff is classified as Very High, High, Normal, Low, or Very Low (in comparison with the 20th Century flow regime).

The emphasis here is on the entire water-year, equivalent to the "mean annual flow" in gauged records. Thus a classification of a year as "High" or "Low" does not imply that discharge met those descriptors in all seasons. In some years, very high spring runoff may have been considered to have compensated for low summer flow or even drought. In other years, a wet summer or previous fall may have offset a below-average freshet. Each of these years might then have been classified as "Normal", even though the term might not have applied to individual seasons.

The locations of the observing posts within the Assiniboine basin were described in PART THREE. However, greater use has been made of observations from the Red River basin in evaluating runoff conditions. In the modern record, conditions within the two basins are not always comparable, however, and evaluations of years from Red River observations alone adds an additional level of uncertainty to the reconstruction. An attempt was made throughout to treat observations from outside the Assiniboine basin with caution unless there was reason to believe the conditions occurred over a very broad area (such as in 1849).

As in PART THREE, the observers' comments are given in considerable detail, both to illustrate their nature and provide the basis for the evaluation, and to give continuity to the narrative. The details from the flood years in PART THREE have not normally been repeated in this section. An additional reason for including other details of spring and summer conditions which might not seem relevant to runoff has been to make the report as useful as possible to dendroclimatological reconstruction.

1793-1794	Normal

- In September, 1793, water levels in the Assiniboine were described as "good" or "shallow" or "very shallow" in different reaches proceeding upstream from the Forks.

- Snow fell at Brandon House on October 17 and the last half of October was generally cold with some rain at both Brandon House and at the upper Assiniboine post of Marlborough House. The river froze on October 24 at Brandon House.

- November and December were generally cold at Marlborough House and Brandon House. Snow fell on several days, possibly in significant quantity.
  November 19: Wind SW a strong gale with snow and drift. (Fort Pelly Journal [Marlborough House], HBCA B.159/a/1 1793/94)

  November 25: it drifted in the plains. (Brandon House Journal, HBCA B.22/a/1 1793/94)

  December 4: it drifted so much that I could not load my Gun again. (Brandon House Journal, HBCA B.22/a/1 1793/94)

  December 18: the snow was so bad that I could not come near [the buffalo]. (Brandon House Journal, HBCA B.22/a/1 1793/94)

- Most of January was cold with only a short mild interval (January 19-22). Snowfall appears to have been modest.

- In February, cold weather dominated and snowfall increased.
  February 10: ...drifted so much in the plains that I could scarcely find my way home. (Brandon House Journal, HBCA B.22/a/1 1793/94)

  February 20: very bad weather blowing and drifting all day. (Brandon House Journal, HBCA B.22/a/1 1793/94)

  February 21: terrible weather snowing and drifting all day. (Brandon House Journal, HBCA B.22/a/1 1793/94)

  February 27: a strong gale with snow and drift. (Fort Pelly Journal [Marlborough House], HBCA B.159/a/1 1793/94)

- Mild weather began early in March and thawing was occurring by mid-month.
  March 14: The snow melts away very fast. (Ellice [Qu'Appelle] Journal B.63/a/1 1793/94)

- Snow and rain fell in late March and early April and temperatures alternated between cold and mild.

- The Assiniboine was open at Brandon House on April 6 and by April 10 both the Qu'Appelle and Assiniboine near the junction of the two were open.

- From April 9 to the end of the month, the weather was very wet with frequent rain and snow.
  April 9: last night and all this day rained very hard. (Brandon House Journal, HBCA B.22/a/1 1793/94)

April 14: This morning it rained, and Snow all the rest of the Day...dirty weather. (Brandon House Journal, HBCA B.22/a/1 1793/94)

April 15: This is the most dreadfull day we have had this year. It some times rained sometimes Snowing. (Brandon House Journal, HBCA B.22/a/1 1793/94)

April 17: very cold morning some time it snow another time rained. (Brandon House Journal, HBCA B.22/a/1 1793/94)

April 18: a most dreadful weather with wind and rain. (Brandon House Journal, HBCA B.22/a/1 1793/94)

April 22: very bad weather snowing some times rain... it is very Extraordinary such weather in this country in this season of the year. (Brandon House Journal, HBCA B.22/a/1 1793/94)

April 25: very bad weather snow & drifting all day. (Brandon House Journal, HBCA B.22/a/1 1793/94)

- There is no mention of the river during this period but it can be assumed that water levels were at least normal and more probably above average; some indication of this might be the observations of drowned buffalo on the Assiniboine. Buffalo drownings were not unusual but may suggest relatively high water levels in the spring, probably a consequence of the two weeks of very wet weather in April.

April 30: Saw 113 Buffalo drowned in the River, this Day [between Qu'Appelle River and Brandon]. (Brandon House Journal, HBCA B.22/a/1 1793/94)

May 1: Saw 283 Buffaloes drowned in the River [between Qu'Appelle River and Brandon]. (Brandon House Journal, HBCA B.22/a/1 1793/94)

- The observer left Brandon House in early May but the Shell River party continued observations there during their summer. Abundant rain fell in late May, June and early July. (Shell River Journal [at Brandon House], HBCA B.199/a/1 1794/95).

May	June	July
17 - rainy evening	1- rainy evening	1 - rainy morning
19 - a deal of rain this evening	2 - It is constantly raining here- a most terrible day of thunder and rain	5 - rainy Day
20 - very hot weather with Showers of rain	9 - showers of rain	6 - thunder and rain this morning
21 - rainy weather	11 - rainy morning	8 - Showers of rain the Day
23 - rainy weather	15 - Thunder, hail, or Pieces of Ice fell the Day about half Inch thick	10 - a rainy evening
25 - rainy weather	27 - a frightful night of thunder and rain	11 - a most terrible day of thunder, hail, rain and a storm of wind
26 - I am afraid we shall [lose] all the Provisions for it is constantly raining here	28 - rainy Day	
28 - terrible thunder lightning and rain this morning		

- Rain became less frequent and more normal for the rest of the summer but the Assiniboine at Brandon House rose in both July and August; the latter was speculated to be caused by water released from broken beaver dams, By early September, however, the water was reported to be becoming low.

July 18: water rising altho fair weather

August 21: water rising in the river

August 24: the water rose a half a foot last night here, owing I imagine to the Indians

beginning to hunt the Beaver and letting out the water from their dams

August 25: water rising, plenty of water this fall in the red [Assiniboine] river.

September 3: the water getting low

September 7: water getting very Low

- The returning canoes in September did not describe the water levels on the Assiniboine apart from a single mention of "sandy shoals" near Brandon. The weather in late September as the canoes ascended the river was cool and wet, with rain on September 19, snow all night on September 19-20, hard rain on the 25th and more snow on the 29th and 30th.

1794-1795	High

- The high water in April and June are discussed in PART THREE.

1795-1796	Low

- Water levels on the upper Assiniboine were described as "shallow" or "very shallow" in mid- to late October. The Assiniboine at Carlton House froze on November 8 (Meteorological Observations by Peter Fidler at Carleton House, HBCA B.28/a/2 1795-1796) and at Brandon House on November 10.

- Rain and snow were reported on some days in October and early November but overall precipitation seems to have been light at both Brandon House and Carlton House on the upper Assiniboine until mid-December. At Carlton House, Fidler reported 7 days with snow but a total fall of only 1.7 inches in November and 4.8 inches on 8 days in December.

- January was very cold. A temperature of -49° was described as 'exceeding sharp" in the Carlton House Journal and a measure of how "sharp" is Fidler's comment.
  January 18-19: These two Days the mercury were froze solid and continued so above one hour before it resumed its fluidity. (Meteorological Observations by Peter Fidler at Carleton House, HBCA B.28/a/2 1795-1796)

- Snowfall continued to be modest in January. Fidler's record at Carlton House reported only 3.8 inches on 9 days and Brandon House and/or Hibernia mentioned snow on only 4 days between December 19 and February 8

- February alternated between very mild and severe cold conditions. At Carlton House, "drizzling rain" was reported on the 8th and 9th, a "gentle thaw" and "pretty warm" on the 10th and 23rd, but the "mercury froze solid" on the 29th. Again snowfall was light.

- March became consistently mild after the first week, with several heavy falls of snow throughout the month, particularly at Carlton House where Fidler reported more than 8 inches plus several unspecified amounts; much of this fell after March 20. At Brandon House, it "snowed a great deal" on March 27-28.

- Mild thawing weather melted this recently fallen snow and made very wet conditions as the Carlton House party travelled to Swan River House.

  March 30: remarkably hot weather [March 30-April 3] has melted the greater part of the Snow off the ground. Season pretty early. (Meteorological Observations by Peter Fidler at Carleton House [en route to Swan River], HBCA B.28/a/2 1795-1796)

  April 1: Clear and thawed much [near Somerset House] - nearly all the Snow melted in the plains which makes it very bad & heavy hawling. (Carlton House Journal, HBCA B.28/a/1 1795-1796)

  April 2: not any Snow left in the plains - it is all melted and above half leg deep in Water which makes it very heavy & bad hawling. (Carlton House Journal, HBCA B.28/a/1 1795-1796)

  April 3: The water at the Crossing Place above one Foot deep on the River. (Carlton House Journal, HBCA B.28/a/1 1795-1796)

- At Swan River, considerable rain appears to have fallen in the last half of April.

  April 17: Heavy thunder and rain. (Meteorological Observations by Peter Fidler at Carleton House [taken at Swan River after March 30], HBCA B.28/a/2 1795-1796)

  April 22: Rain. (Meteorological Observations by Peter Fidler at Carleton House [taken at Swan River after March 30], HBCA B.28/a/2 1795-1796)

  April 23: heavy rain most part of the night and during day. (Meteorological Observations by Peter Fidler at Carleton House [taken at Swan River after March 30], HBCA B.28/a/2 1795-1796)

  April 30: Rain. (Meteorological Observations by Peter Fidler at Carleton House [taken at Swan River after March 30], HBCA B.28/a/2 1795-1796)

- The Assiniboine "opened" at Hibernia on April 13 and canoes arrived at Brandon House on April 25 but there was no mention of river levels. The Swan River experienced a short freshet rise on April 6-8, was falling from the 9th to the 16th, rising again from the 19th to the 25th, probably in response to the heavy rain mentioned above, and began falling again on the 26th.

- As the brigade moved down the river from Brandon House, the Assiniboine was described as shallow on May 11.

  May 11: water very shoal [between Brandon and Forks]. (Brandon House Journal, HBCA B.22/a/3 1795/96)

- Rain fell more frequently in late May and early June, including one very heavy thunderstorm.

  June 11: At 2 P.M. the rain and hail fell in torrents which in less than an hour laid a foot deep...on the ground, so that a Canoe might [swim?] in the yard...it continued for 2 hours attended with dreadful claps of thunder. (Brandon House Journal, HBCA B.22.a.4 1796/97)

- Summer weather appears to have been normal.

- The returning canoe brigades found the water low in the Assiniboine near the Forks on August 30 and upstream near Portage la Prairie in September.
  September 8: leading almost all day, hard work, water low making the Journey very disagreeable. (Brandon House Journal, HBCA B.22.a.4 1796/97)

- The light snowfall through most of the winter, the short freshet and reports of shallow water by the downgoing brigade in early May suggest that overall runoff was probably low, even though surface water conditions in the Swan River region may have been wet for a short period.

1796-1797	Very High

- Reports of very high spring flow on the Assiniboine at Brandon House, Fort Pelly (Indian Elbow), and Swan River House, and the fall/winter conditions in 1796-97 are summarized in PART THREE above.

- Reports of rain in June at Brandon House and Fort Pelly (Indian Elbow) appear normal in frequency and implied amounts; early July appears to have been wet.
  July 12: Wind West with thunder and rain almost every day since the 6th. (Brandon House Journal, HBCA B.22/a/5 1797/98)

- The end of July and early August were also wet. Rain was reported at Fort Pelly (Indian Elbow) on July 27, 28, August 1, 2, 3, 6, 7 and by August 8, Swan River northeast of the Assiniboine basin was high.
  August 8: they could not get across Swan River the water being high. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/4 1797-98)

- By September, however, the returning canoe brigades reported shallow water in the Assiniboine.
  September 6: we make very slow way on account of the shoalness of the water [Assiniboine above Forks]. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/4 1797-98)

  September 16: The shoalness of the water...[has delayed my trip to Brandon House]. (Brandon House Journal, HBCA B.22/a/5 1797/98)

- Despite the shallow water in September, 1797 (which would not be unusual), the strong freshet and possibly high water in early August (if the Swan River conditions also applied to the Assiniboine basin) suggest much higher than normal runoff for the year.

1797-1798	Low

- The level of the Assiniboine was low in September, 1797 (see above).

- Little precipitation was reported at any post in October; at Carlton House it rained all day on October 18 but reported only traces on 4 other days; at Brandon House it snowed all day on the18th .

- The Assiniboine was shallow and froze on October 23 at Fort Pelly (Indian Elbow), on October 27 at Brandon House.
  October 23: the [Assiniboine] River set fast here, it being very shallow and no Current, is the cause she sets so soon fast here...sharp weather. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/4 1797-98)

  October 27:...so cold that the river nigh frozen over. (Brandon House Journal, HBCA B.22/a/5 1797/98)

- Snowfall at Fort Pelly (Indian Elbow), Carlton House, and Brandon House appears to have been abundant in November and the temperatures were generally cold until the end of the month when milder weather and rain were reported at Fort Pelly (Indian Elbow).

- Cold and mild weather alternated in December and January; snow was reported on several days but overall amounts appear to have been unremarkable. On January 29, the Fort Pelly (Indian Elbow) Journal noted:
  January 29: it has been a very mild winter here which the cause I imagine the Buffalo Cows has been so Long in coming. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/4 1797-98)

- February weather was described as "fine" or "mild" at Fort Pelly (Indian Elbow) and Brandon House throughout the month with occasional snow and only very short cold spells.
  February 28: it has been the mildest weather, the last 2 Months, I ever seed since I have been in this Country. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/4 1797-98)

- Conditions in the Red River Valley were quite different with many heavy snowfalls reported at both Red River and Pembina in January-February which were not reported in the Assiniboine basin.

- Mild weather continued in March but snowfall in the Assiniboine basin increased somewhat with significant falls at Brandon House or Fort Pelly (Indian Elbow) on March 3rd, 8th, and particularly the 9th and 22nd.
  March 9: Wind East the greatest fall of snow I saw this year. (Brandon House Journal, HBCA B.22/a/5 1797/98)

  March 22: Wind East with heavy snow for about two hours this morning. (Brandon House Journal, HBCA B.22/a/5 1797/98)

- At Carlton House, particularly heavy snowfalls occurred at the end of March after prolonged thawing had removed most of the existing snowcover.
  March 27: very warm Weather. Mr. Longmoor returned as the Snow was all off the Ground. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

  March 29: heavy Snow all Day and drift. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

March 30: heavy Snow all Day. there is more Snow fallen these Two Days than has been all Winter before. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

- In the Red River Valley the accumulated snowpack in March was large and heavy rain fell at the end of the month.

March 14: Our journey [between the Forks and Pembina] for the last eight days has been wretched travelling; the Snow was full three feet deep; the ice of the River had much water on it, from the mild weather with small showers of rain, or wet snow. (Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 185)

March 29: Rains very hard all day. (Journal of Transactions by Thos. Miller at Red River, HBCA B.235/a/1 1797/1798)

March 29: Rain continued until noon; The Snow was now so mixed with water that we could not proceed. In the evening Rain came on and continued. (Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 189)

March 30: Showers of Hail and Sleet. With the Guide went to examine the country before us: which appeared like a Lake, with water. (Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 189)

- These entries from the Red River Valley are included to illustrate the apparent difference in conditions between the Red River and Assiniboine watersheds; there is no indication that the Assiniboine basin experienced such heavy winter precipitation, apart from the late March fall.

- After a very mild winter, spring arrived early. At Red River post, the Red opened on April 7 and began rising immediately, reaching flood stages at Pembina by April 12; the sequence of events in this flood are summarized in Rannie (1999).

- In contrast, at Brandon House and Fort Pelly (Indian Elbow), cold weather occurred in mid-April and some rain was reported between April 20 and May 1. The Carlton House party left for Swan River and reported that the Assiniboine was "deep".

April 14: at 8 AM got all over the [Assiniboine] River but the Water was very Deep. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

- There was no further mention of the state of the rivers until May 6 when the Swan River was described as "shallow".

- The Carlton House Journal reported significant rain and snow at Swan River on 8 days between April 28 and May 19.

April 28: heavy rain in the evening. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

May 3: heavy rain all Day. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

May 4: heavy rain and sleete all Day. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

May 19: very warm Weather in the Morning - at 6 PM heavy rain with Thunder and lightning. (Carlton House [Assiniboine] Journal, HBCA B.28/a/4 1797-1798)

- The contrast between winter/spring conditions reported in the Red River and Assiniboine basins is striking. Whereas a modest flood on the Red River was a response to quite abundant late winter snowpack and precipitation in late March-early April, snowfall in the Assiniboine basin appears to have been moderate at best and apart from a single comment that the Assiniboine was "deep" on April 14, there is no indication of water levels until May 6, three weeks after the Red River flood period, when the Swan River was reported to be "Shoald".

- Given the low level of the Assiniboine in the fall, the small amount of winter precipitation, the early spring, and the low water level soon after the freshet, it is conservatively concluded that overall runoff may have been low.

1798-1799	Normal

- The water level in the Assiniboine on October 1 was described as "very shoal" (Brandon House Journal, HBCA B.22/a/6 1798-99).

- Snow fell at Brandon House on October 21 and the Assiniboine froze there on the 28th.

- November was cold at Brandon House until mid-month, then milder during the last half; snow and rain were reported on 6 days but the amounts seem to have been small

- December was cold throughout with only one short moderate period; snow was reported on only two days at Brandon House, but fell heavily on December 21.

- In January, February and March, cold and more mild weather alternated at Brandon House. Snow was reported on only 5 days during the entire period.

- Spring set in early; the ice at Brandon House was becoming "very bad" by April 7 and the level of the river was rising on April 9.

- Colder weather arrived on April 15 and significant precipitation occurred at Brandon House in the last two weeks of the month and in early May until journal entries ceased for the season.

  April 17: snowy weather it rained very hard last night and began to snow towards daylight, there is nearly a foot on the Ground. (Brandon House Journal, HBCA B.22/a/6 1798-99)

  April 21: rained very hard last night. (Brandon House Journal, HBCA B.22/a/6 1798-99)

  April 22: rainy weather. (Brandon House Journal, HBCA B.22/a/6 1798-99)

  April 26: rainy weather. (Brandon House Journal, HBCA B.22/a/6 1798-99)

  April 30: cloudy weather towards Evening it rained very hard. (Brandon House Journal, HBCA B.22/a/6 1798-99)

May 4: rainy weather. (Brandon House Journal, HBCA B.22/a/6 1798-99)

May 9: ...showers of rain at times. (Brandon House Journal, HBCA B.22/a/6 1798-99)

May 12: light showers of rain at times. (Brandon House Journal, HBCA B.22/a/6 1798-99)

- At Swan River at least, the precipitation in April produced normal or high runoff.
  May 2: Snow with harde frost all day... so much water in the river that we were obliged to take up our nets... (Carlton House [Assiniboine] Journal [written at Swan River], HBCA B.28/a/5 1799-1800)

- There are no further entries until late summer when the lower Assiniboine was reported as low as the canoe brigade moved upstream from the Forks.
  August 14: the water are very shallow in the River this year. (Fort Pelly (Indian Elbow) Journal, HBCA B.159/a/5 1799-1800)

- At Somerset House on the upper Swan River, the low water of the summer was expected to have a negative effect on beaver returns.
  September 20: very poor hopes of Their being many Beaver on account of the Water falling off & in Consequence the most of the Beaver expected are perished in their Dens. (Somerset House Journal, HBCA B.204/a/1 1799-1800)

1799-1800	Low

- Freezeup occurred extremely early on the upper Assiniboine.
  October 7: Men came from the boats to inform me that the [Assiniboine] River was set fast so that they could not Proceed on their Journey [on Assiniboine above junction with Qu'Appelle]. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/5 1799-1800)

- The river opened again on the 12th but ice continued to move downriver and the river was very shallow.
  October 16: they cannot Proceed any further [up] the River being shallow and a deal of Ice driveing in the River so that it has hurt the boats and their Legs very much. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/5 1799-1800)

- Little precipitation was reported in the upper Assiniboine, Brandon House or Red River until late in the month when rain and snow fell at most posts.
  October 19: heavy rain all day. (Carlton House [Assiniboine] Journal, HBCA B.28/a/5 1799-1800)

  October 24: rainy weather. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  October 24: it snowed and rained so very hard so that the Men at home could do nothing. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/5 1799-1800)

  October 24: rain in the morning and thick snow in the evening. (Carlton House [Assiniboine] Journal, HBCA B.28/a/5 1799-1800)

  October 25: Wind, Weather...as before. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  October 25: Rains most part of the Day. (A Journal of Transactions by Thos. Miller for the

Time Being at Red River, HBCA B.235/a/2 1799/1800)

- The weather must have been relatively mild since final freezeup of the Assiniboine wasn't completed until the third week of November.
  November 12: Wind N.E. sharp weather [Assiniboine] River full of driving Ice. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  November 13: Wind S...fine day...no Ice on the [Assiniboine] River. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  November 17: Wind N.W. blows fresh snowed all last Night [Assiniboine] river full of Ice. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  November 18: Wind N.W. sharp clear weather [Assiniboine] River nearly froze over. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  November 21: Sharp weather the [Red] River froze over. (A Journal of Transactions by Thos. Miller for the Time Being at Red River, HBCA B.235/a/2 1799/1800)

- Significant snowfalls occurred at Brandon House, Carlton House, Somerset House (Swan River), and Red River on November 23 and December 1 but the fall was judged to have been overall very mild (at Fort Pelly).
  November 30: It has been the mildest Weather this Month Past I ever seed in Hudsons Bay- which is the cause that they are no Buffalo come as yet. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/5 1799-1800)

- Temperatures through December and early January were both cold and mild alternately. Virtually no precipitation was reported at most of the posts until January 19 when "heavy snow [fell for] most part of the day" at Brandon House.

- Extraordinarily mild weather continued throughout February and March, removing what snow had fallen.
  February 22: Wind W very warm weather the Snow nearly off the paths very bad hauling. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  February 24: Wind and Weather as before...very bad hauling broke all their sleds no Snow being on the Plains & very little on the Plains. (Brandon House Journal, HBCA B.22/a/7 1799/00)

  February 28: this has been the mildest Winter here that ever was known it is Pleasanter weather here now than in the Summer. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/5 1799-1800)

  March 31: this winter, 1799-1800, we considered one of the most extraordinary known for many years. Early in November we had an extremely heavy fall of snow; but the rest of the season was open and mild [at Whitemeud]. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 4)

- The same winter weather pattern was reported at Somerset House on the upper Swan River (Somerset House Journal, HBCA B.204/a/1 1799-1800). The river began to freeze on October 6-7 but subsequent mild weather kept it navigeable until November 16. December and early January were described as mild with short cold

periods but the winter from January 13 to the end of the journal on March 30 was probably the warmest in the entire archival record. Of the 78 daily entries between January 13 and March 30, 57 were described as "mild", "warm", or "hot", 14 were neutral but the context suggests they were mild as well, and only 7 were described as "cold". By March 9, the journal reported "very little snow on the ground".

- Breakup of both the Assiniboine and Red Rivers began very early.

March 23: the [Assiniboine] River hardly fit to cross the Ice being so weak I expect in a few days it will break. (Brandon House Journal, HBCA B.22/a/7 1799/00)

March 24: ...Blows a gale the [Red] River open. (A Journal of Transactions by Thos. Miller for the Time Being at Red River, HBCA B.235/a/2 1799/1800)

March 27: three Men came from the boats who tells me the [Assiniboine] River is fast where the Boats is altho open in many Places here. (Fort Pelly [Indian Elbow] Journal, HBCA B.159/a/5 1799-1800)

March 30: [Assiniboine] River Ice very bad. (Brandon House Journal, HBCA B.22/a/7 1799/00)

- Virtually no precipitation had been reported for several months and shortly after breakup, water levels in the upper Assiniboine were reported to be low.

April 10: in the evening the Men returned from the Boats-who tells me that they cannot get them further up than my old Station at the Elbow- for want of water. (Fort Pelly [Indian Elbow] Journal [written at Swan River], HBCA B.159/a/5 1799-1800)

April 11: The Terre Blanche having been clear of ice for some time, I embarked in my canoe for portage la Prairie. Weather excessively hot...In a few days [after April 11] we experienced a dreadful snowstorm which continued with great violence for three days when there were three feet on the ground, but it did not remain long. (Brandon House Journal, HBCA B.22/a/7 1799/00)

April 15: Weather...as before...the Water in the [Assiniboine] River is very shoal. (Brandon House Journal, HBCA B.22/a/7 1799/00)

- Swan River received significant snow and rain throughout April, and rain and snow fell at Brandon House on several days in the last half of the month.

April 6: thicke snow all the remainder of the Day...Snow fell above 6 Inches. (Carlton House [Assiniboine] Journal [written at Swan River], HBCA B.28/a/5 1799-1800)

April 17: rain all day. (Carlton House [Assiniboine] Journal [written at Swan River], HBCA B.28/a/5 1799-1800)

April 18: thicke Snow all day. (Carlton House [Assiniboine] Journal [written at Swan River], HBCA B.28/a/5 1799-1800)

April 18: ...it rained very hard all last night with thunder and Lightning at noon it began to snow and drift. (Brandon House Journal, HBCA B.22/a/7 1799/00)

April 23: snowy weather. (Brandon House Journal, HBCA B.22/a/7 1799/00)

April 24: Thicke Snow... and Drift all these 24 Hours. (Carlton House [Assiniboine] Journal [written at Swan River], HBCA B.28/a/5 1799-1800)

April 24: snowed all last night. (Brandon House Journal, HBCA B.22/a/7 1799/00)

April 25: snowy weather. (Brandon House Journal, HBCA B.22/a/7 1799/00)

April 30: thicke Snow untille 3 pm. (Carlton House [Assiniboine] Journal [written at Swan River], HBCA B.28/a/5 1799-1800)

May 2: snowy weather. (Brandon House Journal, HBCA B.22/a/7 1799/00)

- Journal entries end for the season in early May with a further comment on the mildness of the winter.
  May 7: Wind S fine weather...the [Assiniboine] in general was starving all winter owing to the mildness of the season & no Cattle near us except old Bulls. (Brandon House Journal, HBCA B.22/a/7 1799/00)

- Reports from the Red River Valley indicate that the summer was also very dry there and water levels were very low.
  August 22: I am told the water [in the Red] is lower than has ever been known before. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis)

  August 28: The drought has been so great this season that there is scarcely any water in this little river [plum River] and the entrance is dry ground; this is thought extraordinary by those acquainted with the country. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 69)

1800-1801	High

- A freshet flood in the spring of 1801 and the conditions leading up to it are described in Part Three.

- Water levels remained high until late May at least.

- As the brigade returned in September, 1801, the level of the Assiniboine was described as "very good", in contrast to the shallow water which was more commonly encountered.
  September 9: ...water very good in the [Assiniboine River]. (Brandon House Journal, HBCA B.22/a/9 1801-02)

- Early September was wet.
  September 4: ...a Storm of Thunder etc. all day. (Brandon House Journal, HBCA B.22/a/9 1801-02)

  September 6: ...rain & Thunder. (Brandon House Journal, HBCA B.22/a/9 1801-02)

  September 8: ...hard rain the whole day and night. (Brandon House Journal, HBCA B.22/a/9 1801-02)

1801-1802	Normal

- There is little information about this year but what there is suggests runoff which was at least normal and possibly high.
- Fall and early winter, 1801, appears to have had abundant precipitation in both the Assiniboine and Red River basins; the Assiniboine froze at Brandon House on November 6 and the Red at Pembina froze on November 7.

October 6: a great fall of snow. (Brandon House Journal, HBCA B.22/a/9 1801-02)

November 1: Snow fell about six inches in depth. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 190)

November 4: a dreadful day of snow. (Brandon House Journal, HBCA B.22/a/9 1801-02)

November 6: [Assiniboine] river froze over. (Brandon House Journal, HBCA B.22/a/9 1801-02)

November 15: Heavy rain, which melted all the snow. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 190)

November 17: we had a great fall of snow last night. (Brandon House Journal, HBCA B.22/a/9 1801-02)

November 24: Snow continued [from November 22-24]. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 191)

December 4: Snow all day. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 192)

- Only scattered comments are available from December, January and February but they suggest cold weather in both the Red and Assiniboine basins and heavy snow in the Red at least.

December 15: Weather extreem cold the whole day [between Brandon House and Turtle Mountain]. (Brandon House Journal, HBCA B.22/a/9 1801-02)

December 25: Snowed all day. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 192)

January 8: Extreem cold weather. (Brandon House Journal, HBCA B.22/a/9 1801-02)

February 15: Very severe weather. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 193)

February 19: weather very bad. (Brandon House Journal, HBCA B.22/a/9 1801-02)

February 28: The cold is very severe; snow deep and no grass. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 194)

March 30: Continual snowstorm. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 193)

- Breakup of both the Assiniboine and Red occurred between April 19-24.
  April 19: Red River [at Pembina] began to give away, and the ice moved; snow all melted on the plains. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 195)

  April 23: [Red] River [at Pembina] clear of ice. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 195)

  April 24: the Ice on the [Assiniboine] River gave way yesterday & is now nearly clear opposite the house. (Brandon House Journal, HBCA B.22/a/9 1801-02)

- Considerable precipitation fell in the first half of May.
  May 4: Last night dreadful thunder & rain. (Brandon House Journal, HBCA B.22/a/9 1801-02)

  May 5: Heavy rain; some snow. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 195)

  May 6: Snow all day. (Brandon House Journal, HBCA B.22/a/9 1801-02)

  May 8: Rain all day. (Brandon House Journal, HBCA B.22/a/9 1801-02)

- There is no information on the water level in the Assiniboine but the Red was high on May 9.
  May 9: It required 90 fathoms of net to cross the river as the water is high, and the strong current forms a great bend. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 197)

  May 11: nine inches of snow. Water falling it had risen almost as high as last year. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 197)

- No further information is available for either basin in this water-year except for a single entry in September when the Brandon House Journal recorded "heavy rain" on September 13.

1802-1803	Insufficient Data

- Virtually no information is available for this water-year, except that the Assiniboine froze on October 30 at Brandon House.

- Conditions in the Red River basin are summarized in Rannie (1999). Heavy snow fell during the winter, spring arrived early and high water occurred on the Red at Pembina in late March, and the prairies were very wet.
  March 27: The plains are covered with water from the melting of the snow so suddenly...The water is commonly knee deep, in some places up to the middle... (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and

Haines Inc., Minneapolis, p. 210)

- The plains between Pembina and Portage la Prairie were very wet in late May.
  May 24: Set off for Portage la Prairie... We found much water in the plains... mosquitoes by the millions. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 212)

  May 31: ... there was too much water on the plains for our horses to proceed [between Riviere aux Gratias (Morris River) and Pembina River. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 213)

- If these conditions are at all representative of those in the Assiniboine basin, it is likely that water levels there were at least normal and possibly high but there is no direct evidence of this.

1803-1804	Low

- Very little information is available from the Assiniboine posts but from what there is and from the conditions in the Red River Valley, it is concluded that the winter and spring were very dry.

- In October and early November, abundant snow and rain fell at Pembina on October 17, November 2, 6, 7. The Red River froze at Pembina on November 8 and ice was forming in the Assiniboine upstream of Brandon House on November 9.
  November 9: the River Driving full of ice. (Brandon House Journal, HBCA B.22/a/11 1803-04)

- The Assiniboine basin seems not to have received as much snow as the Red and even near Pembina, the snow cover seems to have substantially disappeared by late December.
  December 1: ...its surprising no snow will fall which prevents the Cattle from coming nigh this place. (Brandon House Journal, HBCA B.22/a/11 1803-04)

  December 30: There was not enough snow for a train. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 233)

- There is no information from the Assiniboine basin during the entire winter and early spring but at Pembina, severe cold was reported through January. Very little snow seems to have fallen and net accumulation was even smaller because of the removal of the grass cover by fires the previous fall.
  February 6: The grass has been burned here the same as all over the plains of Red River; what little snow falls is instantly drifted off, and the bare ground is so much exposed to the frosts that the earth has cracked in a surprising manner. We met with crevices in the portage half a foot wide, and some few near a foot. The ground is so dry that our dogs and cariole raised a thick dust. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 238)

- Considerable falls of snow occurred near Pembina on February 12 and 26. Temperatures must have moderated considerably as the snowcover had disappeared by March 19-21 in the Red River Valley and the Red River was breaking up before the end of the month (it became clear on April 4)

  March 19: I set off at dusk for Riviere aux Marais- a tedious trip; no frost but much water on the plains, and dogs of no use. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 239)

  March 21: Snow entirely melted. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 239)

- The only weather references from the Brandon House Journal for May-August are three widely-spaced reports of severe storms on May 5, July 5, and August 8.

- The period 1803-05 has been identified by Kemp (1982) as one of severe and very widespread drought over an area from the Missouri River eastward to Lake Nipigon. He suggested that these conditions may have been caused by persistent high pressure over the region which diverted low pressure systems northward of their normal path.

  Kemp, D.D., 1982. The drought of 1804-1805 in central North America. Weather, v. 37 (2), 34-41.

- Reports of Assiniboine water levels in the fall were somewhat contradictory but imply reasonable water depth in some reaches.

  October 4: plenty of water [above Brandon]...men started for Elbow [upper Assiniboine], I kept twelve parcels back, as the water here is too shoal. I mean to send them as far as the Rapid River by Horses, where they will find better water. (Brandon House Journal, HBCA B.22/a/12 1804-05)

- Despite the lack of direct evidence from the Assiniboine basin, the drought region reported by Kemp was so broad and contiguous to the Assiniboine basin (including the Red River basin) that it is a reasonable assumption that the Assiniboine experienced it as well.

1804-1805	Very Low

- Although "plenty of water" was reported in the Assiniboine above Brandon on October 4, low water elsewhere was preventing canoes from proceeding upriver (see above).

- The Assiniboine was virtually frozen over at Brandon House on November 13 but reopened a week later.

  November 13: the [Assiniboine] River being nigh froze over, we had a Deal of trouble to cross the Horses. (Brandon House Journal, HBCA B.22/a/12 1804-05)

  November 20: the River opposite the house is open. (Brandon House Journal, HBCA

B.22/a/12 1804-05)

- There is no further information about either the Assiniboine or Red Rivers until June, 1805, when Harmon confirmed that the severe drought of the previous year had continued.

June 1: The [Assiniboine] River at present being so low (as we have not had a drop of Rain since last autumn) [near Pine Fort]. (D.W.Harmon in Lamb, W.K. , ed., 1957. Sixteen Years in the Indian Country: The Journal of Daniel Williams Harmon, 1800-1818. The MacMillan Company of Canada, Toronto, p. 90)

October 10: ...the [potato] crop has failed owing to the excessive heat, which scorched everything early in the season. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 267)

- Heavy rain was reported by Larocque along the Souris River from June 5-9 and must have been widespread because it produced high water in the Souris and other smaller streams.

June 5: At 12 it began to rain and continued hard and uninterruptedly until next morning [on the Souris River]. (Larocque's Journal in Burpee L.J., ed., 1910. Journal of Larocque from the Assiniboine to the Yellowstone, 1805. Publications of the Canadian Archives No. 3, Government Printing Bureau, Ottawa, p. 13)

June 6: ...the rain began again, and fell amasingly hard so that in a few hours every hollows or valley in the plains were full of water and every brook or creek was swellen to rivers...At night the rain began again and continued without intermission until morning [on Souris River]. (Larocque's Journal in Burpee L.J., ed., 1910. Journal of Larocque from the Assiniboine to the Yellowstone, 1805. Publications of the Canadian Archives No. 3, Government Printing Bureau, Ottawa, p. 13)

June 7: the weather continued cloudy, but the appearing now and then we hoped for fair weather...but as yesterday it began to rain at 12 [on Souris River]. (Larocque's Journal in Burpee L.J., ed., 1910. Journal of Larocque from the Assiniboine to the Yellowstone, 1805. Publications of the Canadian Archives No. 3, Government Printing Bureau, Ottawa, p. 13)

June 9: The water being amazingly high we made a raft to cross our things over the River [the Souris at its most southerly point nearest the Missouri]. (Larocque's Journal in Burpee L.J., ed., 1910. Journal of Larocque from the Assiniboine to the Yellowstone, 1805. Publications of the Canadian Archives No. 3, Government Printing Bureau, Ottawa, p. 13)

- This may have begun the end of the drought since heavy rainfall was also reported at Brandon House later in the month.

June 19: last night it blowed so hard with rain that all the West Stockades of the Garden fell down. (Brandon House Journal, HBCA B.22/a/13 1805-06)

June 24: rain most part of the day. (Brandon House Journal, HBCA B.22/a/13 1805-06)

June 25: rain all day and a Hurrican at night. (Brandon House Journal, HBCA B.22/a/13 1805-06)

- Despite the rain in June and high water report on the Souris, Harmon's comment on June 1 clearly indicates that the severe drought conditions of 1803-04 had continued through the winter and spring runoff period and the summer was probably also dry. This is supported by the shallow condition of the Assiniboine in late

September.

September 25: the [Assiniboine] water is so shoal and the boats so worn out by hard Launching that the men really thinks they will not arrive at this House. (Brandon House Journal, HBCA B.22/a/13 1805-06)

1805-1806	High

- No direct information is available for this water-year from the Assiniboine basin, which is unfortunate because an exceptionally wet summer in the Red River basin produced minor summer flooding at Pembina. This event is discussed in Rannie (1999) but is worth summarizing here as well because of its unusual nature.

- Alexander Henry's account at Pembina suggests that the winter and early spring were cold and snowy, particularly in March and April.

March 17: All my people laid up snowblind with sore eyes occasioned by the continual storms and drifts. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 274)

April 13: Dreadful snowstorms. (Alexander Henry in Coues, I. ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 275)

May 1: Great banks of snow still lying on the edge of the woods. This certainly has been the most extraordinarily cold and stormy weather I have experienced on Red River.(Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 275)

May 4: A deluge of rain; our stores flooded and the property damaged. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 275)

- It is assumed that the Red was high during the freshet and it continued to rise throughout much of the summer because of a extraordinary rainfall.

June 26: Water extraordinarily high [on Red River] and continued storms which breed an incredible number of mosquitoes. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 281)

July 7: The travelling was tedious from the heavy rains which made ugly and laborious walking for our horses...In many places we found several feet of water; every little hollow formed a pond, and every rivulet appeared like a river. Our horses often sunk up to their bellies...The water [in the Red River] was very high...They attempted to go there [to the east side of the red] but found the country almost entirely overflowed...[travelling northward from Pembina]. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 285-86)

August 8: This summer's extraordinary rain, having overflowed the low country, has caused the buffalo to resort to the high lands southward. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 420)

August 14: We found a great quantity of water, and for a long distance our horses had it up to our bellies...This road used to be firm and good but the continued rain of the summer has altered the face of almost everything, and there is now mud and water knee deep [between Pembina Escarpment and Pembina post]. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p. 421)

- The only indication that the Assiniboine basin may have shared in these conditions is a comment 14 years later by Peter Fidler in his journal entry for May 16, 1820.
  May 16, 1820: found the East end of our House [at Fort Dauphin] 4 feet deep 9½ inches higher than the water in the Lake-the Summer of 1806 it was all covered with water" (HBCA B.51/a/2 1819/1820)

- Fort Dauphin and Dauphin Lake were not in the Assiniboine basin but were close and would reflect conditions in the Riding and Duck Mountains. That he remembered this event 14 years later and chose to mention it suggests that it was also a wet summer in the vicinity of the upper Assiniboine at least.

- Thus, despite the lack of direct evidence, it seems likely that runoff in the Assiniboine basin was high in this water year.

1806-1807	Insufficient Data

- It is presumed that the moisture status of the basin in the fall of 1806 was high.

- Freezeup of the Assiniboine at Brandon House began by October 29 but was not completed until November 20.
  October 29: Ice driving in the River. (Brandon House Journal, HBCA B.22/a/14 1806-07)

  November 20: the River froze entirely over last Night. (Brandon House Journal, HBCA B.22/a/14 1806-07)

- Only 3 scattered references from Brandon House are available during the winter.
  November 27: clear cold weather. (Brandon House Journal, HBCA B.22/a/14 1806-07)

  December 4: very heavy snow last Night and to day. (Brandon House Journal, HBCA B.22/a/14 1806-07)

  February 28: blows a Violent gale of Wind with very heavy snow all day. (Brandon House Journal, HBCA B.22/a/14 1806-07)

- Spring and the breakup of the Assiniboine were late in 1807.
  April 2: No appearance as yet of Spring. (Brandon House Journal, HBCA B.22/a/14 1806-07)

  April 30: the River broke up. (Brandon House Journal, HBCA B.22/a/14 1806-07)

- The only other comment from Brandon House was that heavy rain fell on May 13.
  May 13: heavy rain all day. (Brandon House Journal, HBCA B.22/a/14 1806-07)

- There is no additional information from the Red River basin.

- It is probable that runoff was at least normal but the data are not sufficient to reach this conclusion with confidence.

1807-1808	Normal

- Winter conditions arrived in early November. The Assiniboine at Brandon House and the Swan River froze on November 8 and at Pembina, a heavy snow fell and the Red froze there on November 12.

- No information is available for either the Red or Assiniboine until April. However, Peter Fidler's meteorological record at Swan River indicates abundant snowfall there (November - 11.6 inches, December - 5.85 inches, January - 5.85 inches). No measurements are given for February but "thick" snowfall was reported on 2 days and on February 25, Fidler reported "Snow on the ground 15.8" on a level". (Meteorological Journal at the Lower Crossing Place [Swan River] 1807-1808, HBCA E.3/5 mfm4M103). Particularly heavy snowfalls occurred in late March and early April:

March 21: rain + 3/4 inches snow	March 28: 4 inches
March 22-23: 5 inches snow	April 1: 5 inches
March 26: 3 inches snow	April 9: 6 inches

- Breakup of both rivers occurred in early April.

April 7: the [Assiniboine] ice being very weak. (Brandon House Journal, HBCA B.22/a/15 1807-08)

April 8: Snow entirely gone [in vicinity of Pembina]. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p.429)

April 9: The [Red] river broke up. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p.429)

April 11: [Red] River clear of ice. (Alexander Henry in Coues, I., ed, 1965. Manuscript Journals of Alexander Henry and of David Thompson. Ross and Haines Inc., Minneapolis, p.429)

- In late April and May, Fidler canoed almost the entire length of the Assiniboine from Carlton House to the Forks. The weather was generally cold, with snow on the 21st.

May 21: Snow fell in the night 4 inches & lay on the ground till noon before it melted away. (Journal of a Journey from Swan to the Red River [Assiniboine] and down it in a canoe from the Elbow to...Lake Winnipeg, HBCA E.3/5 p. 23d-33, mfm 4M103)

- Fidler's account is exceptionally detailed in its descriptions of phenomena along the river but makes no mention of water levels. Virtually all comments on the current, however, described it as strong and the absence of reported difficulties suggests that the river was within the normal range.

- Little information is available for the rest of the water-year and none of it comes from

the Assiniboine basin. Very low water levels were described for the Eau Claire River in Minnesota in May, the weather was excessively hot in Red River in June, and the Red River between Pembina, and the Forks was very low in September (Rannie, 1999).

- It is concluded that despite the evidently dry summer, overall runoff during the water-year was probably normal because of the (probably) normal spring level.

1808-1809	Insufficient Data

- The only references to weather in the Assiniboine basin were to "much snow" on October 22 at Brandon House and lack of snow on April 10.
  April 10: [Thomas Thorn] not...able to get the least thing hauled home for want of snow. (Brandon House Journal, HBCA B.22/a/16 1808-09)

- In 1820, Peter Fidler remembered the winter of 1808-09 as being cold.
  The winter 1808-1809 the Ice [on Dauphin Lake] was very thick. (Report of the Manitoba District, 1820, by Peter Fidler at Fort Dauphin, HBCA B.51/e/1)

- Little additional information is available from the Red River basin other than that at Pembina, heavy snow fell on December 16 and January 22, late March was cold, and the Red broke up on April 14-16.

1809-1810	High

- Very high water on the Assiniboine at Brandon House in April and on the Souris in late May and early June are described in PART THREE above.

1810-1811	Normal

- Few comments are available directly describing weather in the Assiniboine basin.
  November 3: the [Assiniboine] river setting fast with Ice above. (Journal of Brandon House, Red River, kept by Wm. Yorstone, Selkirk Papers, vol. 62, p. 16516)

  November 3: Ice driving Continually. (Brandon House Journal, HBCA B.22/a/18a 1810/11)

- Snow fell all day at Brandon House on December 14, 1810, and it rained "continually" on April 29 and May 16 of 1811. (Brandon House Journal, HBCA B.22/a/18a 1810/11)

- These comments by themselves are insufficient to characterize runoff but better information is provided in two letters, written in the fall of 1811, which describe a very large flood on the Red River that spring.

An extraordinary inundation occurred this spring on the South or Pembina branch of the Red River, which overflowed its banks the extent of 4 miles on each side the river into the Country while the Northern branch [Assiniboine] was not more swollen than usual. This flood was occasioned by the melting of snows which fell last winter towards the source of that uncommonly great. Such a circumstance has not been before in the memory of the oldest Indian, & perhaps may happen again. (Letter, Miles MacDonnell [York Factory] to Lord Selkirk, October 1, 1811, [Note F] Sessional Papers [No. 12], British House of Commons, p. CXCV)

You will learn with great mortification that the S. Branch or proper Red River was so overflowed that Mr. Henry's House in the Pabina was under water for 28 days the bed of the River generally 5 feet deep was increased to 55 & the Country on both sides deluged forming a Lake thro' its whole Course of about 8 miles instead of being only 100 & oftener only 50 yards in breadth. (Letter, William Auld to A. Wedderburner, York Fort, October 5, 1811, Selkirk Papers, vol. 1, p. 86-87)

- Despite the very severe conditions which occurred in the Red River basin, both letters are clear that the Assiniboine was not involved and MacDonell's letter states explicitly that the Assiniboine (Northern branch) "was not more swollen than usual".

1811-1812	High

- Very high discharge from the Souris basin in late May and possible flooding of the lower Assiniboine in early June were described in PART THREE above.

- No further information is available until fall when the Red River at least was described as having been high for some time previous at Pembina.
  October 6: no post down there [near the mouth of the Red River] is perfectly able to support itself unless they have an opportunity of catching a great number of fish in the fall-which the very high water of this year forbids me to expect. (Pembina Journal of Occurrences, HBCA B.160/a/4 1812/13)

1812-1813	Normal

- The Red River froze at Fort Daer (Pembina) on November 5-6 and the Assiniboine on November 8.
  November 8: they left the Boats at Portage la Prairie being there set in with Ice. (Ellice (Qu'Appelle) Journal, HBCA B.63/a/2 1812/13)

- By November 10, however, the Ellice (Qu'Appelle) Journal reported that the weather had been "remarkable fine...for this time of the season".

- No further information is available until spring at Fort Daer. The Red River there opened on April 9-10 and was rising on April 15.
  April 15: The water in the [Red] river keeps rising much ice drifting. (Journal No. 2 of Miles McDonell, Fort Daer, Selkirk Papers, vol. 62, pp.16813-16816.

- The only comment from the spring in the Assiniboine basin refers to abundant rain

in May but contains no information on the river.
May 5: Arrived at Brandon House at 10 A.M. after having experienced a very bad Journey since our departure from River Qu'Appelle continually raining. (Qu'Appelle Journal, HBCA B.63/a/2 1812/13)

- From the absence of commentary on river levels, it is inferred that they were within the normal range.

1813-1814	Insufficient Data

- Freezeup of the Red River at Fort Daer occurred on November 8.

- According to Bryce (1909), very heavy snows fell in the winter of 1813-1814 in the Red River Valley (Bryce, Dr. G., 1909. The Romantic Settlement of Lord Selkirk's Colonists. Barse and Hopkins, N.Y.)

- The Red River at Fort Daer broke up on April 23 but no information about the level of either river is available until August when Peter Fidler reported that the Red River was rising.
August 13: Water rising fast in the [Red] river these 4 days from rains in the Upper Country. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

- Rain must also have been abundant in September in the upper Red basin since Fidler reported the Red to be rising in early October. Fidler's journal reports heavy rain on several days from August 31 to September 28 but probably not in amounts which would be sufficient to produce a rise in the Red so rainfall must have been greater in the southern Red River basin.
October 6: water rising [in the Red] very fast these 5 Days. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

- There is too little evidence to draw a conclusion for this water year but it is likely that runoff was within the normal range, especially if the Assiniboine basin received the apparently significant late-summer rainfall which produced a rise in the Red.

1814-1815	High

- Peter Fidler's meteorological record at Brandon House indicates that the winter of 1814-1815 was remarkably mild throughout. The first significant snow occurred on November 15 (7 ½ inches). Smaller amounts fell on several days in late November and December, and then on many days in January, February and March. By March 12, Fidler commented on the depth of snow.
March 12: Snow on the level in the woods 24 Inches being deeper than usual. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

- A further 8 inches (20 cm) fell between March 12 and March 31.

- Thawing conditions began in early April. The Assiniboine began to break on April 21 but ice was still "driving" on the 28th.

  April 13: Showers of snow; The tops of the knolls beginning to be bare of Snow. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

  April 15: water on the river Ice. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

  April 21: Ice moving a little in the river. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

- Fidler reported 9 inches of new snowfall in the last week of April and another 9 inches on May 1 and 2.

  May 2: 6 ½ Inches of snow...never so bad weather seen for a continuance {(for the last 4 days). This has been a backward spring - & the winter rather milder than in general. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

- Fidler left Brandon House on May 15 and met flooding on the Red River when he arrived at the Forks. His comments indicate, however, that the Assiniboine was "lower than usual".

  May 19: Water remarkably high in Red River overflowing its banks to a considerable distance, the water at Fort Daer rose to within 4 inches of the Upper part of the Door within the fort. The water rather lower than usual on the North Branch [Assiniboine] and damed up above the forks above 10 miles, tho' the river has a considerable descent, very deep snow in Red River this winter & most all the Horses died in consequence. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

  May 26: The water is very high in the Red River and has not yet begun to abate it is about 10 feet below the bank at the settlement on the N. side, but into the woods on the other side. Water so high that very few fish is caught. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

- Fidler's comment that the Assiniboine was "lower than usual" is in contrast with the observation by Colin Robertson later in the year which suggests that the Assiniboine was overbank in the spring of 1815.

  November 11, 1815: The Grande Marie [at Portage la Prairie] is a beautiful part of the country. The Marie or rather Lake encircles a considerable point of land covered with Oak, Elm and Maple, when the water rises this Lake overflows and forms swamps in the low meadows which appears to have been the case last spring. (Colin Robertson's Diary, at Fort Douglas, HBCA E/10/1)

- This apparent discrepancy may be explained in two ways: first, Fidler's May 19 comment suggests that the Assiniboine was "damed" by an ice jam 10 miles upstream of the Forks. Ice jams were not uncommon on the lower reach of the Assiniboine below Portage la Prairie prior to artificial straightening in this century. Second, the flood peak was very late in the Red; even large floods such as in 1950, 1979, and 1997 have begun to fall long before the time period reported by Fidler. The following comments indicate how late spring was.

  June 4: the water [in the Red] falling fast daily-very few leaves have yet made their appearance. Indians arrived from lake Winnipeg say it is fast yet except a little water along the shore. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

  June 10: ...water falling about 5 inches perpendicular daily. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

The very "backward" spring with heavy snow at Brandon House at the end of April, the long travel time for melt from the upper Assiniboine make it possible that the peak flow had not yet reached Red River until after Fidler's May 19 comment and any subsequent rise in the level of the Assiniboine would be masked by backwater from the Red (which appears to have been high into June).

- Considerable rain fell at Brandon House and Red River in late May and early June.
  May 22: rain all night. (Brandon House Journal, HBCA B.22/a/19 1815/16)

  May 25: Thunder Lightening & rain. (Brandon House Journal, HBCA B.22/a/19 1815/16)

  May 30: Rain fell these two days. (Brandon House Journal, HBCA B.22/a/19 1815/16)

  May 31: Rain nearly all day. (Peter Fidler's Journal, HBCA B.235/a/3 1814/15)

  June 3: Showers, thund. & Lightning. (Brandon House Journal, HBCA B.22/a/19 1815/16)

- There is virtually no mention of rain in the Brandon House Journal for the rest of June, July, August or September and it is concluded that the summer was very dry. By late August the level of the Assiniboine was low.
  August 29: Mr. McKay sent off his boat for Brandon with half a Cargo on account of the shallowness of the Assiniboine River. (Colin Robertson's Diary, at Fort Douglas, HBCA E/10/1)

- The balance of evidence suggests that overall runoff during the water-year was high.

1815-1816	Low

- The Red River at Fort Daer (Pembina) was unusually low in early October.
  October 8: The weather remarkably fine...I am afraid the Rafters will have some difficulty on account of the lowness of the water [on the Red]. (Colin Robertson's Diary at Fort Douglas, Vol. III [1815], HBCA E/10/1)

- Snow and rain fell in late October at Brandon House and Red River. The Assiniboine at Red River began to freeze November 7 and was fast at Brandon House on November 10; the Red River at Red River froze November 9.

- After cold weather in the first week, November was mild in the Red River Valley with thawing toward the end of the month. The snow cover was modest near Red River but deeper westward toward Brandon House.
  December 1: Snow on the Ground about 3 Inches deep [near Red River Settlement]. (Peter Fidler at Red River Settlement in Brandon House Journal, HBCA B.22/a/19 1815/16)

  December 2: Snow till noon then cleared up [between Red River and Brandon House]. (Peter Fidler in Brandon House Journal, HBCA B.22/a/19 1815/16)

  December 3: Snow and Drift till 10 A.M....the Snow is pretty deep here which makes it hard walking without Snowshoes [between Red River and Brandon House]. (Peter Fidler in

Brandon House Journal, HBCA B.22/a/19 1815/16)

- The weather at Brandon House and Red River alternated cold and mild in December and little snow fell. January was exceptionally mild throughout with little snow until January 23 when it "snowed all day" (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1).

December 30: ...the softness of the weather and want of snow is very alarming. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

January 8: The weather uncommonly fine, our Cattle are feeding on the plains the same as in the fall of the year. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

January 17: The mildness of the season is really astonishing, the Therm. was 10 above the Cypher at mid-day in the shade. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

- Little information exists for February (apart from snow at Brandon House February 4-9) and for most of March. On March 23, the Brandon House Journal reported that snow depth on the plains was 12.7 inches deep but at Red River, Colin Robertson reported "the snow has almost left us". By the end of March a strong thaw had set in at both Brandon House and Red River.

March 28: Creeks running & snow nearly all gone. (Brandon House Journal, HBCA B.22/a/19 1815/16)

March 29: the walking is certainly bad, as the plains in many places must be covered with Water, from the melting of the snow. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

March 30: very little snow left on the Ground, only in low places & in the thickets. (Brandon House Journal, HBCA B.22/a/19 1815/16)

- The Assiniboine and Red Rivers opened April 15-23 and the water level of the Assiniboine at Red River Settlement was apparently low.

April 22: Ice a good deal drove by. (Brandon House Journal, HBCA B.22/a/19 1815/16)

April 22: The [Red] River entirely clear of Ice, but the Assiniboine is still fast, this is owing to the want of water to raise the ice from its old bank...The Ice moved on the Assiniboine River this afternoon. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

April 24: I am informed that there is still some Ice in the Assiniboine, had there been the usual quantity of snow this winter the rivers would have been clear by the 10th of this month. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

- Reports of low water in the Assiniboine continued into May and June.

May 9: On Monday we started from the House [Qu'Appelle] and owing to the shallowness of the [Qu'Appelle] river... (from a letter in the Brandon House Journal, HBCA B.22/a/19 1815/16)

May 29: The weather warm we had little or no rain this spring which makes the Rivers very low in this quarter. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

May 30: The weather exceedingly warm, the ground almost parched up. (Colin Robertson's Diary, at Fort Gibralter, Vol. III (1815-1816, HBCA E/10/1)

June 9: water shoal in the Assiniboyne river. (Brandon House Journal, HBCA B.22/a/19 1815/16)

- No further information exists for this water-year. Despite the slender information base, there seems little doubt that overall runoff was low.

1816-1817	Low

- No information is available from either the Assiniboine or Red River basin for the fall of 1816 and the only comments during the winter refer to a heavy snowfall in the Red River Valley in early January.

- Breakup of the Red occurred in mid-April; no information exists about spring runoff conditions on either river.

- The levels of both rivers were low in the summer which appears to have been very dry despite references to several heavy falls of rain.

July 12: water very low in the [Red] river. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

July 20: heavy rain- water remarkably low in the [Red] river- & the Crops exceedingly backwards- some potatoes only 4 inches aboveground. The Grass is also remarkably short & ground dry- all the little runs of water now Dry-so there is every reason to expect a bad Crop on account of the Great want of rain-The season has been colder than usual. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

July 21: heavy rain. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

July 25: at night very heavy Thunder & Lightning rain & Wind... near 6 Inches water in the yard in places. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

July 30: Water very low in the [Red] River. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

August 3: Rain most part of the Day. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

August 6: passed Sturgeon river we keep the Track nearest the [Assiniboine] river on account of water, as we are afraid there is none in the outer Track, the Spring & Summer being so very dry...Heavy rain from the time we left the Fort to the Crossing Place afterwards clear & cold [travelling from Red River Settlement to Brandon House]. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

August 8: proceeded to Muskrat creek... it runs into Mannitobaw Lake, but very little water in it now. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

August 9: went...to the Stinking water, small saltish Lakes, many of them now Dry. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

August 12: water very low here [at Brandon House] and the French Garden every bit as backward as those at the Forks, all for want of rain. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

August 24: The water [in the Assiniboine] has rose about 2 Inches since we passed here [near White Horse Plain] going up - very cool weather for the season & a very sharp frost 17th Inst. at Brandon which killed there all the Potato Tops. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

August 30: Very heavy rain & Thunder in the afternoon. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

September 1: Rain last night. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

September 7: paid off the Freemen for Carrying provisions down here from Brandon House and to carry up there- as very little water is in the [Assiniboine] river. (Peter Fidler at Red River Settlement, in Brandon House Journal, HBCA B.22/a/20 1817-18)

September 27: [the hay] is very short to what it [usually] is owing to the Dryness of the summer. (Brandon House Journal, HBCA B.22/a/20 1817-1818)

- Although the summer was dry (notwithstanding the frequent references to rain) and water levels low, the absence of any information from the spring freshet makes it difficult to estimate runoff during the entire water-year. However comments in 1818 (see below) suggest that it was low.

1817-1818	Low

- Cold weather with snow began at Hibernia on the upper Assiniboine on October 13 (Hibernia Journal, HBCA B.159/a/6 1817-18) and the Assiniboine at Brandon House froze very early on October 23 (Brandon House Journal, HBCA B.22/a/20 1817-18).

- Considerable additional snow fell at Hibernia in the last week of October and the weather remained very cold until early November when warm weather removed most of the snow cover.

November 2: All the Snow which fell sometime ago nearly melted away. (Brandon House Journal, HBCA B.22/a/20 1817-18)

November 3: very warm weather very little snow left on the Ground which before fell deep. (Brandon House Journal, HBCA B.22/a/20 1817-18)

November 9: very warm weather these many days past like summer, not a bit of Snow left- but the Ice in the [Assiniboine] river still keeps firm. (Brandon House Journal, HBCA B.22/a/20 1817-18)

- Cold and mild periods alternated for the rest of November and on the 30th, the Assiniboine river ice at Brandon House was "covered with water" (Brandon House

Journal, HBCA B.22/a/20 1817-18)

- Considerable snow was reported in December at both Brandon House and Hibernia. Much of this melted under mild weather in late December.

December 6: ...snowing all day the snow is about 12 Inches deep. (Hibernia Journal, HBCA B.159/a/6 1817-18)

December 15: Warm day, strong wind at West with thick snow in the afternoon...Near 1 foot of Snow fell when our men got half way back. (Brandon House Journal, HBCA B.22/a/20 1817-18)

December 18: ...snowing & cloudy all day. (Hibernia Journal, HBCA B.159/a/6 1817-18)

December 22: ...snowing all day. (Hibernia Journal, HBCA B.159/a/6 1817-18)

January 4: very warm weather since Christmas & little snow on the Ground. (Hibernia Journal, HBCA B.159/a/6 1817-18)

- January was generally severely cold, with little new snow reported. On the 18th, the Brandon House Journal commented on the dryness of the 1816 and 1817 summers.

January 18: These two last winters have been particularly severe and the Summers short, cold & little rain the crops not ripening as usual. (Brandon House Journal, HBCA B.22/a/20 1817-18)

- Very cold weather continued through February. Some snow was reported but not in large amounts.

- A sudden thaw on March 8-10 removed most of the snow cover at Brandon House and thawing conditions were also reported at Hibernia. The March 9 comment, however, indicates greater snow cover to the south of Brandon House in part of the Souris basin.

March 9: Thawed much the plains almost entirely bare of Snow heavy rain this afternoon-Snow on the Ground on the level this winter 7 Days ago only 6 3/4 inches which is the least I have ever observed these 30 years past. The Ind. Say it is deep ½ way between this & the Mandan villages [on the Missouri River]...could not hawl any firewood for want of Snow. (Brandon House Journal, HBCA B.22/a/20 1817-18)

March 10: Very thawy weather so soon in the season-ground almost all clear of Snow except in Deep Creek & the Woods...in the evening Snow fell 1 ½ Inches & froze hard-Much water on the [Assiniboine] River Ice. (Brandon House Journal, HBCA B.22/a/20 1817-18)

March 31: ...light Showers of Rain the snow now begins to disappear fast but the lakes & Rivers are quite solid as yet. (Hibernia Journal, HBCA B.159/a/6 1817-18)

April 1: the Ground being nearly clear of snow...Ice broke up in Red River at Fort Daer [Pembina] being very early in the season [report from a man just arrived from Forks]. (Brandon House Journal, HBCA B.22/a/20 1817-18)

April 2: the snow is mostly thawed Weather cloudy & warm. (Hibernia Journal, HBCA B.159/a/6 1817-18)

April 5: Most all the snow gone. (Brandon House Journal, HBCA B.22/a/20 1817-18)

April 5: tripping with Dogs is entirely over for the season. (Hibernia Journal, HBCA B.159/a/6 1817-18)

April 8: [a man] could not proceed to Red Lake to Trade Sugar as the Snow was off the Ground. (Brandon House Journal, HBCA B.22/a/20 1817-18)

- Spring was very early from Hibernia to Red River.

April 9: The Frogs begin to croak-much water on the river ice. (Brandon House Journal, HBCA B.22/a/20 1817-18)

April 10: The Red River was open upon the 10th of April... (Letter, A. MacDonnell to Lord Selkirk, dated at Fort Douglas, July 20, 1818, in Selkirk Papers, vol. 15, p. 5192, PAM 175)

April 11: water [in the Assiniboine] very low & no Snow. (Brandon House Journal, HBCA B.22/a/20 1817-18)

April 12: Weather remarkably warm. The [Assiniboine] River is almost navigeable as the greatest part of the Ice has disappeared. (Hibernia Journal, HBCA B.159/a/6 1817-18)

April 12: a very hot day & strong wind at South. Ice in [the Assiniboine] river moved a little being about a week sooner than usual. (Brandon House Journal, HBCA B.22/a/20 1817-18)

- The Assiniboine at Brandon House broke April 17-18. The river was rising prior to April 18 but falling by the 24th.

April 18: Ice driving [in the Assiniboine]...Water rose about 2 feet perpendicular this last week. (Brandon House Journal, HBCA B.22/a/20 1817-18)

April 21: Much Ice driving down the [Assiniboine] River & many drowned buffalo. (Brandon House Journal, HBCA B.22/a/20 1817-18)

April 24:Cold weather & the water falling fast. (Brandon House Journal, HBCA B.22/a/20 1817-18)

April 27: Water falling off 3 Inches daily. (Brandon House Journal, HBCA B.22/a/20 1817-18)

- From May 1 onward, reports of low water in the Assiniboine and other streams become common.

May 1: a man arrived from the Boats informing us that they could not proceed on as the [Assiniboine] River is remarkably Shoald...Weather cloudy and still very cold. (Hibernia Journal, HBCA B.159/a/6 1817-18)

May 5: water very shoal in the Rapid river. (Brandon House Journal, HBCA B.22/a/20 1817-18)

May 7: water falling regularly now about 1 inch daily. (Brandon House Journal, HBCA B.22/a/20 1817-18)

May 18: these 2 last years the [Assiniboine] river has been very shoal...(Brandon House Journal, HBCA B.22/a/20 1817-18)

May 26: Sutherland & Finlay arrived from...the Elbow of this River ...they have been long on the passage owing to the shoalness of the water...The Beaver Creek Batteaux will have great difficulty in reaching this, being so long before they started that the water falls off rapidly daily; since the Ice Drove by about 5 Weeks ago... (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

May 27: The Swan river Boats arrived...considerably injured by the Shoalness of the water...The NW Batteaux all left this a week ago for the Forks. They have left at Riviere Qu'appelle above 300 Bags pemmican they could not take down. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

May 30: The Water is falling fast daily. (Brandon House Journal, HBCA B.22/a/20 1817-18)

- As Peter Fidler travelled from Brandon House to the Forks, he encountered low water on the lower Assiniboine, and on the Red below the Forks.

June 3: owing to the shoalness of the water [in the Assiniboine] & numerous Sand banks it was Sun Set before we reached Grants village [near Portage la Prairie]. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 6: ...many sand bars...detain us much. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 8: water low in the Red River [at the Forks], but rather more than in the N branch [Assiniboine]. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 16: they left a considerable part of their Cargo at Brandon House...a great deal of it very wet, owing to the leakiness of the Batteaux & the frequent places they were obliged to drag them over [because of low water on the Assiniboine]. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 20: The water [on the lower Red River] is very shoal. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

- Fidler also encountered low water on the Winnipeg River but very heavy rain in late June had elevated the small tributaries.

June 22: very heavy Thunder & rain in the Night which made out Tent 6 inches under water [near mouth of Red]. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 23: rain ...water low here [on Winnipeg River] but all the small rivulets falling in are entirely full of water owing to the very heavy rain that fell last night - in the evening very heavy Thunder & a Deluge of rain - that lasted 2 hours. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 24: Water rising [on the Winnipeg River] (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 25: the very heavy late rains have [swollen] the White River, a western tributary [of Winnipeg River] considerably above its usual height... (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

June 25: Thunder & Rain last night...came to the head of the Pinawa which the NW Canoes go down in years of very high water, now not an Indian light canoe could go down it without frequently carrying. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

- As Fidler returned to Brandon House in August, he noted low water in tributaries to the Winnipeg River, on the lower Red, and on the Assiniboine, and observed evidence of a tornado along the eastern shore of Lake Winnipeg.

August 25: very little water in White river now, which was very full as we went up owing to the ...very heavy rains; Stoped 1 ½ hours for rain. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

August 27: beyond Hunter's Point [on Lake Winnipeg between Winnipeg River and Red River] a very heavy storm has been from the Nward about a month or 5 weeks ago that has broke almost every tree down near 6 miles along the edge of the Lake & twisted all the rest in a very surprising & powerful manner. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

August 30: The Grasshoppers has made Great havoc in the crops at the Colony, particularly in the Barley...the Fishery this Summer has been bad, owing to the very low state of the water [in the Red]. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

September 1: water very low in the [Red] River - and a very dry season scarce a single shower of Rain all summer, all the Potatoes & Garden stuff quite burnt out as also the 2 ½ Bushels of Barley sown there-when 3 Inches high all killed by the Great drought-These 3 Summers past remarkably little rain-as also very little Snow in winter-quite different from what it used to be. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

September 9: [Sturgeon] have been very scarce all summer, which is attributed to the Shoalness of the water [in the Red]. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

September 17: little [goods] can be taken [to Brandon House] in Canoes the water very shoal in the Assiniboyne River. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

- However, significant rain must have fallen in late August and September in the Assiniboine and upper Red River basins since the Red was rising on September 8 and 11, and the Assiniboine on October 3. Nevertheless, both rivers remained low.

September 8: ...water rising fast in the Red River owing to heavy rains above. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

September 11: Water rising in the [Red] River. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

October 3: Water [in the Assiniboine River at Brandon House] is now as high in the river as the first of June last-but too shoal to come up with Loaded Boats. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

1818-1819	Normal

- The water level in the Assiniboine at Brandon House rose somewhat in early October from low summer levels but was still considered low (see above).

- Considerable snow fell in mid-October in the upper Assiniboine (Hibernia) and Brandon House. Ice began to form at Brandon House on October 20 but milder weather delayed complete freezeup until November 17.

October 16: Much Snow fell in the night. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

October 18: Strong Gale at W with Snow. (Brandon House Journal, HBCA B.22/a/21 1818-19)

October 19: Snow most part of the afternoon & fell 2 ½ Inches. (Brandon House Journal, HBCA B.22/a/21 1818-19)

- Snow fell in late November at Hibernia and Brandon House, and at Brandon House

in early December. Very little additional snow was reported in the last three weeks of December at Brandon House and temperatures were moderate or mild through most of January at Brandon House and Red River.

January 15: The fine weather which is milder than we ought to expect at this degree of latitude is the reason for the remoteness of the buffaloes. Cold and snow would make them seek the streams, which are the only places where there are woods to shelter them. (J.N. Provencher to Bishop Plessis, in Nute, G.L., ed., 1942. Documents Relating to Northwest Missions, Minnesota Historical Society, Saint Paul, p. 191)

- Snow fell at Brandon House on January 26-28 and on 3 days in February but total accumulation was not large. Temperatures were very mild through most of February, with melting on numerous days.

- March at Brandon House was cold until late in the month and considerable snow fell March 10-12, and particularly March 24-26th.

March 25: a very bad day snowing drifty Day. (Brandon House Journal, HBCA B.22/a/21 1818-19)

March 28: One of our men returned [who] I sent away yesterday- says the Snow is very deep-& wishes to have some [one] accompany him. (Brandon House Journal, HBCA B.22/a/21 1818-19)

- Mild temperatures began March 26 and continued into April. The snow was still reported deep at Brandon House on April 6 but was disappearing by April 9.

April 6: Ducks first seen, being late for the Season...Rain in the evening. Snow still deep. (Brandon House Journal, HBCA B.22/a/21 1818-19)

April 9: Left off hawling firewood as the Ground is now Bare in places. (Brandon House Journal, HBCA B.22/a/21 1818-19)

- Concern was expressed over the possibility of low water at Hibernia in mid-April; the river began to open at Brandon House on April 19.

April 14: to lighten the Boats from this place as the river is very shoal above this place- and at present there is little hope of a great flush of water. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 16: First Goose seen this day-indicative of a late Season as Geese have been seen at York Factory on the 20th & the Seasons here are supposed to be a month earlier than those on the Shore. Swans also seen...Very little Snow on the plain and not much in the Woods from which we dread a Shoal Season. the River open partially & will be clear of Ice in less than 10 days. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

- The river was low at Hibernia and Brandon House on April 20 as the ice broke.

April 22: The River is quite clear of Ice- the water not so high as could be wished...Ice Driving in the night... (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 22: the water is low for so soon in the Season. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

- As the canoes descended the Assiniboine from Hibernia after April 23, water levels were generally adequate and the stage was rising at Brandon House from April 26 to May 3. Much rain and snow was reported in the Hibernia and Brandon House

journals in late April and early May.

April 23: Clear of Ice this morning-started at 8 A.M.- found the River to be in a middling state. the Rapids very numerous & some of them of difficult descent. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 24: Current swift. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 25: deep water the whole day. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 26: ... water rose 6 Inches these 2 Days-but this day stationary. (Brandon House Journal, HBCA B.22/a/21 1818-19)

April 26: ...the current strong but the course of the river tediously serpentine. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 28: took shelter from Rain at ½ past 1 P.M....Rain continues- no Shoals this day. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 29: much rain having fallen in the night & morning-Weather Cold & Cloudy... a few Rapids this day but none of them Shoal. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

April 29: water rose 3 Inches these 2 Days. Much rain in the night & 3 Inches Snow on the Ground this morning...Cold weather Strong wind at NW-snow all gone nearly. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

April 30: Rain at times & cold. (Brandon House Journal, HBCA B.22/a/21 1818-19)

May 2: about Sun rise it began to snow & continued till 10 AM when it became fair-& fell 7 Inches... (Brandon House Journal, HBCA B.22/a/21 1818-19)

May 2: Much snow last night [near Shell River]. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

May 2: Snow on the ground on a level...14 ½ Inches. the first part of the Winter very mild & little snow. Latter part cold & a [??] of Snow fall. River Ice cleared away 20th April and the water rose then very little but since has rose 10 Inches and is now 30 April still rising gradually... All the snow melted away except in vallies & shady places by the 25th-29 April Cold weather with strong wind & 1 ½ Inch rain then became Snow & fell 3 ½ Inches more & on the 2nd May Snow from 5 AM to 10 AM & fell 7 Inches... 3 Days after the whole melted away. (Peter Fidler's Journal at Brandon House, HBCA B.22/a/21 1818-19)

- The rain and snow in the upper basin also produced high water in the rivers draining the eastern Riding/Duck Mountains.

April 28: ...started [from Fort Dauphin] with the intention of going over land to Big Point, but after narrowly escaping drowning I was obliged to return, the Rivers being so rapid, and swollen so much above their usual dimensions by the dissolving of the snow on the North side of the Riding Mountains, where the sun has not so soon the same influence over it, on account of their shadown, and of course causing the season to be much further advanced before it thaws... (Report of the Manitoba District for 1818-19 by William Brown, HBCA B122e/1 1818/1819)

- River levels (although falling) remained generally adequate for the canoes but were low in the lower Assiniboine by May 20.

May 20: Found the River very little obstructed by Shoals... (Fort Pelly [Hibernia] Journal,

HBCA B.159/a/7 1818-19)

May 21: a wet disaggreeable morning-The River shoal in places- which detained us much [between White Horse Plain and the Forks]. (Fort Pelly [Hibernia] Journal, HBCA B.159/a/7 1818-19)

- In early June, Fidler observed the Assiniboine to be low and falling at the Forks.

June 2: Water falling fast in the Assiniboyne River [at the Forks]. (Peter Fidler's Journal at Brandon House, HBCA B.22/a/21 1818-19)

June 3: Water [in the Assiniboine at the Forks] shoal, the NW will have great difficulty in getting their Batteaux down here on the account. (Peter Fidler's Journal at Brandon House, HBCA B.22/a/21 1818-19)

- Abundant rain must have fallen in the upper Red River basin because Fidler reported that the water level at the Forks was rising fast in late June but the Assiniboine remained low.

June 21: Water [in the Red] rising fast. (Peter Fidler's Journal at Brandon House, HBCA B.22/a/21 1818-19)

June 22: Water rising fast from Red River-Assiniboyne river low. (Peter Fidler's Journal at Brandon House, HBCA B.22/a/21 1818-19)

- Although scattered comments suggest that the summer was hot but not particularly dry, water levels in both the Assiniboine and Red were low by late August.

July 7: bad weather, could do no work about the House. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

July 30: Sewered the Ground about the Houses to prevent the wet running under the buildings. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

August 29: Water very shoal in both rivers. (Peter Fidler's Journal at Brandon House, HBCA B.22/a/21 1818-19)

September 2: a very heavy Gale at N and clear which blew down many Elm trees very large near the House. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

September 3: Heavy gale continued all last night & this Day till evening. (Peter Fidler's Journal, HBCA B.22/a/21 1818-19)

- Although the freshet was not large, it appears to have been within the normal range.

1819-1820	Low

- There is little information from either the Assiniboine or Red River basin for this entire water-year, other than that the ground at Red River was snow-covered on November 24. Records are available, however, for Fort Dauphin, located on Dauphin Lake. Although it is not in the Assiniboine drainage basin, it is at the northeastern flank of Riding Mountain and receives drainage from both the Riding and Duck Mountains.

- Cold weather arrived early in the Riding/Duck Mountain region. In his summary for the year 1820, Peter Fidler observed

  The last fall [1819] was the earliest [winter] we have had for many years, the Lakes being covered with Ice entirely the 22 of October and kept in this state near Ten Days when a continuous run of very warm weather opened them again & no Ice to be seen except what lay on the Shores. (Report of the Manitoba District, 1820, by Peter Fidler at Fort Dauphin, HBCA B.51/e/1)

- Snow (3 inches) fell on October 28 but melted in subsequent unseasonally warm weather which continued through November and into December, until the 21st when very severe weather arrived.

- January alternated between cold and mild periods. Relatively little snow was reported. February temperatures were moderate and snowfall was somewhat greater (about 8 inches) but still not heavy.

- Thawing weather arrived in the last half of March and the snow was substantially gone by March 25.

  March 19: these last two Days thawed and some spots of Ground bare. (Journal at Fort Dauphin by Peter Fidler, HBCA B.51/a/2)

  March 25: The track is now become so uneven by the thaw that we cannot make use of the wood sled...The ground entirely bare of Snow between both houses. (Journal at Fort Dauphin by Peter Fidler, HBCA B.51/a/2)

- April began colder but strong thawing returned on the 5th and Fidler commented on the early spring.

  April 8: This is the last of the hawling on the Snow this Season, the grass is bare in many places. (Journal at Fort Dauphin by Peter Fidler, HBCA B.51/a/2)

  April 10: Thunder, Lightning and Rain at night-being early in the season...heavy rain apparently to the Westwards. (Journal at Fort Dauphin by Peter Fidler, HBCA B.51/a/2)

  April 14: The Grass on fire to the Southwards...this has every appearance of an Early spring-water along the edge of the Lake. (Journal at Fort Dauphin by Peter Fidler, HBCA B.51/a/2)

  April 17: No snow now left on the Ground. Rather an Early spring...The Frogs begin to croak this Evening. (Journal at Fort Dauphin by Peter Fidler, HBCA B.51/a/2)

- Snow or rain fell on 10 days in April and Dauphin Lake was rising "½ Inch daily" on May 2. The lake cleared of ice on May 5. "Thick snow" fell on May 8, "showers of Rain and Thunder" on the11th and "heavy rain" on the 18th. Despite this precipitation, Fidler suggested that Dauphin Lake was relatively low in comparison with the very wet summer of 1806.

  May 16: found the East end of our House 4 feet 9 ½ Inches higher than the water in the Lake. The summer of 1806 it was all covered with water. (Journal at Fort Dauphin by Peter Fidler, HBCA B.51/a/2)

- When Fidler left Fort Dauphin in late May, he reported an unknown river to be "very shoal".

- There are no observations from the summer of 1820 but a comment in 1821

suggests that it was rather dry (see below).

- If the conditions described above apply to the Assiniboine basin, it is likely that overall runoff during the water-year was low. Possible support for this conclusion comes from the strong drought indicated by the tree-ring record at Maple Creek and elsewhere on the Great Plains and large forest fires in Itasca State Park, Minnesota, both of which were discussed in PART TWO.

1820-1821	Normal

- The only information for this water year comes from sources in the Red River Settlement.

- Late October and early November had snow (October 23, November 2,3,7) and rain (October 30, 31, November 1) and the Red River froze on November 8.

- The last half of November was mild with some snow; "some snow" was reported in the Red River Journal on 7 days in December and temperatures were generally cold.

- January was generally mild with short intervals of colder weather. Precipitation was reported on 8 days, including heavy rain on January 7.
  January 7: Mild cloudy weather with heavy rain towards night, a circumstance that happens but very seldom in those parts, at this period of the year. (Red River Journal, HBCA B.235/a/4 1820/21)

- Cold and mild weather alternated in February and March with snow on 13 days.

- Temperatures continued to alternate cold and mild through April with snow or rain on 11 days during the month. By April 22, most of the snow had disappeared but the Red River remained frozen.
  April 22: The Snow is almost gone by the Solar heat, & a strong Southerly wind, without rain; but the River is still frozen over, & the frost of a night is considerable. I am prevented from crossing the ice however as I am accustomed to during winter for Divine Service at Fort Douglas, from the ice at the edges of the river being broken. (West, J., The British North American Indians with Free Thoughts on the Red River Settlement, 1820-23. PAM MG7 B1 M33, p. 23-24)

- Breakup of the Red occurred on May 1-2.
  May 1: Cold cloudy weather with a fall of Snow...the Ice on the River got under way in the early part of the Day and did not stop until the River was quite clear. (Red River Journal, HBCA B.235/a/4 1820/21)

  May 2: The ice is now broken & floating down the River in large masses. (West, J., The British North American Indians with Free Thoughts on the Red River Settlement, 1820-23. PAM MG7 B1 M33, p. 24)

- May was mild until mid-month, then generally cold until June when it became

extremely warm. Rain or snow fell on 7 days in May and then every day from June 8-14 when weather entries in the Red River Journal ended until September.

- On July 2, a comment by West suggests that spring must have been very late.

July 2: An agreeable change has taken place in the scenery around us; the trees are breaking into leaves, and many plants are in blossom, where, but a short time ago, every thing bore the aspect of winter. (West, J., The British North American Indians with Free Thoughts on the Red River Settlement, 1820-23. PAM MG7 B1 M33, p. 61-62)

- Grasshoppers returned in mid-July.

July 20: The weather is extremely hot, the thermometer more than 90° above zero. Vegetation is making as astonishing rapid progress, and the grain in its luxuriant growth upon a rich soil, presents...the fairest prospects of a good harvest. But the locust...is beginning to make sad ravages, by destroying the crops, as it has done for the last three years, at the Settlement. (West, J., The British North American Indians with Free Thoughts on the Red River Settlement, 1820-23. PAM MG7 B1 M33, p. 62-63)

August 16: The grasshoppers again doing a good deal of damage this year, especially at The Forks; most of the garden stuff has been eaten. Fortunately they are going away without laying eggs. We did not have any at Pembina this spring; everything was excellent. But on July 17 they arrived in such swarms that in five or six days everything would no doubt have been devoured. (Dumoulin [St. Boniface] to Plessis [Quebec] in Nute, G.L. ed.,1942. Documents Relating to Northwest Missions. Minnesota Historical Society, Saint Paul, p. 326)

August 30: The grasshoppers have again greatly troubled the colony this year. We shall harvest scarcely over a fourth of what we hoped. If, however, we had only to fear shortage in the harvest, and if the prairies offered as easy a means of supplementing it as in these past years, our condition would not be serious. But...the buffaloes [are] very far out...The intense heat we have had since the first of June has been the cause of very frequent and abundant storms, always accompanied with terrible thunder. (Destroismaisons [St. Boniface] to Plessis [Quebec] in Nute, G.L. ed.,1942. Documents Relating to Northwest Missions. Minnesota Historical Society, Saint Paul, p. 328-9)

- In his report on the Manitoba District for 1821, Peter Fidler provided some evidence that both winter snowfall and summer precipitation were adequate in the vicinity of Fort Dauphin.

The Snow has been deeper this year than the last, the fall long and lingering, but the weather in general has been milder than last year. (Report of the Manitoba District, 1821, by Peter Fidler at Fort Dauphin, HBCA B.51/e/2)

[The better conditions of the deer this winter] is principally owing to a good deal of rain falling the Last year. And made the grass much more plentiful-for these last 4 or five years there has been much less rain than before. (Report of the Manitoba District, 1821, by Peter Fidler at Fort Dauphin, HBCA B.51/e/2)

- Despite the abundance of observations at Red River, there is no mention of the water level in the Red and it can only be concluded to have been in the normal range, in the spring at least. The two brief comments by Fidler at Fort Dauphin suggests that precipitation throughout the year was not abnormal and it is concluded that runoff in the Assiniboine basin was probably within the normal range.

1821-1822	Insufficient Data

- Little information exists about the winter in the Red River basin, and none for the Assiniboine.

- The Red froze about November 8.
  November 8: Set in ice going to Pembina in Boats at the big point. (Diary ascribed to Paul Reyburger, Red River Settlement, HBCA E8/9 1821/22)
- Spring set in very early.
  March 14: The river at present produces a very few fish but that cannot be expected to continue beyond a week as the current is now getting so Strong owing to the melting of the snow that it is unsafe to set nets. (Governor Simpson's Journal, HBCA D/3 1821/22)

  March 24: ...compelled to walk through the plains up to the knees in Slush & water 16 miles to the Fort on acct. of the bad state of the Ice. (Governor Simpson's Journal, HBCA D/3 1821/22)

  March 25: Heavy rain. (Governor Simpson's Journal, HBCA D/3 1821/22)

  March 25: The thaw continues...shouldn't be late before the River breaks up, & is clear of ice, so as to prevent catching Sturgeon...Saw two geese, the sure harbingers of spring. (West, J., The British North American Indians with Free Thoughts on the Red River Settlement, 1820-23. PAM MG7 B1 M33, p. 37)

- Severe cold returned on March 27 and continued into April; final breakup of the Red didn't occur until April 26.
  April 26: The River broke up on the 26th and a considerable quantity of Sturgeon have been taken. (Governor Simpson's Journal, HBCA D/3 1821/22)

- In May, George Simpson noted the difference in winter weather between the northern and southern portions of the Red River basin, in addition to expressing worry about the aboriginal strategy of using fire to keep bison away from the posts.
  May 20: The Company's establishments from this place to the source of the Assiniboine have even been at times in a state of famine...The failure of the Buffalo may be attributed to two causes, one is that the plain Indians [disliked the merger of the Hudson's Bay and North West Companies and by way of having revenge determined on Starving the Traders by keeping the Buffalo off in the Summer and Fall, which was easily effected by obstructing them at their usual passes to the Northward, setting fire to the Plains, etc. The other cause was that in this part of the Country and to the Northward we have had an unusually severe Winter with an extraordinary quantity of snow nearly 3 ft Deep, whereas to the Southward the Season has been mild and little or no snow so that the unfavourable state of the season prevented the Cattle from taking their usual Northern tour... (George Simpson [Fort Garry] to A. Colville, in F. Merk, ed., 1868. Fur Trade and Empire: George Simpson's Journal. The Belknap Press of Harvard University Press, Cambridge, Mass., p. 180)

- May was cold.
  May 23: The Settlers have been very industrious in getting in their seed corn; but the weather has been, and continues to be very cold, with a strong north and north-easterly wind, which has checked the vegetation; and the woods around us still wear the dark hue of winter. (West, J., 1824. The Substance of a Journal During a Residence at the Red River Colony. L.B.Sealey and Son, London, reprinted 1966, Johnson Reprint Corporation, S.R.Publishers, p. 148)

- There is no information on water levels but they are assumed to have been within the normal range for the Red during the freshet period and the good harvest reported in early September suggests adequate summer precipitation.

- It is unclear whether Simpson's comment on May 20 can be interpreted to include the Assiniboine basin and there is no other information from within the basin on which to base a judgement.

1822-1823	Low

- Simpson's worries about prairie fires were confirmed in the fall of 1822 when fires raged from the Red River Settlement to the Saskatchewan River. (NOTE: in this year, all references to Fort Ellice Journal refer to the Beaver River site 1-2 km south of the later site of actual Fort Ellice)

  September 23: Cloudy, with soft rain at intervals. The plains have caught fire on the south side of the river, and the flames are spreading in every direction. (Red River Journal, HBCA B.235/a/5 1822/23)

  September 24: The Plains are all on fire...which has run almost thro the whole Country hereabouts. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  September 28: The fire still raging in the Plains. (Red River Journal, HBCA B.235/a/5 1822/23)

  October 9: Here [at Rapid River] we are happy to find the plains not burnt. Nearly the whole way between this and the Forks has presented a black dismal prospect and we have scarcely found wherewithal for our horses. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  October 31: Fire still raging in the plains and the Country burnt in every direction. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  November 1: ...[some Stone Indians] inform us that the whole way between this and the Saskatchewan River is burnt. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  November 29: The season has been so dry that the prairies are burned almost completely, a condition which will probably cause us to experience famine at least as far as meat is concerned. Fortunately the harvest was quite abundant; but without meat one has a poor livelihood. The fire not only traversed the Red River area, but also all the prairies as far as Fort des Prairies whence the company gets much of its supplies...I did not receive his letter until the day before All Saints'; and even then the rivers had for some twelve days been frozen solid enough in spots to carry men and even horses; it is true that subsequent mild weather has caused the ice to melt, and the rivers are now open. (Bishop Provencher [St. Boniface] to Bishop Plessis [Quebec City] in Nute, G.L. ed.,1942. Documents Relating to Northwest Missions. Minnesota Historical Society, Saint Paul, p. 379-80)

- Cold and mild weather alternated in early October at Red River and Beaver River but the last half of October was continuously cold. Some rain and snow fell and the rivers were frozen.

  October 21: Very cold...[men] prevented by Ice from crossing the River. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

October 22: Some of our men in a boat started this morning for Pembina but were obliged to return in consequence of the [Red] River being frozen over. Thos who were to go to Netley Creek...also failed for the same reason. (Red River Journal, HBCA B.235/a/5 1822/23)

- November began with sufficiently mild weather until mid-month to open the rivers again but thereafter became much colder. Red River and Fort Ellice reported significant snow on several days from November 15 to the end of the month.

November 15: Snowing all day. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

November 16: The Assiniboine and Red Rivers are both frozen across opposite the Fort. (Red River Journal, HBCA B.235/a/5 1822/23)

November 24: In the evening it began to snow and continued most part of the night. [25th] There fell about four inches of snow in the course of last night. (Red River Journal, HBCA B.235/a/5 1822/23)

November 28: Heavy fall of snow during last night. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- Both severe cold and mild weather occurred in the first half of December but after December 14, "excessive", "severe", "extreme" cold prevailed until early January, (with a temperature of -40°F reported on December 21 at Red River). Heavy falls of snow occurred on December 12, 15 and 31; at Fort Ellice the burned prairie reduced snow retention but in the Red River Valley deep snow cover inhibited travel.

December 12: Blowing a strong Gale of North Wind during the whole of last night with heavy falls of snow. Bad weather continues all day. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

December 12: Snowing and blowing hard from the N.E. This is as stormy a day as any Gentleman here has ever seen in any part of the Indian country. (Red River Journal, HBCA B.235/a/5 1822/23)

December 15: Thick snow...The hauling is so bad owing to the plains being burnt and not retaining the snow. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

December 19: Weather still so severe that it requires the work of six or seven men to furnish the different dwelling houses with firewood. In the evening John McLeod...arrived from Pembina with two horses but owing to the depth of snow and the consequent badness of the roads they were under the necessity of leaving above 400 lbs fresh meat about half way from us. (Red River Journal, HBCA B.235/a/5 1822/23)

December 31: ...the other men clearing snow which fell pretty thick last night. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- From January 5-23, the weather was almost continuously mild at Red River and Fort Ellice; snow fell at Red River on 4 days in January.

January 8: Weather rather milder and cloudy...[some men] started [for Brandon House] this morning...but were obliged to return on account of their dogs not being able to go on in concequence of the depth of snow. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

January 17: [The scarcity of buffalo] is partly to be attributed to the mildness of the season, and partly to the plains being burnt, which keeps the Cattle scattered over the Country in quest of pasturage. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- February was cold with short "mild" intervals; at Fort Ellice, the accumulated snow cover was slight.
  February 17: ...he lost his track in the burnt ground, there being no snow to leave a trace upon... (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- March was relatively mild throughout at Red River. Fort Ellice reported some colder intervals but with thawing conditions in mid-March and very little snow cover.
  March 15: There is too little snow for hauling with Dogs any longer. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- Spring and river breakup developed slowly in the first half of April.
  March 27: Fine weather and thawing a great deal. The ice on the river is now entirely covered with water from the melted snow on the banks. (Red River Journal, HBCA B.235/a/5 1822/23)

  April 2: Fine clear weather tho cold for the season. The ice in the river is become extremely dangerous. (Red River Journal, HBCA B.235/a/5 1822/23)

  April 6: ...as there is no snow on the ground, the men could not follow [the buffalo's] track. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  April 13:...we were unable to get...across the River, owing to the bad state of the Ice, which is broken. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  April 14: Rain at intervals in the course of the day...Visited two nets which are set in an opening of the ice, but caught only 5 small fish. The sturgeon have not yet made their appearance, the water being so low that the ice cannot drift tho much broken. (Red River Journal, HBCA B.235/a/5 1822/23)

- Some precipitation was reported but apparently not in large amounts until April 18 when rain and snow fell for several days
  April 18: Cloudy with rain at intervals. The ice drifting very thick in the Assiniboine River. (Red River Journal, HBCA B.235/a/5 1822/23)

  April 19: Cold weather and snowing all day. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  April 20: Continued snowing all last night and continues all this day. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

  April 20: There fell about three inches of snow in the course of the day & night. (Red River Journal, HBCA B.235/a/5 1822/23)

  April 21: ...The Snow the last two days past, fell about two feet deep. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- Breakup in the upper Assiniboine basin was not completed until April 25.
  April 25: The River entirely clear of ice. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- Virtually no precipitation fell from April 22 to May 10 and temperatures were generally cold for the season.

- The water level of the Assiniboine at Fort Ellice was low on May 11.
  May 11: Men employed greasing the Bateaux in order to be off as soon as possible on

account of the lowness of the Assiniboine River. (Fort Ellice Journal, HBCA B.63/a/3 1822/23)

- May continued cold and very dry, warming after the 23rd.
  May 26: Fine warm weather. The growth of our crops of grain and vegetables is much retarded for want of rain. (Red River Journal, HBCA B.235/a/5 1822/23)

- There are no further entries from the upper Assiniboine after the brigade left Fort Ellice in mid-May but the Red River region remained dry into June.
  June 6: Fine warm weather, the seed crop comes on but slowly on account of the drought. (Red River Journal, HBCA B.235/a/5 1822/23)

- No other direct observations are available but numerous comments by Keating and others later in the summer imply a dry summer and low water levels over a broad region.
  August: ...the river at that time was unusually low [Red River just below Pembina]. (Keating, W.H., 1959. Narrative of an Expedition to the Source of the St. Peter's River, Lake Winnepeek, Lake of the Woods, etc. Performed in the Year 1823. Reprinted, Ross & Haines Inc., Minneapolis, Minnesota, p. 37)

  August: It is probable that this, as well as other rapids of the river, is at times much finer than it was when we saw it, for the stream [Winnipeg River] was considered low. (Keating, W.H., 1959. Narrative of an Expedition to the Source of the St. Peter's River, Lake Winnepeek, Lake of the Woods, etc. Performed in the Year 1823. Reprinted, Ross & Haines Inc., Minneapolis, Minnesota, p. 96)

  August: ...it is usual for voyageurs to make a small portage over this point. It did not exceed one hundred yards at the time we crossed it. Out guide says that it is often under water so that the canoes pass without difficulty. This requires a rise of about five or six feet above the level of the waters at that time. (Keating, W.H., 1959. Narrative of an Expedition to the Source of the St. Peter's River, Lake Winnepeek, Lake of the Woods, etc. Performed in the Year 1823. Reprinted, Ross & Haines Inc., Minneapolis, Minnesota, p. 37)

  September 16: Last year's harvest provided some of the comforts...that we had not before. This year the harvest will bring little drought having killed the grain to some extent and even more the garden stuff, a part of which did not come up until July when rain finally came to moisten the earth. (Bishop Provencher [St. Boniface] to Bishop Plessis [Quebec City] in Nute, G.L. ed.,1942. Documents Relating to Northwest Missions. Minnesota Historical Society, Saint Paul, p. 379-80)

- A comment in 1824 confirms the dryness of the summer.
  June 1, 1824: In spite of last year's [1823] drought and hail the harvest yielded considerable grain... (Bishop Provencher [Red River] to Bishop Plessis [Quebec], in G.L. Nute, 1942, (ed.). Documents Relating to Northwest Missions. Minnesota Historical Scoiety, Saint Paul, p. 419)

- From the lack of snow cover in the upper Assiniboine, reports of low water on the Red in mid-April and on the Assiniboine on May 11, and an apparently dry summer, it is likely that overall runoff was low.

1823-1824	High

- Virtually no information is available for the fall and winter from either the Assiniboine or Red River basins, apart from the fact that water levels were low in the Minnesota River adjacent to the southern Red basin and that the Red froze somewhat early and the winter may have been exceptionally cold.

  October 31: It now began to be late in the fall...The [Minnesota] river was quite low, and we experienced considerable trouble in getting over, or around, sand bars, or shoals. Such was the slowness of our progress that it was quite late in the season when we reached Fort Snelling. In fact ice was already floating in the river... (Reminiscences of Mrs. Ann Adams, Minnesota Historical Collections, 2:124, quoted in Parker, D.D., 1964. Lac Qui Parle: Its Missionaries, Traders and Indians. South Dakota State University Press, p. 241)

  November 6: The [Red] river is now completely set fast, and will be so till April. (David Jones Journal, PAM MG7 B2 CMS A77)

  June 4, 1804: I am now brought through the rigours of a Winter, five months long, and of uncommon severity...the cold weather when the Thermometer fell to 60° below Zero always affected my chest. (David Jones Journal, PAM MG7 B2 CMS A77)

- Spring was very late at Red River.

  May 16: The Spring is very backward, and snow on the ground yet in some places since November last. (David Jones Journal, PAM MG7 B2 CMS A77)

  June 7: It rained heavily all day...The Lake [Winnipeg] was yesterday clear of ice... (Red River Journal, HBCA B.235/a/6 1824/25)

- Rain fell frequently in June at Red River and the levels of the Assiniboine and Red Rivers were high.

  June 19: The Weather continues boisterous. The nets could not be set in either of the Rivers in consequence of the height of the water and strength of the current. (Red River Journal, HBCA B.235/a/6 1824/25)

  July 2: The Weather continues fine, and favourable for all sorts of grain excepting Indian corn, which it is supposed must fail owing to the constant wet weather... (Red River Journal, HBCA B.235/a/6 1824/25)

- At Swan River House, rain caused a rise in the river.

  July 2: Heavy rain and Thunder. The waters of the [Swan] river [rose] two feet last night. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

- July and August were particularly wet at Swan River, somewhat less so at Red River (although several heavy falls were reported there as well).

Reports of Rain at Swan River and Red River, July-August, 1824	
July 2: Heavy rain and Thunder. (Swan)	August 4: At noon a heavy rain. The meadows being so full of water, it is difficult to get the hay dried. (Swan)
July 4: Thunder and rain at intervals. (Swan)	August 15: this morning a storm came on and that very suddenly of which I never saw an equal. (David Jones Journal, PAM MG7 B2 CMS A77)
July 4: Much rain Thunder & lightening. (Red)	August 15: The weather overcast raining for the greatest part of the day. (Swan)
July 10: ...could not work in the gardens on account of the heavy rains, which makes the waters in the [Swan] river rise fast. (Swan)	August 16: Last night there fell heavy rain. (Red)
July 14: Rainy weather. (Red)	August 17: Rainy weather. (Red)
July 16: Heavy rain with thunder & lightening..(Red)	August 17: The weather cloudy and raining. (Swan)
July 17: ...weather the same as yesterday. (Red)	August 18: Heavy rain during the whole of the day. (Red)
July 18: Had much thunder and a very heavy rain. (Swan)	August 18: ...some rain at intervals. (Swan)
July 20: thunder and heavy rain. (Swan)	August 19: The weather continued rainy. (Red)
July 27: thunder and a great fall of rain. (Swan)	August 19: ...continued raining. (Swan)
July 29: Excessive heavy rain throughout the day. (Red)	August 20: Rainy weather. (Red)
August 1: Heavy rain with thunder and lightening during all last night and cloudy weather with showers of rain during this day. (Red)	August 20: Continued raining for the greatest part of the day. (Swan)
August 1: Heavy fall of rain with Thunder. (Swan)	

- The rain was sufficient to cause a considerable rise in the Swan River level through much of August.

August 15: Continued rains for some time past, made the waters of the [Swan] River rise five feet above its usual height. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

August 16: ...the waters of the [Swan] river rising more and more. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

August 18: ...the waters of the [Swan] river continue rising so much, that they nearly reach the top of the bank, which is far from being low. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

August 19: ...the women...got no fish as they say the water being too high for fishing...(Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

August 21: The rains still continued pouring and the [Swan] river rising more and more. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

- The Swan River began to fall on August 22.

August 22: The weather very fine. The waters in the river are decreasing. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

August 27: The water in the river decreasing rapidly. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

August 29: The weather continued very fine, and the waters in the river continue decreasing rapidly. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

- The rainfall in August must have been very widespread since the Red River was reported rising "considerably" in early September.
  September 2: The weather continues wet, which has caused the River [probably Red] to raise considerably. (Red River Journal, HBCA B.235/a/6 1824/25)

- Very wet weather continued into September. At Red River, rain was reported on 7 of the first 8 days and the period from the 14th to 20th was wet at Red River and Swan River.
  September 14: Heavy rain all day... (Red River Journal, HBCA B.235/a/6 1824/25)

  September 15: Heavy rain all last night & part of this day ... (Red River Journal, HBCA B.235/a/6 1824/25)

  September 16: The weather dark and rainy. (Fort Pelly (S.R.House) Journal, HBCA B.159/a/8 1824-25)

  September 18: Last night had a heavy shower of rain...The weather continued raining at intervals. (Red River Journal, HBCA B.235/a/6 1824/25)

  September 19: The weather fine throughout the whole day, until evening when we got a heavy shower of rain [between Swan River and Fort Pelly]. (Fort Pelly Journal, HBCA B.159/a/8 1824-25)

- Although little is known about snow conditions during the winter or the weather sequence during the freshet, spring was exceptionally late. Both the Assiniboine and Red Rivers were reported high in June and must have remained so during the entire very wet summer. Support for this conclusion comes from the fact that after a visit to the Red River Settlement more than 30 years later, Wesley Bond stated that "The heaviest floods known in the country occurred in 1824, '25, and '26..." (Bond, J.W., 1857. Minnesota and its Resources, to which are appended Camp-Fire Sketches or Notes of a Trip from St. Paul to Pembina and Selkirk Settlement on the Red River of the North. Kenn & Less, Chicago, p. 323).

1824-1825	Very High

- Flooding and very high spring and summer flows are discussed in PART THREE above.

1825-1826	Very High

- Conditions in the Assiniboine basin during the record 1826 flood on the Red River are discussed in PART THREE.

- August, 1826, was very wet at Red River.
  August 4: High winds & heavy rains all day. (Red River Journal, HBCA B.235/a/8 1826/27)

  August 15: the weather was exceedingly cold and wet; the rain fell in torrents the whole

day...The hay which we had cut was covered with water. (Rev. W. Cochran's Journal, PAM MG7 B2 CMS A85)

August 19: Very wet, and cold & wind blowing from the north. (Rev. W. Cochran's Journal, PAM MG7 B2 CMS A85)

August 22: Windy weather with showers of rain. (Red River Journal, HBCA B.235/a/8 1826/27)

August 29: The weather was wet and exceedingly cold and appeared unpropitious to the corn and potatoes. (Rev. W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Rain also fell frequently in September in the Red River Settlement; in total rain was reported on 14 days and the period September 18-29 was particularly wet with rain on 8 days. Many of the falls were heavy.

September 3: I set out for the lower [church]; the rain pouring in torrents upon me. (Rev. W. Cochran's Journal, PAM MG7 B2 CMS A85)

September 23: The wind blew tempestuously, and the rain fell in torrents... (Rev. W. Cochran's Journal, PAM MG7 B2 CMS A85)

September 24: the late heavy rains have left little hope of the late barley crops or any of the wheat ever ripening or even approaching to maturity. Rainy weather. Wind N.E. (Red River Journal, HBCA B.235/a/8 1826/27)

September 27: High winds and heavy rains continue. (Red River Journal, HBCA B.235/a/8 1826/27)

1826-1827	Normal

- The only sources of weather information for this year come from the Red River Settlement.

October 1: Froze keenly during last night which together with the late constant heavy rains has given the death blow to the standing crops of barley & wheat and has also destroyed a large portion of the potato crops. (Red River Journal, HBCA B.235/a/8 1826/27)

- Most of October was relatively cold and rain fell on 9 days after October 11.

- November was also wet. With the saturated state of the basin, sufficient precipitation fell in early November to cause a rise in the Red River (and perhaps the Assiniboine since the plural "rivers" is used in the November 4 comment.

November 1: Snowed heavily towards evening with a strong gale from the S.E. (Red River Journal, HBCA B.235/a/8 1826/27)

November 2: Snowed all day. (Red River Journal, HBCA B.235/a/8 1826/27)

November 3: Heavy rain throughout the day which dissolved all the snow that fell during the two days preceding. (Red River Journal, HBCA B.235/a/8 1826/27)

November 4: Rained incessantly during all last night and this day, which together with the late melted snow has swollen the rivers and laid the country under one general sheet of water. (Red River Journal, HBCA B.235/a/8 1826/27)

November 5: The wind veered round to the south; the snow melted and heavy rain ensued...In the afternoon, the weather [continued] wet. (Red River Journal, HBCA B.235/a/8 1826/27)

- The Assiniboine froze on November 18 but the Red did not completely freeze until November 25.

November 18: Weather intensely cold. Wind N.W. The ice set fast in the Assiniboine River last night and the Red River runs from bank to bank with drifting ice. (Red River Journal, HBCA B.235/a/8 1826/27)

November 25: The ice in the Red River has been setting fast by degrees since the 20th Inst. And is now sufficiently strong in all places, to admit of foot passengers crossing upon it without risk. Clear frosty weather. Wind N.W. (Red River Journal, HBCA B.235/a/8 1826/27)

- Snow fell heavily on December 3 and 5 but was removed by milder weather on the 7th.

December 5: A considerable quantity of snow having fallen the day and night before...The snow was too deep for the ride on horseback. (Rev. W. Cochran's Journal, PAM MG7 B2 CMS A85)

December 7: Thawed during the day which with the high winds on the 4th Inst. Has cleared the ground once more of snow. Wind South. (Red River Journal, HBCA B.235/a/8 1826/27)

- Mild weather continued until the 15th when very cold weather arrived accompanied by much additional snowfall.

December 15: Snowed heavily last night, and this day with a strong N.W. wind. It was the only real severe weather we have had this season, which is proof of its being a remarkable mild winter so far. The inhabitants after housing their livestock for the season, in the latter part of October, were induced by the late continuance of mild weather, to let them out to graze again in the plains, where they have provided for themselves for a month past and thereby saved to the farmers much of their fodder. (Red River Journal, HBCA B.235/a/8 1826/27)

December 17: Snowed all day.. (Red River Journal, HBCA B.235/a/8 1826/27)

December 21: Snowed and drifted all day. (Red River Journal, HBCA B.235/a/8 1826/27)

December 25: The Snow drifted very much all day. (Red River Journal, HBCA B.235/a/8 1826/27)

- Intense cold prevailed until the 3rd week of January and snow fell on 4 days. After January 21, temperatures were milder with little additional snow.

- Cold weather returned on February 1 and remained until late March with only short milder breaks. Snow fell on only four days during February and March.

- Spring arrived suddenly at the end of March.

March 31: This is the first day of genial thaw, the spring is getting very late and this makes the people dread another flood...The past winter has been very mild until this last fortnight; during which time it has been in the other extreme. (D. Jones Journal, PAM MG7 B2 CMS A92)

April 1: Thawed during last night and this day. The plains in many places clear of snow- and

a great deal of water on the ice in the rivers. The quantity of snow has been this winter but trifling in comparison with that of last year. Geese and Ducks seen for the first time this Season. Wind S. (Red River Journal, HBCA B.235/a/8 1826/27)

April 8: Warm weather in the forenoon. Wind S. In the evening the wind veered to E. and was followed with heavy rain, the first of the Season. Geese, Ducks and Swans flew past in considerable numbers towards the North. Snow all melted. Rivers rising rapidly. (Red River Journal, HBCA B.235/a/8 1826/27)

- The Red rose throughout the next week and the ice broke up amid very high water on April 16; the Assiniboine did not break up until May 1.

April 16: this evening the ice in the Red River broke up and passed down with great velocity. The water rose so high as to cover some of the low lands along the river. (Red River Journal, HBCA B.235/a/8 1826/27)

April 17: The big River now runs open, but the Assiniboine is still fast. (Red River Journal, HBCA B.235/a/8 1826/27)

- The water level continued to rise into May.

April 24: cold; the wind blew from the north and the river continued to rise which increased the creeks to such a prodigious height that it was with great difficulty that I could get through them. I was obliged to go about two miles out into the plains to pass the ends of them, where the water flows out of the swamp. (Rev. W. Cochran's Journal, PAM MG7 B2 CMS A85)

April 30: Some of the farms on low grounds are now under water from the swelling of the rivers, and the owners of such have been obliged to abandon their houses in consequence. But such of the settlers whose lands are on high situations have commenced ploughing. (Red River Journal, HBCA B.235/a/8 1826/27)

May 2: The ice in the Assiniboine River broke up entirely, being forced away by a flush from bank to bank. Fine warm weather, Wind S.W. (Red River Journal, HBCA B.235/a/8 1826/27)

May 3: Both rivers continue rising at the rate of three inches in twenty-four hours and spread rapidly on the low grounds. (Red River Journal, HBCA B.235/a/8 1826/27)

May 5: The waters seem to be at their height having neither risen nor fallen during the last twenty-four hours, which happy circumstance has relieved the poor settlers from much anxiety as they were greatly alarmed least a recurrence of last years disaster would befall them. (Red River Journal, HBCA B.235/a/8 1826/27)

- The water levels fell after May 5 and the weather was generally warm and dry for the rest of May (although heavy showers fell on May 20).

- Early June was very hot and dry. Heavy rain fell on June 13 but complaints of drought became frequent by the end of the month.

June 15: Rained a little during last night, which was much required, the crops being much parched by the late long continued drought. (Red River Journal, HBCA B.235/a/8 1826/27)

June 20: A light hoar frost fell again last night which together with the long continued drought...are evils which justly dishearten the inhabitants at large. (Red River Journal, HBCA B.235/a/8 1826/27)

June 29: Since the 20th the weather continues oppressively hot & dry-so much so that the crops assumed a yellow tinge and considered by the Colonists ruined beyond recovery but a genial shower fell to-day, which has entirely changed the aspect of things. (Red River

Journal, HBCA B.235/a/8 1826/27)

- The drought ended with the rain on June 29 and rain fell frequently during the rest of July and into August. By the end of August and into September, the rainfall had been so frequent and heavy that the crops were suffering and rivers rising.
  August 31: Since the 14th scarcely a day has passed without heavy rains, a circumstance of serious consideration to the inhabitants, and their crops are in part rotted on the ground. (Red River Journal, HBCA B.235/a/8 1826/27)

  September 3: The rainy weather continues and the crops suffer materially from its effects. (Red River Journal, HBCA B.235/a/8 1826/27)

  September 8: Heavy showers of rain every day. (Red River Journal, HBCA B.235/a/8 1826/27)

  September 20: Not a day passes without heavy rains...The Rivers are greatly swollen by the late rains, as much so, as after the ice went off in the spring and it is even a difficult matter to go on horseback from one end of the Settlement to the other, the face of the country is so entirely covered with water. (Red River Journal, HBCA B.235/a/8 1826/27)

  September 30: Scarcely a dry day has been experienced since the last date [September 20], but the Colonists have been indefatigable in saving their crops, and have been, it is pleasing to state, much more successful than could be expected under such circumstances. (Red River Journal, HBCA B.235/a/8 1826/27)

- All of the above information is from the Red River Settlement and refers principally to the Red River. Clearly a flood occurred there and some of the comments refer to the plural "rivers" which might be taken to include the Assiniboine. However, the Assiniboine was very late breaking up, which would probably not have been the case if it were experiencing the same extreme flow as the Red. It seems likely that the Assiniboine flow was not much greater than normal during the spring. Nor is it clear that the Assiniboine basin experienced the same heavy precipitation during August and September. Thus it is concluded that the Assiniboine runoff was probably at least normal, especially given the saturated state of the basin in the previous fall; it may have been high but that assessment cannot be made with confidence.

1827-1828	High

- Snow fell at Red River for the first time on October 28 but melted on November 5, causing the rivers to rise.
  October 28: During last night the snow has fallen to the depth of 6 Inches [Taylor at White Horse Plain travelling west]. (George Taylor's Journal, HBCA B.235/a/11 1827/28)

  November 5: Most of the snow has been melted off the ground within these last few days, which together with the water previously on the ground has laid the plains under an entire sheet of water and greatly swollen the Rivers. (Red River Journal, HBCA B.235/a/9 1827/28)

- Heavy snow fell near Turtle Mountain (south of Brandon) in mid-November and the Assiniboine and Red Rivers froze at the Red River Settlement on November 17-18.

November 17: Both Rivers set fast last night opposite the fort, but are still partially open below it...The weather of late has been generally cold with snow showers. (Red River Journal, HBCA B.235/a/9 1827/28)

November 18: We are again this morning fairly and permanently surrounded by wintry scenery; the river is fast-the snow deep on the ground-thermometer below zero-the sky clear and cloudless and perfectly blue. (David Jones Journal, PAM MG7 B2 CMS A92)

- Some streams south of the Red River Settlement were still open on November 24 and water levels in them were high.

November 24: we had some difficulty in getting a cross this small creek which is very deep [between Pembina and Forks]. (George Taylor's Journal, HBCA B.235/a/11 1827/28)

- Heavy snow fell at Red River on November 28.

November 29: I could not attempt more yesterday [November 28] as it snowed very heavy all the day but as it cleared up this morning I started [for Fort Alexander from Netley Creek]...very much fatigued from walking in Snow up to the knees every step. (George Taylor's Journal, HBCA B.235/a/11 1827/28)

- Early December was cold but became mild from December 20 to the end of the month.

December 31: Ever since the 20th Inst. The weather has been uncommonly mild & pleasant-Though not exactly so warm as to melt the snow, it was within a degree or two of doing so. (Red River Journal, HBCA B.235/a/9 1827/28)

- Cold weather prevailed at Red River through January and early February but the last half of February and all of March were mild.

February 29: The weather of late has been unusually mild for the season-thawed about noon for the last ten days. Wind generally S. (Red River Journal, HBCA B.235/a/9 1827/28)

March 15: The weather has ever since the beginning of the month been remarkably mild, even so much as to cause a partial melting of the snow about noon in southern aspects. (Red River Journal, HBCA B.235/a/9 1827/28)

March 31: The weather keeps remarkably fine, and thaws a little about noon daily. (Red River Journal, HBCA B.235/a/9 1827/28)

April 2: Weather so warm as to melt the snow during the whole day.(Red River Journal, HBCA B.235/a/9 1827/28)

- Despite the comments above, spring was judged to be late by April 10.

April 10: The spring is very late; during the last two or three days the weather is a little warm; but the none [sic] appearance of any water fowl shows that spring is not yet commenced. (David Jones Journal, PAM MG7 B2 CMS A92)

April 13: Snow falling very fast and we feel the severity of winter now more than at any former period of the season. (David Jones Journal, PAM MG7 B2 CMS A92)

April 19: From the last date to the present, the weather has been cold and boisterous, with heavy falls of snow, but the wind changing this day about noon from the Northward to South, warm weather succeeds the cold almost instantaneously. (David Jones Journal, PAM MG7 B2 CMS A92)

- Breakup of the Assiniboine and Red Rivers occurred on April 22-25 and water levels

were immediately high.

April 22: The ice in both rivers broke up towards evening and ran fast for some time with great velocity but was stopped again until midnight at Point Douglas, during which time the water rose rapidly-Last night was the first of the season, that did not freeze- Most of the snow is melted off the plains and cattle graze out. (Red River Journal, HBCA B.235/a/9 1827/28)

April 25: The Red River is entirely clear of drifting ice, but the Assiniboine still runs full of it. Abundance of wild fowl flying about & some geese were killed ten days ago. The plains are now entirely clear of snow. (Red River Journal, HBCA B.235/a/9 1827/28)

April 28: Some have already sown wheat on ground ploughed last autumn...The Assiniboine point is now overflowed as are also most of the low points along the Big River. Warm weather. Wind S.W. (Red River Journal, HBCA B.235/a/9 1827/28)

- Both rivers were reported to be still rising on April 30 and heavy snow fell on May 5.

May 5: This day is more stormy than any I have seen since the commencement of winter; it blows a storm from the North with a tremendous drift and wintry scenery seems to have set in again completely. (David Jones Journal, PAM MG7 B2 CMS A92)

- The rivers reached their peak on May 12 and the water level was high with some flooding.

May 19: The rivers continued to rise until a few days ago, and were more swollen this spring, than during any season in latter times, that of the great floods excepted. The waters are now receding from the flooded lands and as the soil drys, the seed is planted. Weather sultry. Wind S.W. (Red River Journal, HBCA B.235/a/9 1827/28)

May 31: The rivers have fallen rapidly of late, and are now within their natural limits, and the land overflowed by them is now under crop. (Red River Journal, HBCA B.235/a/9 1827/28)

June 18: Nous avons passe l'hiver assez heureusement. L'eau est montee encore beaucoup, mais n'a pas noye les terres de St. Boniface. Pembina et audessus a ete submerge c'est laquatrieme anne desuite. (Mgr. J.N.Provencher, Eveque de Juliopolis, a Mgr. Lartigue, Eveque de Telmesse, dated Riviere Rouge, 18 juin, 1828, PAM MG7 D1)

- June seems to have been warm and dry but July and August were extremely wet. Rain (often heavy) was reported on 14 days in August and the comments imply that the actual number was higher.

July 10: The weather of late has been Rainy with frequent thunder Storms. The Crops are in a thriving state. (Red River Journal, HBCA B.235/a/9 1827/28)

July 22: Weather warm & Rainy with frequent Thunder storms. (Red River Journal, HBCA B.235/a/9 1827/28)

July 31: Weather continues warm and rainy. (Red River Journal, HBCA B.235/a/9 1827/28)

August 12: a dense thunder cloud passed over the house which emitted flash after flash in close succession the peals of thunder were so loud that I could not hear my own voice, the rain fell in torrents. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

August 13: many were absent on account of the heavy rain. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

August 15: The weather mild and showery, commenced reaping our barley which was now ripe, and a tolerable crop, except on the low ground which was much destroyed by the water

standing on it after the frequent heavy rains. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

August 22: This was the most awful night I ever witnessed, the whole atmosphere appeared on fire, every peal of thunder reminded us of the day of final retribution...In the morning after prayers...went to carry the barley...to a piece of dry ground. The rain which fell the preceding night being now standing on the ground, on which it grew to the depth of three inches. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

August 27: The weather very wet in the morning and cloudy; the whole preceeding night the rain fell in torrents. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- After dry weather in the first half of September, it rained frequently during the rest of the month.

- Although virtually all of the information for this water-year was from the Red River Settlement, the Assiniboine was implicated in the descriptions of high water in the spring. There is no direct commentary which would indicate that the Assiniboine basin received the same abundant summer precipitation as was reported in the Red River Settlement but it is assumed to have been the case since high water was reported in the Swan River on September 3, in the Assiniboine and Rapid Rivers on October 7 and the Rapid River remained high into November.

September 3: I must observe that the small quantity [of fish] caught is occationed by the High state of the waters in this part of the Country [Swan River]. (Fort Pelly Journal, HBCA B.159/a/10 1828-1829)

October 7: Want of food induced our people to make several attempts at erecting fish weirs in the Rapid River, which unfortunately proved unsuccessful owing to the unusual height of the waters- The same result followed similar attempts in the Assiniboine River. (New Brandon House Journal, HBCA B.22/a/22 1828/29)

October 19: The weather continues dry & windy and the plains burn incessantly...We have made two more fruitess attempts at weir making in the Rapid River, which abounds with fish- We failed owing to the force of the water therein. (New Brandon House Journal, HBCA B.22/a/22 1828/29)

November 4: [the weir on the Rapid River] had scarcely been completed, when it was swept away by the violence of the current. (New Brandon House Journal, HBCA B.22/a/22 1828/29)

1828-1829	High

- Reports of high water on the Assiniboine at Brandon House and Fort Pelly in late April-early May and the antecedent conditions in the winter are described in PART THREE above.

- High water continued through June (PART THREE)

- July and August of 1829 were warm with only occasional rain; by early September, the Red River was reported to be low and the dryness of the season was noted on September 26.

September 9: The weather fine & the water very low. (Red River Journal, HBCA B.235/a/13

1829/30)

September 26: Weather still fine owing to the dryness of the Season the Ground is so hard that the farmers are unable to Plough. (Red River Journal, HBCA B.235/a/13 1829/30)

1829-1830	Very High

- The very high water level of the Assiniboine in April and much of May, and the winter conditions leading up to them, are described in detail in PART THREE

- The summer, however, was very dry, in the Red River Settlement at least.
  July 29: This Spring the whole of the people in my neighbourhood have suffered severely from the heavy rains which fell in May. In the beginning of May, the rain fell in such abundance that the whole surface of the plains was a sheet of water. This obstructed every kind of Agriculture for upwards of ten days. As soon as the land was so dry as to bear cultivation, the people commenced sowing. The seed time lasted for 20 days, the weather being so dry as to allow us to work upon the ground. After we had sown the wheat and planted the potatoes, the rain fell in such profusion that the ground was perfectly deluged. This continued till it destroyed a large portion of the wheat and most of the potatoes. This is a general calamity in my neighbourhood; about 10 miles further up it has been partially felt. Since the 15th of June, we have had only one slight shower. The ground is now parched with the long continuation of dry weather. (Letter, Rev. W. Cochran to Secretaries, Church Missionary Society, London, PAM MG7 B2 CMS A77, p. 395)

- An additional comment the following spring confirms the low water in the late summer and fall of 1830.
  April 25, 1831: ...It is rather Singular that the ice in both the Rivers have dissolved (notwithstanding the Weather has been cold) and the Rivers ran clear all at once without any Ice drifting. But this may be accounted for [by] their Shoalness last autumn and the principal Substance was Snow in place of Ice. (Fort Pelly Journal, HBCA B.159/a/12 1830-31)

- Despite the low water during the late summer, the very high runoff in the spring freshet suggests that overall runoff would have been very high.

1830-1831	High

- The winter weather and streamflow conditions during this water-year are described in detail in PART THREE. The spring peak was short and small and total spring runoff was undoubtedly low. This was followed, however, by remarkably frequent and heavy rainfall during June and July which caused sufficiently high summer water levels that overall runoff during the year was probably high.

1831-1832	Low

- Daily records at Fort Pelly indicate relatively dry mild weather throughout October

with some snowfall after the 21st. Ice formed on small water bodies but melted by the 28th.

October 25: Sharp frost. The Small Lakes & Creeks taken with Ice We may now Expect the winter to commence from the long continuance of fine weather. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

October 28: Wind South and the weather mild which has now dissolved most of the Ice that was taken. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- Snow which fell in October was melted by mild weather early in November which continued until the 27th. Small snowfalls were reported on 6 days, with one heavier fall on November 14-15.

November 14: fell about 2 Inches of Snow this Evening. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

November 15: Snowed most part of the night and the morning was so mild that the Thermometer rose to 30° above 0. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- Severely cold and milder weather alternated throughout December. Snow fell on eight days, two of which appear to have been significant.

December 18: fell a good deal of Snow during the night. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

December 26: Snowed most part of day. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- The weather was unusually mild in January with one cold spell (January 23-27) and virtually no snowfall.

January 7: Weather continues mild. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

January 10: Weather continues mild for the Season. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

January 21: The weather Mild and Blowing a gale from SW at day break...in the plains...in many places the ground is bare of snow. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- Severe cold prevailed from January 30 to March 1 with somewhat greater snowfall.

February 8: the weather More Mild Wind East. Snowed a little during the night and continued most of the day. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

February 14: We had this morning the lowest temperature of Cold, we ever Experienced even during Mr. R. two years residence in Churchill being 43 Degrees below Zero. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- Very mild weather arrived on March 2 and continued to the end of the month with only short colder intervals. Comments on the lack of snow and possible low water become common.

March 2: a mild day. So much So that the Snow was melting on the tops of the Houses. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

March 10: there is every appearance of low water this year. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

March 20: The Thermometer rose pretty high to day which has had a great effect on the

pretty Snow. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

March 22: Weather fine Snow disappearing fast...I fear our winter transport is nearly closed, towards the Old fort & from that place to Pine camp the Snow on the plains & rising Ground is almost gone. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

March 25: the wind has again got round to the Southward which I fear will dissolve the few grains of Snow remaining. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

March 28: Thermometer 52 above 0...the Snow is nearly all disolved...the Sudden disolving of the snow has completely put an end to trapping. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

March 29: Froze pretty Sharp last night...the Small Creeks nearly overflow their banks, the Snow, except in the woods & Sheltered places was entirely dissolved and very little water in the Plains. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

April 7: fell a light Scume of Snow during the night which Scarcely covered the Ground...killed a Duck to day. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- Breakup in the vicinity of the upper basin had begun by April 10 and continued for the following week. The Red River had opened by April 18.

April 10: Weather Warm. The people returned from Swan River. Which they Say is nearly breaking up. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

April 12: The Men Returned from Swan River Says that the water rose but the Ice appears to hold Still to the Bottom. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

April 14: Weather fine...the River...is broke up and the Ice drifting down but remarkably Shoald more So than any of the people ever Seen before. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

April 18: The [Red] River being now clear of ice, as far as Netley Creek, and the most of the snow thawed. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Only small amounts of rain fell in April and the level of the Assiniboine was very low.

April 25: Remarkably dry Weather. The rivers getting very low and we fear there will be much difficulty in getting down everything. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

April 30: Froze hard during the night...the Ground was hard frozen in the forenoon [getting the property down in time] would be no difficult task if the River was not so low. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- May began cold but became very hot by mid-month and remained dry throughout (although a heavy fall of snow occurred at Red River on May 7).

May 7: Had an extraordinary fall of snow. The storm continued to rage for twenty four hours, till many drifts were formed higher than any we had the preceding winter. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

May 7: The Weather Milder...they seem to think that a Batteaux can hardly be taken down over the Rappids light without the River rises. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

May 15: Weather remarkably fine but vegetation comes on very Slow owing to the Scorching Drought. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

May 18: Severe frosts every morning and dry Scorching weather throughout the day. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

May 23: Scorching dry Weather and Scarce any appearance of vegetation. (Fort Pelly Journal, HBCA B.159/a/13 1831-32)

- Fort Pelly records ended for the season on May 25 with the comment "A Continuance of the Same dry weather".

- Heavy rains fell at Red River in June and there is an indication (see July below) that much more rain had fallen there in early May than at Fort Pelly.

June 14: Heavy and incessant rains are falling in this neighbourhood. The ground is deluged, the wheat and barley look sickly and many potatoes which are planted on wet soil are rotting. At Netley Creek...the rains are heavier than they are at the Rapids. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

July: The whole season has been unfavourable. We had heavy falls of rain & hard frost up to the 20th of May. About the 24th the weather became genial. This left us very little time to put down a crop. About the 10th of June heavy and constant rains commenced, rotted many of the potatoes. (Letter from Rev. Wm. Cochran to Secretaries, Church Missionaries Society, London, undated, PAM MA MG7 B2 CMS A77)

- An early frost on August 19 and then again on August 29-30 severely damaged crops at Red River.

August 19: The morning air was excessively cold, a thick hoar frost covered the ground and the stagnant waters of the swamps were frozen...The potato tops are blasted. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

August 30: A most unexpected frost last night which completely cut down everything in the shape of vegetation; there are many sorrowful faces at Red River to day as by far the greatest part of the wheat is in an unripe state. (David Jones Journal, PAM MG7 B2 CMS A92)

- Little information is available at Red River during September, apart from a heavy thunderstorm on the 9th and strong heat on the 18th. By the end of the month, temperatures were cooler there and snow fell at Fort Pelly on September 28.

September 26: The weather is now turning cold-the leaves are falling, showers of snow are driven about and there is every indication of an early fall. (David Jones Journal, PAM MG7 B2 CMS A92)

September 28: Cold disagreeable weather with snow showers. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- Despite some indication that rainfall at Red River may have been greater than at Fort Pelly, the very low spring freshet and dry weather reported at Fort Pelly throughout May suggest overall runoff was low.

1832-1833	Normal

- Rain fell at Fort Pelly on October 9 but thereafter only 2 days with precipitation were

reported until November 2.
November 2: Snowing the whole of the day which will no doubt put an end to the fires. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- November was very mild until December 11, apart from a cold period from the 16th to the 20th.
November 23: Some Snow fell last night but not in Sufficient quantity to be of service. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

November 26: It is a surprising proof of the mildness of the season that no snow remained on the ground yet, which generally is the case every year six weeks before this. (David Jones Journal, PAM MG7 B2 CMS A92)

- In December, periods of intense cold alternated with milder weather until the 22nd when it became cold until January 7.
December 12: I arrived [at the Stone Fort] at eight in the evening almost stiff with cold; thermometer being 14 degrees below zero or 46 below the freezing point. (David Jones Journal, PAM MG7 B2 CMS A92)

December 20: Therm. 28 below zero this is the first regular cold day we have had. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- Snow seems to have fallen heavily at Red River in mid-January and the weather there was cold until the 21st when thawing conditions set in.
January 14: the track [to the Stone Fort] is wretchedly bad owing to the late heavy falls of snow. (David Jones Journal, PAM MG7 B2 CMS A92)

January 21: Weather unseasonably mild-the snow quite soft and the eaves of the houses in the middle of the day dripping like in spring weather. (David Jones Journal, PAM MG7 B2 CMS A92)

- No further useful comments are given at either Red River or Fort Pelly until late February when temperatures of -30 to -40°F were reported at Fort Pelly from February 24 to March 3.

- A sudden change occurred at Fort Pelly on March 4 with exceptionally warm weather and thawing from March 5-8.
March 8: Ther at mid-day 55 above and snow diminishing. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- After a week of cold weather (March 9-15), very warm weather returned and continued until April 7.
March 16: fine weather ther in the course of the day 50 above Zero snow fast diminishing. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

March 23: fine weather...we have now very little snow. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

March 28: Mild weather with a little rain snow fast disappearing. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

March 29: I proceeded to the Stone Fort on horseback the Snow being nearly all melted away and too much black earth for the cariole to draw. (David Jones Journal, PAM MG7 B2 CMS

A92)

April 2:...the snow has entirely disappeared first geese seen. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

April 6: Mild weather some snow fell last night which disappeared in course of the day. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- A return to generally colder temperatures from April 7-16 delayed breakup and worries were expressed over the low state of the rivers.

April 18: fine Weather...we are now anxiously waiting the Breaking up the Assiniboine and swan Rivers. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

April 20: Snowing the whole of the day this I am in hopes be of great Service to us not only in breaking up the Rivers but raising the waters in them which hitherto has been unusually low. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- The Assiniboine broke up April 21-23 and the following week had considerable rain.

April 21: fine weather...the snow [in the fort] fully a foot in depth...the River is still fast. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

April 22: fine mild weather the snow has nearly disappeared. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

April 23: fine W therm 65 above Zero...the River is now broke up. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

April 26: A heavy rain last night but this morning promises fine weather. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

April 27: April showers falling all day... (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- Rain continued to be frequent and heavy at Fort Pelly until May 21 (with snow on several days) and the Assiniboine was unusually high and rising.

May 4: Stormy Weather with heavy & constant rain...Swan Lake...still fast. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

May 5: Constant Rain. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

May 5: the rain was falling in torrents and the swamps were so deep that my horse could not carry me. I was obliged to plunge through them on foot [at Red River]. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

May 11: Severe Cold Weather with snow. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

May 15: raining great part of the [day]. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

May 16: Snowing in the morning afterwards succeeded by cont. rain. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

May 18: a constant pour of rain the whole of the day the River is now unusually high and Still Rising. (Fort Pelly Journal, HBCA B.159/a/14 1832-33)

- The Fort Pelly Journal reported rain on 12 days from May 4 to May 19. The record there ended with "fine weather" from May 21-26 but an entry upon their return in

September suggests that the summer was very wet with flooding.
September 7: from the heavy and constant rain during the Summer this part of the country may be said to have been under water in Several places. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- The snowmelt freshet seems to have been very small but heavy rain in May (and apparently throughout the summer) suggests that overall runoff can be (conservatively) estimated as at least normal and it may have been high, depending on the magnitude of summer flooding.

1833-1834	Low

- Some snow fell at Fort Pelly in October and temperatures were cold from the 10th onward. The Assiniboine began to freeze on October 20.

- Milder weather in November removed the snow by the 7th and the weather became extraordinarily warm during the last week.
November 21: Therm. 10 above fine Weather...[Indians unable] to follow the tracks for want of snow. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

November 26: therm. 55 above most extraordinary weather for this season of the year. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Mild temperatures prevailed both at Fort Pelly and Red River until December 26th. Although the weather became colder after the 26th, little snow fell.
January 3: Therm. 33 below...there is not sufficient snow for Trains, an unusual circumstance at this season of the year. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Snow which fell on February 3 was melted by a return to mild weather by the 9th.
February 9: the weather excessively warm which carried off all the Snow from the Plains (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

February 12: ...there has been little or no snow in plains. What there was the late mild weather has carried off. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

February 17: fine Weather...no snow on the ground [on trip to Beaver Creek] nor has there been sufficient for trains any time during the winter. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Temperatures remained mild until early March and the only precipitation reported was considerable rain on February 26.
February 26: a constant pour of rain the whole of the day. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Colder weather began on March 6 and snow fell on several days before the end of the month. Spring conditions arrived in earnest on March 29 with some snow on March 31 and April 1. From the April 2 comment below, mild winter conditions must have been widespread across the prairies.
April 2: Therm. From 10 to 42 above fine Weather...[a man] informs me the South Branch of Saskatchewan has been open since February. (Fort Pelly Journal, HBCA B.159/a/15 1833-

34)

April 6: Therm. 70 above most extraordinary weather for the season of the year, and what is rather surprising no wild fowl have made their appearance altho the wind has been constantly from the Southwd for several days & frogs were heard this evening. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

April 9: the snow has now nearly all dissolved and the surface of the earth beginning to be soft. This is the earliest spring I have seen in Red River, it is just one month earlier than it was the year of the Deluge [1826]. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Despite the small snow cover, high water was initially reported in the upper Assiniboine basin on April 11 and temperatures were extraordinarily warm. Water levels began falling soon after, however, and concerns about low water began to be expressed.

April 11:Therm. 83 above heat oppressive...[some men] found the travelling very bad as all the Rivers are broken up and very high. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

April 16: Therm. From 25 to 50 above fine weather. River falling fast. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

April 17: Therm. 45 Snowing & raining the whole of the day which I hope will keep up the River. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

April 21: ...the State of the water [still falling off] makes me anxious to get [the boats] down as soon as possible. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- The warm weather continued throughout April and May. Rain fell on April 28-29 and May 3-4 but there is no further mention of the state of the river. No additional information is available until late September when "unusually low" water was encountered during the brigade's return.

September 26: cold severe weather arrived at mid day Just 20 days from Red River Settlement where I left every thing quiet with abundant crops had some delay in the Lakes from Stormy Weather also in the Rivers from the unusual low state of the water... (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- It is concluded that overall runoff during the water year was low, or at best in the lower range of normal.

1834-1835	Low

- At Fort Pelly, October had both cold and mild weather with considerable precipitation (3 days of rain, 7 with snow). The Red River froze October 25-28.

October 7: disagreeable weather with rain. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

October 17: Therm. 22 above zero Snowing great part of the day. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

October 25: Was prevented from visiting the Indian Settlement owing to the state of the River which is now froze but not sufficiently strong to carry the weight of a person. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

October 29: therm from 36 to 58 above heavy rain in the morning but fine weather the rest of the day. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- November was "fine" or "mild" with some snow reported. Cold weather began on November 29 and generally remained so through December (but with thawing conditions on December 13-17). There was little snow on the ground until late in the month at Fort Pelly and early January at Red River.
  January 10: The weather cold and stormy, the snow drifting almost to suffocation the track invisible by the heavy fall of snow. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

  January 20: The wind blowing high from the North, the snow drifting every track full. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- February at Fort Pelly was alternately mild and very cold with little snow reported.

- Warm weather arrived suddenly at Fort Pelly on March 11 and thawing conditions continued to the end of the month. Little new snow was reported at Fort Pelly but more seems to have fallen at Red River. By the end of March, there was no snow on the prairies in the region of the upper Assiniboine basin.
  March 19: ...the snow has nearly disappeared. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

  March 20: The weather exceedingly stormy, a strong wind blowing from the north with much snow which rendered the track invisible, the drift flying thick almost to suffocation...The drifts in many parts were as high as the tops of the bushes. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

  March 24: fine Weather...[some men] say the Snow has entirely disappeared [toward Carlton House]. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

  March 27: ...the Snow has entirely disappeared in the plains. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

  March 30: ...the Snow has now entirely disappeared in the woods as well as in the plains. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Rain fell at Fort Pelly on March 31-April 1 and small water bodies were already open. The Red River continued to be snowy.
  March 31: disagreeable Weather with rain Several of the Small Lakes are now open. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

  April 6: ...the track had many parts the snow and water to the horses belly. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- The lack of snow cover and precipitation made the people at Fort Pelly apprehensive of low water. By April 5-8, temperatures of 60-70° were reported.
  April 3: fine Weather but blowing Strong from the South. This constant windy weather has entirely dried up the water which I fear will be very low in the Rivers when they break up. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Colder temperatures began on April 9 and most of the rest of April was cold. The rivers were not thawed by April 21 but were open by the 25th. More fears of low water were expressed.

April 21: therm 22 above Stormy Weather...from the Rivers being still fast we are now at a stand...[sending goods by water] I believe will be entirely out of the question as there is every prospect of the Rivers being unusually low. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

April 26: Cold disagreeable Weather with Snow forwarded the Batteaux to Beaver Creek in consequence of the very low state of the water. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

April 28: Therm 18 above disagreeable Weather...[some men] found rather more water after they passed the White Mud river. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Snow fell at Fort Pelly on the 26th and 29th and cold temperatures continued into early May.

May 1: Therm. 27 above Stormy Weather altho so far advanced in the Season there is not the least appearance of vegetation which cannot be otherwise from the continued frost at night and Strong gales during the day. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

May 6: Therm. 20 above Gloomy Weather...[some men] inform me the Lake is Just as firm as in the middle of Winter. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

- Although the weather warmed after May 6, significant precipitation was not reported until May 17 and 20th and the water level was very low. On June 5, Provencher complained that the weather was "too dry".

May 13: Therm 79 Still blowing Strong from the South some rain fell in course of the day...Jack Easter returned from Beaver Creek he was nine days getting there he says he has not seen the water so low for 40 years. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

May 17: Therm 48 heavy rain during the day. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

May 20: Snowing and raining the greatest part [of the day]. (Fort Pelly Journal, HBCA B.159/a/15 1833-34)

June 5: nous avons eu un hiver court et pas bien froid. la neige etoit fondue a la fin de mars, nous avons eu des revers en avril et mai. Ici le temps est trop sec. (J.N.Provencher to J.I.Lartigne, dated Riviere Rouge, 5 juin, 1835, PAM MG7 D1)

- Scattered entries in Cochran's Journal during the summer at Red River refer to "oppressive heat" in mid-June and early July, "frequent rain" (July 17) and "gloomy & autumnal" weather by August 23, with "sleet and rain all the day" on August 24. Overall, however, there is no indication of abnormal precipitation amounts.

- The extremely low water in the spring freshet period, dry conditions in May and June, with no indication of a particularly wet summer suggest that overall runoff in the water-year was at least low and perhaps very low.

1835-1836	Insufficient Data

- No information is available from the Assiniboine basin.

- Conditions at Red River indicate an early onset to winter. The ground was snow-

covered by October 10 and the Red River was frozen by October 25-28 (David Jones Journal, PAM MG7 B2 CMS A92)

- Scattered comments from late November to early March all indicate very cold winter weather but make no reference to snow conditions.

- By March 26, it was thawing strongly.
  March 26: Rain and sleet all day & the snow melting fast...the ground covered with slush more than half knee deep. (David Jones Journal, PAM MG7 B2 CMS A92)

  March 31: The roads are now nearly impassable with melted snow. (David Jones Journal, PAM MG7 B2 CMS A92)

  April 2: Weather very fine and the snow is disappearing fast. (David Jones Journal, PAM MG7 B2 CMS A92)

- Significant precipitation occurred in early April; the Red River opened on April 15.
  April 3: ...the morning was very gloomy. All the ground covered with snow excepting a few patches here & there which had been laid bare by the sun of the last two days... (David Jones Journal, PAM MG7 B2 CMS A92)

  April 6: A heavy rain last [night] and subsequently warm morning; but the wind veered to the North in the middle of the day and brought on sleet and snow again. (David Jones Journal, PAM MG7 B2 CMS A92)

  April 12: A good deal of snow fell last night again but the air is generally warm. The ice moved a few yards in the afternoon. (David Jones Journal, PAM MG7 B2 CMS A92)

- By late May, Jones was complaining of drought, despite heavy rain on May 29. The drought ended in early June.
  May 28: Our Wheat, Barley, potatoes and garden seeds are all sown...the drought however at present is severe and keeps everything backward. (David Jones Journal, PAM MG7 B2 CMS A92)

  May 30: The drought is very severe; there was a slight shower with thunder in the afternoon but it soon passed away again. (David Jones Journal, PAM MG7 B2 CMS A92)

  June 6: Soon after retiring last night we were disturbed by the approach of a thunder storm and the sound of abundance of rain, which nature has been gasping and panting for, for weeks past. (David Jones Journal, PAM MG7 B2 CMS A92)

  June 30: We were overtaken between Grantstown and this little Settlement by a most terrific thunderstorm which drenched us terribly; the reverberations accompanying the frequent electrical discharges were the most stunning I ever knew. (David Jones Journal, PAM MG7 B2 CMS A92)

- Crops were damaged by the early season drought, a severe frost on June 8, and a killing frost on August 19.
  August 19: On the 19th of August we were visited by a most destructive frost which destroyed the reward of the farmer as to agricultural [sic] in wheat; it was truly a gloomy morning the whole of the vegetable world drooped and blackened as the sun grew warm and air was filled with a most unpleasant odour.... (David jones to William Jowett, Church Missionary House, London, dated Red River Settlement, Oct. 20, 1836, PAM MG7 B2 CMS A92)

- It seems likely that the water in the Assiniboine basin was low but there is insufficient data directly from the basin to be confident.

1836-1837	Low

- No information is available from the Assiniboine basin until September, 1837.

- At Red River, snow fell on October 16 and in mid-November but cold weather was late arriving and overall snowfall was apparently slight.

December 3: The Manitobah Lake had but recently its icy covering. {Simpson, T., 1970. Narrative of the Discoveries of the North Coast of America, vol. 1, 2nd ed. Canadiana House, Toronto, p. 29)

...The season continued cold, drizzly, and frosty, till the latter end of October, which added another item to the catalogue of evils by destroying the fall fisheries: after that, however, the weather became unusually mild and pleasant, insomuch that men were whistling at the plough on the 12th of November, and hauling their carts without snow, till the 14th of January, 1837. (Nor'Wester Newspaper, July 1, 1861, "History of the Red River Settlement", extracted from the original by Alexander Ross, The Red River Settlement, Hurtig Publishers, Edmonton, p. 188)

- Little useful information exists until late March and early April which were very cold. Cold weather continued throughout April and May with little precipitation. According to Cochran's April 24 comment, little snow had fallen during the winter. Breakup of the Red River didn't occur until the end of April.

April 13: First ducks of the season at table to day. The ice in the river is as solid as in December. Since the year of the deluge I have not seen so late a spring. (David Jones Journal, PAM MG7 B2 CMS A92)

April 24: Very little snow has fallen during the winter, this has exposed the ground to all the influence of a dry cold which is more pernicious to agriculture than any summer drought...There are fissures in the earth sufficiently wide to admit the foot of a horse or ox, and many of them are four feet in depth. These run in every direction dividing the ground into small pieces of two or three yards square, thus all the moisture has evaporated and the frost has gone to an unusual depth. As there is no water from the melting of snow and no rain to enter the earth and thaw it, all beneath 4 inches on the surface (which is affected by the solar rays) down to the depth of 4 feet is as hard and dry as rock, and cold as ice.
(W. Cochran's Journal, PAM MG7 B2 CMS A85)

April 26: Since [April 13] the weather has been very unfavourable and gloomy. This day the ice moved about twenty yards and then choked up again. (David Jones Journal, PAM MG7 B2 CMS A92)

May 10: The state of the weather has kept every thing in a most desponding state. Cold bleak winds from the North and every morning ice half an inch in thickness. (David Jones Journal, PAM MG7 B2 CMS A92)

May 22: The weather continues dry, cold and stormy. Very little of the wheat that we have sown is germinating. There is every reason to believe the wheat crops will fail again...At present a great quantity of the wheat which was sown 3 weeks ago, is as dry as when in store. (David Jones Journal, PAM MG7 B2 CMS A92)

- Drought persisted into June when rain fell heavily on the 8th and 12th. Cochran's comment on June 11 (below) reiterated the dryness of the preceding winter.

  June 8: At midnight there was thunder and rain and in the afternoon the object of many prayers was granted in a fine general rain which fell without violence and without ceasing the whole of the evening. (David Jones Journal, PAM MG7 B2 CMS A92)

  June 11: This evening we were favoured with a weighty shower of rain that saturated the ground 4 inches in depth. Few can conceive the gratitude that was felt in many a bosom to God for this refreshing shower. We have had no rain since September and scarcely any snow during the winter consequently everything is parched, and no appearance of summer...our fields are just as we sowed them, and our cattle come lowing home for want of grass. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Severe frosts occurred on June 19 and 29 and crops were affected. Provencher confirmed the lack of winter snow or spring rain.

  July 4: j'ai trouve le pays pauvre parlemanque de recolte les grains ne promettent rien cette annee, ainsi triste perspective pour notre avenir. Le tems a ete trop froid et trop sec. Il n'y a pas eu de neige et ce printemps il n'y avait pas assez d'humidite dans le terre pour faire germer le grain qui a mis beaucoup de tems a lever. (J.N.Provencher toJ.I.Lartigne, dated 4 July, 1837, PAM MG7 D1)

- Some rain fell in August, and September was very wet.

  September 6: ...heavy rain and miry track. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

  September 7: We have had two days of thunder and rain of the most alarming nature, the lightning was incessant and vivid...The plains are now covered with water. Found the track nearly impassable. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

  September 11: The weather extremely unfavourable for harvest, the ground covered with water. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- When the brigade returned to Fort Pelly, they noted the lowness of the water generally along their route.

  September 14: at mid day arrived from York Factory being...eight weeks an unusually long voyage... [because of] Stormy weather in Lake Winnipeg, low State of the Water in the Rivers after leaving Norway House, particularly Shoal River...the Crops [here] had entirely failed, not even seed. (Fort Pelly Journal, HBCA B.159/a/17 1837-38).

- The winter and spring drought was severe at Red River and the September 14 comment suggests that it extended to the Assiniboine basin as well. Although there is no direct evidence, it is likely that runoff in the Assiniboine was at least low and possibly very low.

1837-1838	Normal

- October was very wet at Fort Pelly. Snow fell on 10 days, beginning on the 2nd with rain on 3 other days.

  October 3: men soon obliged to leave off [taking up potatoes] in consequence of a heavy fall of Snow. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

  October 4: ...it commenced Snowing which continued most part of the day. (Fort Pelly

Journal, HBCA B.159/a/17 1837-38)

October 8: Most disagreeable Weather with thunder lightning & Constant rain. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

October 10: towards Mid day it commenced Snowing which continued without ceasing the remainder of the day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

October 12: Therm. 8 above fine clear weather...there is now an unusual quantity of Snow on the ground for this season. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

October 13: Gloomy weather...heavy rain. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

October 16: Gloomy weather with heavy rain towards evening. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- Mild temperatures and rain removed the snow cover by the 15th but further snow fell on 9 days from November 1-19. Temperatures were generally mild until the end of November and the snowpack was reduced.

November 1: Snowing great part of the day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

November 8: Therm. 18-32 with constant Snow during the day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

November 12: therm. 18-30: with a heavy fall of snow. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

November 17: therm. 28-43 above with a heavy fall of Snow in the morning which changed to rain after Mid day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- December was cold with further heavy falls of snow on the 1st, 15th and 25th, and in January on the 11th.

December 1: most disagreeable weather attended with a heavy fall of snow. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

December 15: Therm. 5 below 8 above Snowing the whole of the day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

December 25: Therm. 6 below 5 above a heavy fall of snow last night. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

January 11: Therm. 1 below 12 above snowing great part of the day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

January 14: Therm. 14-28 above fine weather...the Travelling is now very heavy from the great depth of snow. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- Temperatures were generally moderate from mid-January to mid-February. Cold weather prevailed from February 20 to early March with another heavy snowfall on February 24.

February 24-27: ...a constant fall of snow with Stormy weather which continued the whole of the Journey [to Fort Ellice]. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- Mild weather arrived on March 8 and continued into April with a very early spring.

Thawing began on March 9 and because of mild March temperatures and little additional snowfall, the snow near Fort Pelly was gone by March 28.
March 28: Therm. 30-62 Wind SE...snow entirely off the ground. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

March 29: Therm. 38-81 Wind S.W. geese and Ducks Seen an extraordinary occurrence at this Season the River is also reported open in Several places. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

March 31: Therm. 30-55 Wind NE...frogs heard another unusual occurrence in the Month of March. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- The Assiniboine opened on April 4. Rain fell at Fort Pelly on April 4 and 6 and snow fell on April 11. By April 12 the Assiniboine was described as "high".
April 4: Therm. 45-71...the River was perfectly clear of ice. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

April 12: Therm. 9-30 Wind NW blowing a gale...as the River is now high [some men] had to be crossed with a Canoe. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- Additional snow fell at Fort Pelly on April 15-17 and on April 23-24 but the river level had been falling for some time before the 26th.
April 16: Therm. 27-41 Wind SE Snowing the whole of the day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

April 24: Therm. 34-36 Snowing the whole of the day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

April 26: Therm 32-47 Wind NE the snow has now disappeared without adding to the Water in the River which still continues to fall off. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- No further precipitation fell until May 19, the final entry at Fort Pelly.
May 14: ...found the roads heavy which I am rather surprised at from the long continuance of dry weather. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

May 19: in consequence of heavy rain in the morning I was unable to take my departure till after Mid-day. (Fort Pelly Journal, HBCA B.159/a/17 1837-38)

- At Red River snow fell on May 22 and heavy rain on May 30 and June 2 and 17. There is no information from August. September at Red River was cool and dry, apart from heavy rain on September 23.

- From the entries at Fort Pelly, the freshet runoff was high but relatively short. It is likely that overall runoff was within the normal range.

1838-1839	Insufficient Data

- No information from the Assiniboine basin is available. At Red River, heavy snow fell on October 14 and scattered references suggest that the entire fall and early winter were cold, with little indication of significant additional snowfall.

October 14: Set out early for the Upper Church, track deep strong wind from the North heavy snow...Returned, an awful storm, at some times the wind would fairly poise me and the horse and the snow was drifting thick and direct a head. I had often to turn my horse round from the wind and wipe the congealed snow off his face. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Moderate or even mild conditions occurred from January 2-15, becoming colder but not severely so thereafter. Snow was reported on only 3 days but may have been more frequent; drifting was reported on numerous days.
January 13: ...Snow very deep. (Red River Journal, HBCA B.235/a/14 1839)

January 20: ...the track deep [on the way to Upper Church]...the weather stormy and excessively cold. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

January 28: ...the weather stormy and excessively cold, snow drifting so thick as to render the track invisible. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- February began cold but became mild on February 7 and remained so until the 26th with thawing conditions on several days. Snow was only reported on 3 days in February but may have been more common since 9 days were described as stormy.
February 18: ...rapid Thaw Snow disappearing fast. (Red River Journal, HBCA B.235/a/14 1839)

- Cold and mild conditions alternated until mid-March when mild conditions with thawing became predominant. Considerable snow fell from March 7-13.
March 7: The morning stormy, snow falling and drifting so as too obscure the track and every object. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

March 11: heavy fall of snow. (Red River Journal, HBCA B.235/a/14 1839)

March 13: The weather still stormy and track nearly impassable owing to the heavy fall of snow. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

March 20: rapid thaw. (Red River Journal, HBCA B.235/a/14 1839)

- By March 30, strong thawing temperatures were reported with water covering the Red River ice on March 31-April 2. Heavy rain fell on April 4 and 11-14 and the Red River was partially opened by April 8.
April 3: Rapid thaw, great deal of water upon the ice. (Red River Journal, HBCA B.235/a/14 1839)

April 7: The plains covered with water and half melted snow, thinly crusted with ice. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

April 15: Fine weather. Commenced our agricultural operations. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- No further observations are available in April.

- At Red River, May was generally cool with snow on the 1st, 7th, 13th and rain on the 10th, 19th, and 20th. Overall amounts must have been slight, however, because the soil was dry on the 20th. The crops were injured by frosts on the 19th and 25th.
May 20: Gentle rain, very opportunely. The Stormy North winds which have prevailed since

the beginning of the month have dried up everything. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

May 25: weather excessively cold, hard frost in the evening, much wheat cut off. (Red River Journal, HBCA B.235/a/14 1839)

- Warm weather arrived in June and became "oppressively" and "intensely" hot by mid-month. No rain was reported until July 4 when drought was affecting crops.
  July 4: Returned in the evening, heavy rain and loud thunder...The rain was much required, the fields were yawning for it. Many of these openings in the wheat were sufficiently wide to admit the hand to be pushed down 8 inches. Had the drought continued many days longer, my fields of wheat would have dried from the roots. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Rain fell again on July 7th and no further information is available until mid-August when the growing season was described as "dry and exceedingly warm".
  August 12: This has been one of the finest Summers I have ever passed in the Indian Country- The weather has been exceedingly dry and warm, but the heavy dews at night prevented its being injurious to the crops which are much more abundant than was anticipated. (John Ballenden, Fort Garry, to James Hargrave, dated Fort Garry, red River Settlement, 12th August, 1839, in The Hargrave Correspondence, 1821-1843. Greenwood Press, Publishers, New York, originally published as Champlain Society Publication XXIV, p. 304-5).

- Late August and most of September were wet, with rain on 11 days from August 25-September 14.

- There is nothing to suggest abnormal conditions in the Red River (although runoff may have been in the low range of normal) but there is no basis to extend this conclusion to the Assiniboine basin.

1839-1840	Insufficient Data

- No information is available from the Assiniboine basin. At Red River, little snow was on the ground by December 4.
  December 4: The track rough and so little snow upon it. (Red River Journal, HBCA B.235/a/14 1839)

- By mid-January, significant snow had accumulated and the last half of the month was very cold.
  January 13: ...the wind was blowing almost a hurricane. Thermometer 8 below Zero and the snow drifting. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  January 18: The wind was blowing strong and snow was fine as dust drifting along made it impossible to see the track. I know it would be scarce possible to get the Cariole through the deep snow...in the afternoon the wind abated considerably so that I was not much troubled by the drifting of the snow but what had fallen was so deep that my horse...could scarce get through it. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Most of February was also cold and deep snow was reported.

January 28: ...the cold is now excessive. Thermometer 20 below Zero wind blowing fresh and almost constantly snowing. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

February 6: At this time the ice upon the river in front of my house is near 4 feet thick. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

February 8: ...the snow is deep...that my horse sometimes nearly stuck fast. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

February 11: It has been one of the most winterly days I ever saw. Blowing almost a hurricane with clouds of snow as fine dust and the Thermometer 20 below Zero...the weather is such as nearly to prevent any one from moving out at all. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

February 22: It has been a most winterly day...the wind was blowing so strong and the snow drifting in such a way that it was with great difficulty the boy could get my horse to face it. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- No information is available from March but by April 4 a strong thaw was occurring.
  April 4: ...I had a most disagreeable ride owing to the Thaw. The horse was up to the knees in mud and water most of the way. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Cold weather returned on April 5 and the Red River was only breaking up on April 25.
  April 25: ...the River is in such a state that it is undafe to walk across and the ice is not sufficiently broke up to cross in a canoe... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Rain fell on April 29 and snow "nearly the whole day" on May 1 but it melted the next day. Heavy rain fell on May 12 and May 16-19.
  May 16: It rained nearly the whole day and was pouring down in torrents when I left home this evening...the ground is quite overflowed [my horse] was often to the knees in water...The rain has done a great deal of good for every thing was becoming very dry. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  May 17: ...the Roads being completely deluged with water. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  May 18: It being very wet to day so that we were not able to get on with ploughing. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- The weather became extremely hot at the end of May and through most of June, July and into August (although a severe frost on June 14 did some damage to crops). Scattered references indicate that rainfall was sufficient to produce good crops.

- It is likely that runoff in the Assiniboine was within the normal range but there is no direct evidence to support this conclusion.

1840-1841	Insufficient Data

- Again, there are no direct weather observations from the Assiniboine basin.

- Observations from Red River indicate an early freezeup (by mid-October) with snow.

  October 18: La neige commence ici le 18 octobre et elle couvre la terre qui est gelee; les rivieres sont prises et nous avons un long hiver. (J.N.Provencher to J. Signay, 20 Octobre, 1840, in Lettres de Monseigneur Joseph-Norbert Provencher, Premier Eveque de Saint-Boniface, Bulletin de la Societe Historique de Saint-Boniface, vol. III, 1913, Imprimerie du Manitoba, Saint-Boniface, p. 193)

- November was cold but apparently little snow fell.

  November 29: The roads not yet being sufficiently covered with snow [for the] Cariole...the Thermometer now being 20 below Zero. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Very cold weather continued through December and January and heavy snow fell in late January.

  January 23: It has been a most winterly day...the snow having drifted nearly to the height of the fences. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  January 24: Found it difficult to get along in consequence of the deep snow that fell yesterday. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  January 29: ...most boisterous journey. The wind was blowing strong and the snow drifting till we could not see the track and in some places could scarcely get through the drifts. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- February was also cold, apart from mild weather from February 15-22. Heavy snow fell on several days. By early March, the depth of snow seems to have been considerable.

- Strong melting was occurring by the last week of March and there were signs of an early breakup.

  March 21: Track almost impassable in some parts from overflowings; Stuck fast in them and got turned over into the melted snow. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

  March 22: Returned home through half melted snow, in many parts above the horse's knees. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

  April 2: The snow having melted a good deal the track was bad...We then proceeded along the river...I perceived by the light of the moon that there were open places in the ice. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  April 11: Snowing thick, river dangerous, the open places concealed by the new fall of snow...Returned home through deep snow. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Although melting occurred through much of April, the full onset of spring occurred slowly and river breakup was exceptionally late. Considerable rain fell on April 22nd, 23nd and 28th, and snow on 29th.

April 17: The roads now being so bad...the horse going nearly knee deep in mud and water the whole 13 miles. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 20: We now have an appearance of warm weather the snow has melted very fast to day and the ground is now impassable. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 22: The wind has changed to the north and we have had rain to day the first rain fo9r the last six months. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 28: It rained nearly the whole day which has for the present destroyed our prospects of being able to commence wheat sowing. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 29: The wind is now blowing a gale and it has been snowing and drifting all day as if it were the month of Jan. The ground is again quite solid and the snow several inches deep. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 30: We have now arrived at the end of April without any appearance of winter leaving us. Every thing looks just as it did at Xmas all locked up in the solid ice... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 1: The roads were worse than ever I saw them being for the most part covered with water that was frozen over an inch thick. The ice breaking with the weight of the horse let him through to the knees at every step. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 9: The ice in the river being unsafe to walk upon and not sufficiently open to pass in a canoe I have been unable to get across. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 11: Busy sowing wheat...The ice has to day been floating out of the river in large blocks from two to three feet thick. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 12: Finished sowing wheat to day. We have great reason to be thankful that we have been favoured with a week of such fine weather at this advanced period of the season. The river is now clear of ice and there is an appearance of the weather continuing fine. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- The weather from mid-May through August appears to have been normal in terms of precipitation and temperature, apart from an extreme fall of hail on July 19.
- Runoff in the Red River appears to have been in the normal range but this conclusion cannot be extended to the Assiniboine basin with confidence.

1841-1842	Insufficient Data

- There is no information from the Assiniboine basin.
- At Red River, winter conditions began in late October as the Red began to freeze on October 25. Rain fell on 3 days and heavy snow fell November 1-4.

October 25: I was detained some time in crossing the river, as it had frozen sharp during the night and I was compelled to wait while the ice was broken to make way for my canoe. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

November 1: Winter has commenced in good earnest to day. The wind has been blowing a gale from the north with a heavy fall of snow. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Additional precipitation fell in November and freezeup of the Red was completed November 16.

November 8: It rained nearly the whole way...and as it was also freezing I was completely caked in ice when I reached home. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

November 16: The river is now sufficiently frozen to admit of my horse walking across the ice. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

November 22: ...we have had very winterly weather the snow drifting the whole day. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Scattered comments suggest that December and January were cold and stormy with a deep snow cover.

January 6: The snow was deep and no track I could scarce get on. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

January 7: ...still found great difficulty in getting through the deep snow. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Cold persisted through most of February. By late March, strong thawing was occurring and spring arrived early.

March 27: ...going all the way by way of the river. There was a good deal of water upon the ice owing to the melting of the snow... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 2: The general thaw seems to have commenced in consequence of which it is not practical to travel by the river it is very bad getting about. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

April 7: The ice in the river has broken up to day and is consequently impassable until it has all cleared away. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 10: The river is now tolerably clear of ice and the Indians were able to cross. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Little precipitation was reported in April, apart from snow on the 25th (which melted the same day).
- There is no weather information for May and little from the summer. The Saskatchewan River was extremely low in June.

June 2: ...the Country is certainly poor but I think that the failure is owing to the extraordinary early setting in of winter and the no less extraordinary early spring which deranged the usual spring operations of the natives. (N. Finlayson [Fort Alexander] to James Hargrave, dated 2nd June 1842, in The Hargrave Correspondence, 1821-1843. Greenwood Press, Publishers, N.Y., originally published as Champlain Society Publication XXIV, p. 399)

June 14: The water in the [Saskatchewan] river is extremely low...[at the mouth of Saskatchewan on journey to Cumberland House]. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

June 17: In consequence of the extreme lowness of the water [in the Saskatchewan River] the Indians have been compelled to lighten the boat... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- There is insufficient data to categorize runoff in the Assiniboine basin, although the references to the low water in the Saskatchewan might suggest low runoff in the Assiniboine as well. Low water was also reported as being general in southern Minnesota for several years prior to and including 1842.

  In 1840, it was estimated that they [Sioux Indians near Lac qui Parle] made as much corn as in any two years previous to 1839. Last year [1841] their corn suffered from drought...they never planted so much corn ...as this season, but the cold weather in May...the several frosts between the 10th and 20th June, and the subsequent dry weather, have so entirely destroyed it, that it is doubtful whether they will have as much as one sixth, or even an eighth as much as last year...For the last few years the waters in all the prairies northwest of Traverse de Sioux have been rapidly diminishing. Where a few years since, were beautiful lakes several miles in circumference, now not a drop of water can be found. Even streams dignified with the name of river, in which the Indian was accustomed to paddle his canoe, have entirely disappeared, and where the trader dreaded to pass, because it was difficult and somewhat dangerous or impractical to transport his goods dry in carts, he now searches in vain for water to quench the thirst of himself and haorse. The muskrat ponds have dried up, and the muskrats in them have perished, or [have] gone, nobody knows where. (Report of the Commissioner of Indian Affairs for 1842, Serial 413, pp. 417-431, quoted in Parker, D.D., 1964. Lac qui Parle: Its Missionaries, Traders and Indians. South Dakota State University Press, Brookings, S.D., p. 214-5)

1842-1843	Insufficient Data

- There is no information from the Assiniboine basin.

- At Red River, heavy rain fell in early October and heavy snow on November 12. The Red was frozen on November 14.

  November 14: The winter has now commenced in good earnest, the thermometer at Zero and the river frozen over. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Considerable snow fell in early January.

  January 8: ...the track [was] heavy in consequence of the drifts of snow carried together by the storm of yesterday. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- From late January through February and March, the weather was intensely cold, with some snow. Severe conditions extended over a broad area (see March 31).

  February 12: [attendance was poor] owing partly I suppose to the deep snow that has fallen recently. The thermometer being 40° below Zero... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  February 16: The thermometer was this morning 52° below Zero. [This] excessive cold...has

now lasted nearly three weeks. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

February 19: For the last 10 days the thermometer has in a morning been generally down at the point where Mercury freezes, namely 40° below Zero, and on two occasions it has been even twelve degrees below that or in other words at 52° below Zero. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

March 6: It commenced snowing when we left the Fort and continued the whole day, sometimes drifting to such an extent that we could not see the track. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

March 31: The winter of 1842-43 was one of the severest winters I ever saw. The snow fell first about a foot and a half [deep], and went off mostly and fell again over a foot, and mostly went off again. And in February [snow] fell again, near two feet, again making in all nearly four feet of snow... [at Prescott, Wisconsin]. (Parker, D.D. The Recollections of Philander Prescott, Frontiersman of the Old Northwest, 1819-1862. University of Nebraska Press, Lincoln, Nebraska, p. 173)

- Thawing was occurring by April 7 but April was generally cool and river breakup didn't occur until April 20-23.

April 7: The thaw is now going on very rapidly and there being so much water I find it difficult to move about. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 14: The morning [was] very unfavourable in consequence of a heavy fall of snow mixed with rain. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 20: There was in the afternoon a more general breaking up of the ice and the river is now impassable. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 23: The river being full of floating ice is quite impassable... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 24: In the afternoon the weather was so unfavourable owing to a cold north wind and excessive rain... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 28: ... a very stormy day of wind and rain. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 29: It has been snowing all day and the snow drifting with a strong north wind till at times I could scarce see twenty yards from the house... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 4: The weather continues cold and wet and the land unfit for the plough. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- The weather improved after May 4, although snow fell on May 15.
- Very heavy rain fell on June 15 and 25th but little additional information is available until the harvest period from August 14-30 in which the weather was warm and dry.
- In early September, heavy rain fell as Smithurst travelled from the Forks to Portage la Prairie.

September 4: [near White Horse Plain] there came a most awful storm of thunder, lightning and rain with scarce any intermission. The rain came down in torrents...The storm lasted for

a full hour... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

September 5: ...before we had advanced five miles the rain came down in torrents...The rain continuing we pitched there for a day...[near Long Lake]. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

September 7: [At Portage la Prairie] we had such a storm of wind and rain that I expected [the tent to be blown away]... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Additional rain fell at Red River on September 18-19 but low water was reported between York Factory and the Forks in October.
  October 9: The Boats arrived from York this morning bringing supplies from England. Owing to the lowness of the waters my carrier has left behind five of my Bales...(J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- The data are not sufficient to characterize runoff of the Assiniboine in this year.

1843-1844	Insufficient Data

- No observations are available from the Assiniboine basin.

- At Red River, the Red was frozen by October 27-29. No further data are available until January 1-2 when snow fell.
  January 1: The new year was ushered in by a terrible storm of wind and snow. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Temperatures in January were cold and the snow was deep.
  January 15: The weather [was] very stormy...The wind has blown almost a hurricane and the air has been filled with snow as small as dust. At times it has not been possible to see ten yards from the house...Only the men were able to come the snow drifts are so deep. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  January 23: The storm continued...the drifts are so high that in some places I seem to [be] walking between walls of snow that I cannot see over. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  February 4: The weather being very stormy this morning, the wind blowing strong from the north with a heavy drift of snow. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  February 12: The weather being mild and the snow falling but lightly when we left home I anticipated a fine day...in the afternoon a strong gale set in from the north bringing with it a heavy drift of snow. During the five winters that I have spent in this country I certainly never saw any thing to equal this storm. It was impossible to face the winds for the fine snow was driven with such force that it struck the eyes like sand. At times I could neither see the track nor the horse. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  February 13: ...[church] thinly attended owing to the great drifts of snow. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Strong thawing was occurring by April 1 and continued until late April. Considerable precipitation fell. The Red River broke up on April 12-13 and Peter Garrioch encountered high water on western tributaries of the Red between the Forks and Pembina.

April 1: A great thaw [near Pembina]. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 13)

April 4: This and the last two days have been very warm. We have travelled the whole distance from the Pembina River to here [White Horse Plain] on foot in snow and water. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 13)

April 6: It rained the whole morning and has been damp and misty all day... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 8: The day has been very fine and warm, but the water from the melting snow makes it difficult to get about. The thaw has now fairly commenced...for a week or ten days the attendance will be somewhat irregular owing to the unsafe state of the ice not admitting persons to cross from the other side of the river. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 12: The ice has been clearing away to day. The river is passable though there is still a good deal of floating ice. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 13: Proceeded to the Riviere Islaes des Bois...After going about a quarter of a mile in water of from one to two feet, I came to a creek which took my ox nearly up to the back. I continued about another quarter of a mile through water as before, when I came to another creek, which from its depth and narrowness as well as from the rapidity of its current, I did not like to encounter with my ox and cart... [After getting across] I now hastened to get to dry land and proceeded several hundred yards with that view, tho water up to my knees. At this moment I came in contact with another creek which appeared to be more formidable than any I had crossed...[After crossing] we did not however go more than another hundred yards when he [the ox] again sunk to his belly [along Red River between Forks and Pembina]. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 13)

April 19: Crossed the Pembina River, which, however was accomplished only be a great deal of trouble and risk [by raft]. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 13)

April 29: I had hoped we whould have been able to commence ploughing and sowing this morning but in consequence of the heavy rains which fell last night the ground is now too wet. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Early May was cold and wet but the weather improved and appears to have been favourable for agricultural operations (but with heavy rain on May 25).

May 1: It has been a very wet stormy day which has put a stop to our ploughing. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 3: ...snowing nearly the whole day. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- In July, Peter Garrioch encountered high water in southern Minnesota. Late June and early July were cool. Some rain was reported but dry weather predominated through the harvest period to the end of September.

September 30: The weather unsually fine for this season of the year, we have been interrupted by rain 1 day since we commenced the work of repairing our house 6 weeks ago.

(W. Cochran's Journal, PAM MG7 B2 CMS A85)

- It is possible that runoff was normal or even high based on Garrioch's descriptions of conditions in the Red River Valley, but there is too little data to be certain.

1844-1845	Insufficient Data

- No information is available from the Assiniboine basin.

- At Red River, cold weather set in by mid-October. The ground was snow-covered by October 18 and the Red was frozen by the 27th

- There is little information for November through March. In the first half of March, several heavy snowfalls were reported. Thawing conditions set in by March 16 and became general by the 25th.
  March 7: A heavy fall of snow and stormy. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 42)

  March 11: Another great fall of snow. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 42)

  March 16: Strong north wind and it thaws at a noble rate. Sleet in the evening; snow in abundance before bed time. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 42)

  March 25: A fine warm day. The snow runs down rapidly before the united force of the sun and a south wind. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Colder weather with snow and rain returned in late March-early April.
  March 30: On coming out of Church it began to snow and I had to face a terrible storm which prevented me from seeing the track. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  March 31: Some more snow and plenty of wind. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 45)

  April 3: It blow and drifts like a February day. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 45)

  April 4: Wet morning...The track very miry from the heavy rain which had fallen. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Thawing returned on April 9 and continued for the rest of the month, with significant precipitation in late April. The Red began to break up on April 21.
  April 9: Blew hard and the snow ran down into a liquid...The water on the sides of the river formed a rapid current before twelve o'clock. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 47)

  April 13: The ice upon the River is now covered with water which is in some places deep... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  April 14: Some rain this evening and the Ice took a start at the Image Point. The first thunder

this season was heard this evening. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 48)

April 21: The river is still packed full of immense masses of broken ice. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 25: It fell about 2 inches of snow the last night and continued to snow all this day. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 49)

April 26: The snow is nearly all off again... (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 49)

April 27: Commenced raining at about three in the evening. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 49)

April 29: Has been raining all day... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- May was warm with rain on several days, particularly heavy May 10-13 and 17.

May 10: At sun set we had a storm of thunder and lightning attended with hail and heavy rain... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 11: The storm which commenced last night at sun set increased in violence towards midnight and the quantity of rain which fell has been so great that every level piece of ground is covered with water and the farm is now half under water. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 12: Very wet all day... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 13: In the evening it commenced raining and continued till the following morning. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

May 19: Returned in the evening through heavy rain. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- Scattered references from June to September indicate normal summer weather with hot temperatures, periodic rain, and good crops.

- It is likely that runoff in the Red River basin was normal but there is no basis for extending this conclusion to the Assiniboine.

1845-46	Insufficient Data

- No information exists for the Assiniboine basin.

- At Red River, mild temperatures prevailed until mid-November and the river didn't freeze until November 19-22. Heavy snow fell on November 24.

November 13: We are expecting the winter to set in with all the severity daily, it is nearly a month later than in some years. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

November 18: Nearly all the snow that fell yesterday went off to day before a strong south wind. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 59)

November 20: All the swamps and little lakes are frozen over. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 59)

November 22: This evening the river at this place became a sheet of transparent ice. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 59)

November 24: A great fall of snow. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 59)

- No further information is available until early January when the paucity of snow was noted. Snow fell later in January but from January 22-29, very mild thawing conditions occurred.

January 5: There has very little snow fallen, consequently the tracks up the banks of the River are too slippery for oxen to haul loads. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

January 22: This day has been quite an April one. The wind has been from the south and continues as strong and warm the present moment. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 63)

January 24: The wind still to the South. This day has been altogether an April one. The wind has dissolved so much of the snow that water begins to stand in pools at the doors and the eves of barns hang down with lengthy icicles...It was so wet to day that I was obliged to put on boots in the afternoon. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 64)

January 26: The roads on land were almost entirely bare. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 64)

- Cold weather returned on January 29 and scattered comments in February suggest that it continued, with some snowfall, until the end of the month. By March 1, thawing was occurring again, lasting until the 18th, with some rain and snow.

March 5: Got home a little after sun down under a heavy fall of snow. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 70)

March 6: Quite a smart shower of rain to day. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 70)

March 7: The snow begins to run down into running liquid. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 70)

March 11: A very great part of the road from The Devil's Creek to the Red River was entirely bare. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 70)

- Cold and snow occurred from March 18-20 but the river ice was reported as weak by March 23. Significant precipitation fell in April. The Red River broke up April 21-24 and the Assiniboine at Red River Settlement on the 26th.

April 2: It rained all day and all last night. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 72)

April 3: It continued to rain all last night and till twelve to day... (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 72)

April 5: The ice upon the river was not safe for travelling higher up than 8 miles above this place. We then had to go by the plain which at present is overflowed with water. The frost of last night had coated over the water with ice which broke every step the horses took...

(J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 6: ...It commenced to snow and drift immediately after breakfast and it continues so to this moment which is bed time. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 73)

April 7: Today a heavy snow storm. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

April 9: A great part of the road is covered over with ice in consequence of the late rains and subsequent frosts. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 73)

April 11: Some more snow to day and cold north wind. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 73)

April 17: Yesterday poured down rain; and this day it snows and drifts like ah that! (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 74)

April 19: The track deep with mire and water. (W. Cochran's Journal, PAM MG7 B2 CMS A85)

- The first half of May seems to have been warm and dry. June, July and August were very hot and July may have been unusually wet.

August 8: Our Winter was much as usual, rather severe, but our Summer has been stormy. Last month particularly, very frequent storms of Thunder & lightening. (Thomas Bunn [Red River] to Wm. Bayley [London], in Bayley, D., 1969. A Londoner in Rupert's Land: Thomas Bunn of the Hudson's Bay Company. Moore & Tillyer, Chichester, England; Peguis Publishers, Winnipeg, p. 80)

- Again, the runoff in the Red River basin was probably normal but no firm conclusion can be drawn for the Assiniboine.

1846-1847	Insufficient Data

- There is no information from the Assiniboine basin.

- At Red River, temperatures were moderate in October and November. Snow which fell on November 16 melted by the 18th. Another heavy snowfall occurred on November 20 and the Red River froze November 22-23.

November 20: Snow fell in abundance and a deal of North wind with it. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 80)

- Very cold weather began on November 24 and continued through December. Considerable snow fell in December.

November 24: The season has been unusually fine and winter is only now set in fairly... (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 7)

December 1: It commenced to snow and blow about 12 o'clock the last night and continued all day the same. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 81)

December 2: The weather continued wild and stormy till about sun down to day, when it again assumed its wonted severity. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 81)

December 3: After sun down it began to snow again and wind with it as usual made it to drift. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 81)

December 6: Though the weather was severely cold & the ground covered with three feet of snow the Rapids Ch. Was excessively crowded...The River was not frozen completely so that sometimes horse & sometimes the cariole went through the ice. (Journal of Robert James PAM MG7 B2 CMS A92)

December 31: The old year goes out as death. The Therm. 21 below zero this morning at 8 o'clock, and not above zero all day. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 7)

- January was severely cold, becoming milder by the last week.

January 20: The cold daily and steadily increased up to the 20th of January last when the Thermometer indicated the lowest point during the Winter, 47° below zero. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 27)

January 27: The wind has been south to day, and the weather has been milder than usual. The whole of the present month, with the exception of the last three or four days, has been cold to the Extreme. No year within the remembrance of the oldest settlers has been so cold as this has been. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 83)

January 31: ...During twenty-two consecutive days...from the 5th to the 26th inclusive, the thermometer never once rose to zero... On the coldest day, the 20th, when the thermometer showed -48° at the stone Fort, and -47° at Fort Garry, mercury froze in fifteen to twenty minutes when exposed in bullet moulds. (Donald Gunn's Record at Lower Settlement, quoted in Dawson, S.J., 1859. Report on the Exploration of the Country between lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.)

- Scattered references in February indicate milder temperatures and a heavy snow cover on the ground.

February 1: The weather was so mild yesterday that the Public road on the river was entirely cut up, by horses running on it as usual, on account of the snow becoming quite soft and nearly thawing. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 83)

February 15: The snow was so deep and the road consequently so bad that the oxen scarcely dragged home one past each. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 83)

February 23: Weather quite mild during our absence but a great deal of snow; and a good deal of thaw. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 84)

- Considerable snow fell in early March.

March 2: Snow falls in abundance to day, and the wind being high, we had quite a drifty day. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 85)

March 6: It has been drifting furiously all this day, and now it is about 9 O'clock of the night It does not appear to abate in the least. (Peter Garrioch Journal, 1843-47, PAM MG7 C38, p. 85)

March 7: It has been one of the most stormy drifting days that I have seen since I have been in this country. It is scarcely possible to look out the door without being blinded by the fine snow that was drifting. The wind blew almost a hurricane. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

March 8: The storm continued nearly the whole night so that the drifts were soi large that I have had several men employed to day in cutting tracks... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Strong thawing conditions began in early April but cold returned in mid-April with additional snow. The Red and Assiniboine Rivers broke up April 23-27 and a general thaw occurred during the last week of April.

April 11: The spring here is a most unpleasant season...I had a dreadful ride through [mud] & snow & pools of water... (Journal of Robert James PAM MG7 B2 CMS A92)

April 18: The cold weather has returned and we are fearing another fall of snow. It was so cold today, while reading Prayers in Square, that I could hardly keep my teeth from chattering and the men were all trembling...Strange enough, the birds, which a day or two ago, were going northward, have today been flying southward, not finding the water open on Winnipeg, nor the snow off the swamps where they feed. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 21)

April 20: We have had a very stormy day with a heavy fall of snow. (Journal of Robert James PAM MG7 B2 CMS A92)

April 24: The Thaw continues today, tho' it froze hard during the night. The river cannot now be crossed even on snow shoes. The sun felt warm, and in spite of the melted snow I was able to go some distance up the banks of the Assiniboine, which still set fast, though the water flows over the ice as it streams over the banks... (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 21)

April 25: The Red River broke up last night, the ice having been burst by a strong flood, evidently caused by the melting of the snow to the southward...This morning I had the pleasure of seeing once more open water. In the course of this day the Assiniboine gave way; the ice quietly slipped away, and floated along, till it turned into red River, then jamming and crashing not a little... (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 30)

April 26: The heat today is quite extraordinary. It is summer heat. The therm. rose to 71°!...The ice is flowing fast in very broken masses, down the flooded rivers, and in 2 or 4 days more we shall not have a remnant of ice or snow left... (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 31)

April 27: The ice has moved away and the river is now clear. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

April 28: The south wind and hot sun are melting down the snow and ice rapidly. The prairies are uncovered as far as I can see... (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 33)

- May was cold and dry, apart from snow on the 9th and 10th and some rain on the 25th.

May 9: ...In the afternoon, the wind suddenly shifted to the North, and it now exceedingly cold, and snow is falling fast. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 42)

May 12:The north wind still blows cold and keen. The Lakes still are frozen over, but all the rivers and streams are open. The snow, which fell on the 9th and 10th, melted away in the course of yesterday... (Diary of Colonel J. Crofton, Commander of the First Red River

Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 43-44)

May 20: The weather today is rather wilder, but cold north winds still chill all nature. The large Lakes are still frozen over. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 50)

May 23: It is said by the inhabitants, that the present cold and dry weather is most unusual at this season. The wind and whirling dust today almost blinded us, as we stood at Prayer. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 51)

- The weather in June, July and August was hot and dry. Although rain did fall in June, most comments referred to drought and its effects on crops. The Red was low in early June (see June 7 and 18).

June 7: ...We have had, at last, today a fall of rain, which has been of more value to the people here than if it had rained gold. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 57)

June 7: We have of late been much inconvenienced by the lowness of the river. Neither boats nor canoes can get near solid ground and the people have to land in the mud where they sink almost up to the knee. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

June 18: We had a feu-de-joie from 'Heaven's Artillery', not for Waterloo Day, but for the good of the Land, that much needed the water it shook down from the clouds. (Diary of Colonel J. Crofton, Commander of the First Red River Expedition, 1846-47. Winnipeg Public Library, Ca. 971.274 c, p. 67)

June 22: The Thermometer has been 96° in the shade... To day in the sun it was 118° above zero... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- The spring drought was broken by rainfall in July. Very hot weather continued through August.

July 11: At noon the storm came nearer and the thunder was very loud and incessant the rain descended in torrents and hail stones as large as pigeon's eggs fell for some time. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

July 30: On our prospects as regards the crops here, I an happy to say that there has of late been a very decided improvement- owing principally to the refreshing showers with which at seasonable intervals we have fortunately been favored since about the 4th Instant... (Alex christie, Chief Factor, HBC, Fort Garry, to Sir George Simpson, Hudson Bay House, Lachine, PAM MG2 B5-2, pp. 85-86)

August 7: Commenced reaping wheat to day. It is not more than a foot high the ears very small...nearly all spring sown wheat has faded owing to the extreme drought of May & June. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- A decade later, Hind noted the dryness and low water of the 1847 summer.

In 1847, a very dry season, it was possible to proceed with carts in a direct line near the banks of the [Roseau] river from the beginning of the marsh to the post, one mile and a half from Roseau Lake. (Hind, H.Y., 1869. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858, Vol. I, reprinted 1969, Greenwood Press, Publishers, N.Y., p. 158)

- It seems probable that the freshet in the Red was normal but that runoff in May and

June was very low. Overall, the total runoff in the Red was probably in the low range of normal but the condition of the Assiniboine is uncertain.

1847-1848	Normal

- October temperatures at Fort Pelly were moderate and no snow fell until November 2-3 at Fort Pelly and Red River.
  November 2: The ground is to day covered with snow several inches deep and a cold north wind indicates but too clearly the commencement of winter. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

- Heavy snow fell on November 7 and temperatures remained moderate until late in November. Snow accumulation was slight at Fort Pelly by November 25.
  November 25: Therm. 2 below zero for the first time Stormy weather altho there is little snow on the ground. (Fort Pelly Journal, 1847-48, HBCA)

- December and January were very cold (Smithurst concluded the temperature at Red River was <-50°F on January 9). Little snow was reported at either Fort Pelly or Red River until mid-January when snow fell at Fort Pelly on January 28-30. However, the January 14 comment implies that considerable snow must have fallen.
  January 14: It has been snowing very fast all day so that the snow is now deeper than ever I saw it before. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A96)

  January 16: ...Considerable snow fell last night. (Fort Pelly Journal, 1847-48, HBCA)

  January 17: ...the track heavy from the recent snow. (Fort Pelly Journal, 1847-48, HBCA)

  January 29: ... a heavy fall of snow last night I should say about a foot. (Fort Pelly Journal, 1847-48, HBCA)

  January 30: ...considerable snow also fell in the night. (Fort Pelly Journal, 1847-48, HBCA)

- Mild thawing weather and cold alternated at Fort Pelly through February and March, with considerable snowfall there and at Red River.
  February 19: [travelling to Fort Ellice] ... being a day more than I ever took before in consequence of the state of the road from recent heavy falls of snow... (Fort Pelly Journal, 1847-48, HBCA)

  March 10: Therm 5-30 above Wind NE with a heavy fall of snow which is now an unusual depth. (Fort Pelly Journal, 1847-48, HBCA)

  March 12: I am happy to find that notwithstanding the mountains of drift in which we are entombed, all communications from the outer world is not entirely closed. Such a winter for wind, snow, drift and turbulence...The abundance of snow gives promise of the lacking moisture. (John Bunn, Red River, to Donald Ross, Norway House, quoted in Stubbs, St. G., Four Recorders of Rupert's Land. Peguis Publishers, Winnipeg, p. 105,107)

  March 18: ... snowing greatest part of the day. (Fort Pelly Journal, 1847-48, HBCA)

  March 19: Snowing greatest part of the day. (Fort Pelly Journal, 1847-48, HBCA)

- Strong thawing conditions began in late March and continued through April.

March 23: In the afternoon I went to see the wood cutters, and got up to the knees in water. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A97)

April 4: The sun was very powerful today. The ice and snow began to hasten away...The only drawback on the enjoyment of this season is the wretched state of the Roads. The whole Country is one puddle. (Journal of Robert James PAM MG7 B2 CMS A92)

April 6: Therm. 15-54 Wind SW snow fast diminishing. (Fort Pelly Journal, 1847-48, HBCA)

April 17: ...the snow has nearly disappeared and from the Cold night the water has dried up as soon as the Snow melted. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

- The Red River began to break up on April 19 and the Swan and Assiniboine Rivers broke April 20-26. The Red was high on April 22 but low water was feared on the Assiniboine at Fort Pelly on April 27 and May 3.

April 20: The river is now full of broken ice and quite impassable. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A97)

April 20: ...the [Swan River] is breaking up. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

April 21: The river is still impassable and the water is rising very fast. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A97)

April 22: The water has risen very high in the river several Cattle have been swept away. At one time I saw five oxen going down the stream. The river is walled in by immense masses of ice so that it was difficult to get the Cattle out, four or five have been drowned... (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A97)

April 24: ...the [Assiniboine] River is still fast. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

April 26: ...[some men] had some detention by ice [on Swan River] during which time the water fell upwards of four feet. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

April 27: ...towards evening the [Assiniboine] began to get clear of ice with every prospect of low water it cannot be otherwise from the long Run of Cold weather. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

May 3: Therm. 26-55 Wind NE a gale now for several days past with the constant frost at night is drying up the water both on the land and river. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

- Snow or rain fell at Fort Pelly and/or Red River on May 5-6, 13, 23-24 and was apparently heavy in late May in the southern Red River basin at least (see June 1 comment)

May 5: ...snowing the whole of the day. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

May 6: ...snow Showers greatest part of the snow that fell yesterday disappeared. (Fort Pelly Journal, Sect. B [copy] 1847-48, HBCA mfm)

May 23: It has been raining all day. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A97)

June 1:[travelling from St. Paul to Pembina] The rivers, swollen with a week's rain, were almost impassable. Red Lake River was more than eighteen feet deep at the fording place...Five more rivers has to be forded and at each one they duplicated the experience of the first. They reached Pembina on June 1. (Reardon, J.M., 1955. George Anthony Belcourt. Pioneer Catholic Missionary of the Northwest, 1803-1874. North Central Publishing Company, St. Paul, pp. 99-100)

- Information about summer conditions is scanty but some comments suggest that June, July, and August were hot and relatively dry.

July 18: Le grain est beau et il a peu brule sur les coteaux. La chaleur est etouffante depuis longtemps. Il n'a pas plu...Au moins cette annee nour avons du foin proche; les pluies du printemps l'ont fait pousseur. (J. N. Provencher, to Monseigneur P.-F. Turgeon, 18 Juillet, 1848, in Lettres de Monseigneur Joseph-Norbert Provencher, Premier Eveque de Saint-Boniface. Bulletin de la Societe Historique de Saint-Boniface, Man., p. 269)

August 11: On each side of the river are innumerable small shallow lakes, bearing usually large quantities of rice, but the water in them had sunk so low this season that the Indians were apprehensive of a failure in the crop [Paul Kane on Lake of the Woods]. (Kane, P., Wanderings of an Artist among the Indians of North America from Canada to Vancouver's Island and Oregon, through the Hudson's Bay Company Territory and Back Again. Garvin, J.W., ed., 1925. Master-Works of Canadian Authors, vol. 7, The Radisson Society of Canada, Toronto)

1848-1849	High

- There is no direct information from the Assiniboine basin but high water conditions in the summer of 1849 are inferred from the exceptionally heavy precipitation and flooded streams throughout the northern plains from St. Louis to the Red River Settlement described in PART THREE.

- Relatively little information is available from the winter of 1848-1849 but it seems not to have been unusual. Snow fell at Red River Settlement before the end of October and the Red River was frozen by November 1.

November 1: ...the River being now in a bad state for crossing, and consequently all on the opposite side to the Church are at present unable to attend, until the ice is sufficient strong to admit of walking over. (J. Smithurst's Journals [at Indian Settlement], PAM MG7 B2 CMS A97)

November 1: ...the snow was falling thickly all day. (Journal of Robert James PAM MG7 B2 CMS A92)

- Considerable snow seems to have fallen in November and early December.

November 11: The whole of this week I have been confined to home by the State of the Roads. (Journal of Robert James PAM MG7 B2 CMS A92)

December 3: The continued fall of snow for the last three days induced me to take the River for the Middle Ch....The snow was deep... (Journal of Robert James PAM MG7 B2 CMS A92)

- Late March was sufficiently mild to begin thawing the ice by April 1 and the snow was nearly gone by mid-April. However, colder weather delayed full breakup into May.

- The spring and summer conditions are described in detail in PART THREE.

1849-1850	High

- Although there is no direct information from the Assiniboine basin, the exceptional spring and summer rainfall which produced the large flood in the Red River (described in PART THREE) is assumed to have affected the Assiniboine basin sufficiently to produce at least high runoff.

1850-1851	High

- The widespread summer flooding on the Red and other rivers was described in PART THREE and from the comment by Provencher on July 21, the Assiniboine may have been overbank at White Horse Plain, implying extremely high discharge. In the absence of more data, it seems that runoff during the water-year was at least high.

1851-1852	Very High

- There is no information about weather or river conditions in the Assiniboine basin during the fall and winter

- The probability that exceptionally high water occurred in the spring was discussed in PART THREE above.

- Following the recession of the flood, the weather in the vicinity of the Red River Settlement at least was relatively dry. Although rain was reported on occasion, by early August the crops were suffering from lack of water.
  July 27: Remarkably sultry; crops much in want of rain. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

  August 2: ...Rain fell at last pretty plentifully in the evening much needed to refresh the parched earth. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

- Abundant rain fell for the following 3 days but the Red River was described as low by William Cowan on August 5. Very heavy rain fell in the Settlement during the last 10 days of August and the Fort Pelly Journal also reported rain (occasionally heavy) on several days.

- Nevertheless, the upper Assiniboine basin must also have shared the predominantly dry summer conditions of the Red River Settlement because low water was reported at the end of August.
  August 30: ...the water is too low for fishing. (Fort Pelly Journal, Section B [copy] mfm, 1852-

53)

- Snow fell at Fort Pelly on September 12.
  September 12: Wind North west & cold raw weather- we had a little snow to-day, the earliest that has been known here. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

- Rain or snow fell at Fort Pelly on 8 days from September 15-30.

1852-1853	Normal

- October and the first week of November were mild at Fort Pelly and Red River with rain on 6 days but little snow accumulation. The Assiniboine and Red at the Red River Settlement froze November 10-13 but snow accumulation remained slight until November 15 at Fort Pelly and the last week of November at Red River when considerable snow fell at both places.
  November 9: ...pretty cold there is scarcely any snow on the ground yet. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

  November 15: ...a heavy fall of snow. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

  November 20: ...too little snow for travelling fires east & west main river. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

  November 23: ...snowing all day there is more than a foot of snow on the ground now. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

  November 24: ...A considerable quantity of snow last night [at Red River] and is still falling this evening. Much required to make better roads. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

  December 4: ...The roads [at Red River] are much in want of snow, but one slight fall has yet taken place this winter. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

- Moderate to mild temperatures continued to December 10 when cold weather arrived and became progressively colder to the first week in January. Snow fell in small amounts on 5 days at both Fort Pelly and Red River Settlement, sufficient for travelling but not deep. Some of this snow cover was removed by very mild weather January 5-16.
  January 20: ...So little snow has yet fallen [at Red River] that the roads are in some places almost impractical for sleighs. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

  January 31: ...Some rain fell today. The ground in most places is bare of snow. A very unusual thing at this late season. (Winnipeg Journal, HBCA B.235/a/15 1851-54)

- Cold and very mild weather alternated through February and March and by late March, there was little snow cover at both Fort Pelly and Red River.
  March 18: ...very mild weather very little on the ground now. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

  March 20: ...[at Red River] thawing for some days during day rode over plains very bare.

(Diaries of Dr. William Cowan, PAM MG2 C15 M154)

March 23: ...thawing very much, the snow is disappearing very fast now. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

March 26: L'hiver n'a pas ete bien dur il y a peu de neige, deja elle est en bonne partie disparue. (Msg. J.N.Provencher to Msg. I. Bourget, dated St. Boniface, 26 March, 1853, PAM MG7 D1)

April 1: ...fine mild day-not a particle of snow to be seen any where now. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

- Despite the lack of snow, the Assiniboine was relatively high on April 7 and the Red River was rising on April 8. The ice started running out in both the Red and Assiniboine at Red River on April 12 and the Red River was clear on April 14. The Swan River was still frozen on April 17 and low water was expected.

April 17: ...the Swan River is by report still fast, the water will be very very low-unless heavy rains come. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

April 19: The Assiniboine River is now completely clear of ice & is very low indeed. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

- Mild to warm temperatures prevailed in late April. Heavy rain fell at Fort Pelly on the 20th and on May 1, a heavy snowfall occurred at Fort Pelly (rain at Red River).

May 1: ...a heavy fall of snow last night & continued all day there is more than a foot of snow on the ground now & in some places more...The Swan River will now likely rise rapidly & will enable us to get down in our Batteaux. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

May 1: Heavy rain all day. (Winnipeg Journal, HBCA B.235/a/15 1851-1854)

- Additional snow fell at Fort Pelly on May 2 and May 4 but the expected rise in the Swan River did not occur until May 15.

May 5: ...the sun thawed a little to-day - but not enough to enable us to cart down pieces-the water in the Swan River has not risen at all. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

May 7: ...a pretty heavy shower of rain in the afternoon...owing to the lowness of the water [in Swan River] they will not be able to get further. (Fort Pelly Journal, Section B [copy] mfm, 1852-53)

May 15: ...heavy rain all day...from a sudden rise in the Swan River, they will be able to take down the batteaux...(Fort Pelly Journal, Section B [copy] mfm, 1852-53)

- Some additional rain fell at Red River in May but there is no further mention of the state of the rivers and there is no weather information from Fort Pelly after June 1. However June was very wet at Red River. Rain was reported in either the Winnipeg Journal or the Cowan diaries on 20 days from May 31 to July 6 and on eight of these days, the rain was described as "heavy", "deluge", "great", etc. Rain fell somewhat less frequently in July and August (7 and 8 days respectively) but many of these falls were also heavy.

- The spring freshet appears to have been small and water levels were low. Abundant rain in June, however, probably caused a rise in water levels through

June and July and it is likely that overall runoff during the water-year was in the low range of normal.

1853-1854	Very High

- The high freshet and large runoff during the summer, and the conditions which produced them, are described in PART THREE above.

1854-1855	High

- The only information for the fall and winter comes from Red River Settlement.
- October at Red River was mild throughout, with little precipitation. November was also relatively mild until late in the month. The Assiniboine and Red Rivers froze on November 11 (Cowan Diaries, PAM MG7 C15 M154). Precipitation fell on 7 days but the total amount of rain and snow was not large.
- Very mild temperatures continued through December with little snow reported in the daily entries of Cowan's diary; this is confirmed by the following passage from Knox.

  There was grief in the Red River Settlement that Fall too. The weather was damp and foggy with no snow...Arctic winds came in November but still there was no snow. A prairie fire swept the over haylands from Fort Garry to the Stone Fort...But snow didn't even come in December and the last day of the year witnessed another prairie fire. (Knox, O., 1958. John Black of Old Kildonan. The Ryerson Press, Toronto, 94-95)
- The weather turned very cold on January 2. Cowan reported snowfalls on only 5 days but two of these were heavy (January 11 and 16).
- In February, cold and mild weather alternated. Strong thawing began in the last week of March and continued into April. Considerable snow and rain fell between March 30 and April 11. The ice on the Assiniboine at the Red River Settlement broke up and cleared April 19-22. There is no information, however, on river levels during the spring freshet.
- The only information from the Assiniboine basin, a single comment by Christie at Fort Pelly, suggests that the winter in the upper Assiniboine region may have been more severe than at Red River.

  April: The great depth of snow and severity of the winter has been much against our Horses... (Letter, W. Christie at Fort Pelly to J. Ballenden, Fort Garry, in Fort Pelly Correspondence, Section B [copy] 1854-55, HBCA mfm 475)
- May at Red River was cool with several heavy falls of rain, particularly at mid-month and during the last week. Evidence for heavier winter snowfall and spring rain in the vicinity of the upper Assiniboine is suggested by Rev. James Settee. While travelling from Swan River to Fort Pelly, he encountered high water in several streams.

May 14: ...the Creeks about this time are very high [near Swan River]. (Journal of James Settee, PAM MG7 B2 CMS A95)

May 22: ... the Swan River was running over its first banks. (Journal of James Settee, PAM MG7 B2 CMS A95)

May 28: ... a large portion of the river [exact river is uncertain] is at present under water... (Journal of James Settee, PAM MG7 B2 CMS A95)

- Abraham Cowley encountered variable conditions on a trip from Red River to Fort Ellice in June.

May 26: At White Horse Plain the rain brought us up and we were weather bound the remainder of the day. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

May 27: Still raining. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

June 2: ...the water [in the Whitemud River northwest of Portage la Prairie] was low... there was much water on the ground & small lakes & creeks abounded the whole day... (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

June 5: ... the Rapid River... was active. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

- Cowley had considerable difficulty crossing the Assiniboine at Fort Ellice.

- On June 19, James Settee was at Shoal River near the mouth of the Swan River and reported a very rainy month there.

June 19: The rains in this month as frequent as I have observed both last summer and this which keeps the waters high. (Journal of James Settee, PAM MG7 B2 CMS A95)

- At Red River, Donald Gunn recorded an exceptionally wet summer from June through September.

June: Three inches of rain fell on the 17th, one on the 19th and six on the 25th. (Donald Gunn's Record at Lower Settlement, in Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement (reprinted 1968). Greenwood Press Publishers, N.Y.)

July: 7th, rain 3 3/8 inches...10th rain 3/4 inches. Thunderstorm on the 17th, rain 3 inches. 26th, 1 inch of rain; 29th 3 inches rain; 30th, 2 inches; total 14 5/8 inches... (Donald Gunn's Record at Lower Settlement, in Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement (reprinted 1968). Greenwood Press Publishers, N.Y.)

August: On the 8th, 5 inches of rain fell; 11th, 5 1/4 inches fell, 14th, 2 inches; 27th, 1/4 inch; total 12 ½ inches.

September: Total of rain during the month, 6 ½ inches. (Donald Gunn's Record at Lower Settlement, in Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement (reprinted 1968). Greenwood Press Publishers, N.Y.)

- Gunn's total precipitation of 43 5/8 cannot be accepted at face value or directly compared with modern standardized measurements but must indicate a very wet summer. Gunn was an accredited Smithsonian observer and exceptionally heavy rainfall (10.5 inches) was also recorded at Lac qui Parle in southern Minnesota in

August; values for other months were not given (United States Patent Office, 1861. Results of Meteorological Observations Made Under the Direction of the United States Patent Office and the Smithsonian Institution from the Year 1854 to 1859, Inclusive. United States Senate, Executive Document, 36th Congress, 1st Session)

- The freshet appears to have been unremarkable on the Red River but may have been high in the region of the upper Assiniboine. The levels of the Swan and other rivers in the vicinity were high in May and early June. The apparently heavy precipitation during the summer in Red River, if it also occurred over the Assiniboine basin, suggests that river levels would have remained high during the summer as well.

1855-1856	Very High

- High water and flooding in the upper Assiniboine and Qu'Appelle Rivers due to spring/summer rain are described in PART THREE,

1856-1857	High

- October was generally mild at Fort Pelly. Considerable snow fell October 20-28 but melted. The Red River froze November 3 but relatively mild weather continued at Fort Pelly until November 17. Snow fell at Fort Pelly on 11 days in November.
  October 31: Wind west, fine mild day, all the snow melted away with today's thaw. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)

  November 3: River frozen over last night people crossing on ice to-day. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

- Cold weather dominated December and early January. Snow fell at Fort Pelly on 10 days in December and was deep at Red River on December 24.
  December 24: The snow was exceedingly deep in the open plains... (Journal of William Kirkby, PAM MG7 B2 CMS A92)

- Mild and cold weather alternated at Fort Pelly from January 8 until February 12 with some additional snow on 6 days from February 2-23. Warm weather began on February 12 and continued into March which was remarkably warm with thawing throughout the month.
  March 2: wind South & thawing a great deal. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)

  March 9: ...the snow is very deep. There is an old woman prophesisied that there would be another flood; ... What shall we do if there should be another flood? (Jemima Ross [Colony Gradens] to James Ross [Toronto], PAM RFC 205)

  March 15: Snow sleet & rain have been alternately falling the whole day... (Journal of William Kirkby, PAM MG7 B2 CMS A92)

March 16: Still as wet as yesterday. The snow is melting down to pools of water & the ground is becoming quite bare & soft...The spring has never been known to set in so early as this before. (Journal of William Kirkby, PAM MG7 B2 CMS A92)

March 21: wind South and very mild thawing a great deal. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)

March 23: ...a very difficult job they [men hauling stones] had to get on & off the [Red] river on account of the great rise in the water which the thaw has made. (Journal of William Kirkby, PAM MG7 B2 CMS A92)

March 28: wind South & very mild the snow melted a great deal to-day. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)

March 30: The general thaw seems to have commenced in earnest it has been raining considerably today & very much of the snow is already melted by the warmth of the past week. Journal of William Cowley, PAM MG7 B2 CMS A89)

- The promise of an exceptionally early spring disappeared suddenly and April was cold with considerable additional snow. General thawing conditions did not return until April 24 and the rivers remained ice-covered into May.

April 4: An exceedingly rough & boisterous day. The snow & drift were so bad that one had the greatest difficulty in standing against it. (Journal of William Kirkby, PAM MG7 B2 CMS A92)

April 11: wind variable South & South East and ended in North with snow & drift a very bad night. (Fort Pelly Journal, Section B [copy] 1855-57 mfm 475)

April 24: The great change in the temperature of the atmosphere may perhaps induce many [to go out]. The thaw seems to be very general & the snow is melting away very rapidly. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

April 30: The thaw has so far prevailed as to enable us to remove a little turf...The season for sowing our seeds will be short indeed the winter being so protracted. Although much snow has been thawed on the land near the houses yet far out they tell me winter still holds its sway and even here people have been hauling hay upon the frozen river with oxen & hay frames just as in the depth of winter. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

- No information is available from Fort Pelly after April 11. The Red River broke up May 3-6 but early May remained cool, with rain and a heavy snowfall on May 7-9.

May 7: Much floating ice. Rain came on late in the evening. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

May 8: Very winterly weather frost & snow & quite a gale. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

May 9: The storm has not subsided. Thermometer less than 28° at Noon. Snow drifted to nearly the top of one of the fences say 4 ft. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

May 9: ...we had near a foot deep of snow this morning it was drifting and snowing so much since last night and the ice passing as thick since last week I never seen the like of so much ice going down the river, the water very high rising still it is just where the old oven was we will be getting afraid if it rises much higher we were busy this whole week pulling up our wood out of the water and we are not done yet... (Jemima Ross [Colony Garden] to James Ross

[Toronto], PAM RFC 207)

- Very warm temperatures and rapid thaw began on May 10. The level of the Red became very high with evident flooding south of the Red River Settlement and remained high to the end of May.

  May 12: The season for sowing is so far gone that although the land is very wet we must plough...The water here has risen to such a height that I imagine the country about the Bishop's is nearly under water. Large quantities of drift wood is being daily carried down by the stream indicating that the river has overflown its banks somewhere. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

  May 14: ...Heard that many of the low farms above are flooded & that the Scotch people have fled from their houses & I feel inclined to believe it as the water here is so high. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

  May 15: Water still rising... (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

  May 16: The snow has nearly disappeared another warm day will melt it all no doubt & then perhaps the temperature will be more uniform...Owing to the wet state of the land farming operations have been more difficult this year. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

  May 28: ...I avail myself of an opportunity by canoe part of the way not liking to swim my horse the water being so high & rather cold. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

- Little information is available for June, July or August. On July 25, Palliser reported that the Red was still abnormally high at Pembina.

  July 25: Red River itself is at this time flooded about five feet above its usual level, the depth of water now being 14 or 15 feet. (Palliser in Spry, I.M., ed., 1968. The Papers of the Palliser Expedition, 1857-1860. The Champlain Society, Toronto, p. 100)

- September was warm with rain reported on only 2 days.

- Although there are no direct reports of Assiniboine water levels, the abundant winter snowfall, the high state of the Red in May and thereafter, and the apparent similarity of the weather at Fort Pelly and Red River suggest that water levels were probably high in the Assiniboine as well. According to Morton, the move of Fort Pelly 1/4 mile further from the river in 1856-1857 may have been due to flooding in this year but no independent confirmation of this was found by the writer.

  The tradition is that the first Fort Pelly was removed to higher ground because of floods. It would not appear that the fort itself was under water, though the cellars may have been full, for it would stand up out of the water like an island on its low ridge. (Morton, A.S., 1942. The posts of the fur-traders on the upper Assiniboine River. Transactions, The Royal Society of Canada, Sect. II, 101-114, p. 113)

- Although far from the Assiniboine basin, it may be significant that water levels were also high in the Winnipeg River region during Hind's voyage from Lake Superior to Red River in 1857. At Lac du Bonnet in September, he wrote:

  The Indians we met lamented the failure of the rice this year; they described the appearance in favourable seasons ... as a vast expanse of waving grain...The waters of the river were unusually high, so as to check the growth of the rice [and threaten] them with famine during the coming winter....The same cause...led also to a great scarcity of fish...The extraordinary

height of its waters during the summer of 1857 had so extended the feeding grounds of the fish, that they were with difficulty caught in sufficient numbers to provide the Indians with their staple food. (Hind, H.Y., 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858, vol. I [reprinted 1969], Greenwood Press Publishers, N.Y., p. 118-19)

1857-1858	Normal

- October was relatively mild and dry at Red River. More snow seems to have fallen at Fort Pelly but was melting by the end of the month.

- Relatively mild weather continued at Fort Pelly and Red River until mid-November. The Red froze November 9-13. Snow fell on 7 days at Fort Pelly from November 20-29 but not heavily.

- December and January were abnormally mild with periodic thawing and some short colder periods, and little precipitation at Red River. There is no weather information from Fort Pelly after December 24.

- February was much colder until the 23rd when mild weather returned. Snow was reported by Dawson on 7 days but most were small amounts (Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.).

- March was remarkably mild throughout with thawing conditions on most days from March 5 onward. The Red was rising on March 22 and beginning to break on the 25th (it cleared of ice on April 5). Little snow fell in March and a general thaw was underway by the end of the month.

  March 22: ...River rising. (Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.)

  March 23: The season is particularly mild & the general thaw seems to have commenced. The ice is strong but there is much water along shore & it is unpleasant getting on it. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

  March 25: ...Ice breaking on Red River. (Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.)

  March 31: The winter was mild throughout, except about the middle of February when ...the thermometer indicated -37° Fah., but only on one occasion. The greatest average depth of snow on the prairies did not exceed one foot, while in the wooded region, to the eastward near the Lake of the Woods, it might be about 1 foot 4 inches. (Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.)

  March 31: The spring has set in earlier than usual. The snow is mostly gone-the creeks are all running and the ice on the River has started here today-what it was never known to do in March before-Last year it was the 2nd of May... (Rev. John Black, Frof Plain, to James Ross,

Toronto, PAM RFC 228)

- April was also mild throughout but with considerable snow on April 4-5 and 17. The freshet was short, with the river falling on April 8. The Assiniboine broke at Red River on April 17.

  April 4: The River is just upon the point of breaking up & crossing is extremely dangerous...the weather today is perhaps more boisterous than it has been on any other day during this winter. The Wind veered to the North & blew quite a gale during a heavy storm of snow. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

  April 5: It has been very cold & snowy all day. (Journal of William Kirkby, PAM MG7 B2 CMS A92)

  April 17: Winter in another severe snow storm has made probably its last effort for this season. (Journal of William Kirkby, PAM MG7 B2 CMS A92)

- Records begin at Fort Ellice on May 1 and early May was warm and relatively dry both there and at Red River until the 12th when snow fell heavily on May 12-13.

  May 12: ...Snowing all the afternoon. (Fort Ellice Journal, HBCA B.63/a/4 1858/59)

  May 13: A winterly day snow falling fast the land covered. The Spring has been most favourable for farming operations. (Journal of Abraham Cowley, PAM MG7 B2 CMS A86)

- The weather at Fort Ellice was generally "fine", warm and dry from May 14- 26 when rain fell, beginning 2 months of very wet weather in June and July. Observations reporting rain at Fort Ellice on 27 days from May 26 to August 1 are summarized below.

- The abundant summer rainfall was widespread. At Red River, rain was reported every day from May 26-30, on 12 days in June, and 7 days in July. The Hind Expedition travelled through much of the Assiniboine basin in the summer of 1858 and reported rain on about 40% of the days from June 17 to August 25 (summarized below). Hind was informed that summer rainfall amounts in the upper Assiniboine had been unusually large.

  ...the rainfall in the neighbourhood of the Touchwood Hills and in the region about Fort Pelly in 1858 was represented to be more extreme, than usual during the summer months. (Hind, H.Y., 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858, vol. I [reprinted 1969], Greenwood Press Publishers, N.Y., p. 137)

- Rain fell less frequently in August and September.

- The only mention of water level was early in the period, on June 3, when the river at Fort Ellice was high.

  June 3: ...wet weather rather Cloudy the men that went to make the Barrier came Back and could not manage the Barrier the Watter so high. (Fort Ellice Journal, HBCA B.63/a/4 1858/59)

Days with Rain at Fort Ellice, May 26-August 1, 1858
(Fort Ellice Journal, HBCA B.63/a/4 1858/59)

May 26	...raining a heavy shower in the fore noon	June 29	Slite Showers of rain through the day.
May 28	Slight showers of rain through the day	July 3	...raining and Thundering all night
May 29	...a little rain	July 4	a heavy Showr of Rain the first part of the day
May 30	Slight showers of Rain through the day	July 5	...Raining through the day.
May 31	...a little Rain in the morning.	July 11	In the after noon commenced to rain for a short time.
June 3	...wet weather	July 13	...Raining the most part of the night...
June4	rainey weather all day.	July 18	...towards evening we had a Thunder Storm.
June 8	...a little rain in the after noon.	July 22	...towards evening Began to Rain & Thundering & Lightning
June 16	raining the first part of the day.	July 24	Raining the most part of the day.
June 18	...raining all day.	July 27	...a Slight Showr of rain in the evening
June 20	raining & Thundering all day	July 28	...raining all day
June 25	...rained a heavy Showr last night	July 29	...Slight showrs of rain all day.
June 26	...Thunder and raining all last night.	July 30	...a little rain
June 27	...a light rain.	August 1	...raining weather

Days with Rain Reported by Hind, June-August, 1858
(Hind, 1860, p. 364)

Portage la Prairie
June 17: the warm rain fell in torrents
June 18: Heavy rain, thunder
June 19: Slight rain

Bad Woods
June 20: A terrific thunderstorm, heavy rain

Bear's Head Hill
June 21: [1 p.m.] Tremendous thunderstorm hailstones 1-1½ in. in diameter; [6 p.m.] thunderstorm, heavy rain

Sandy Hills
June 22: Terrific thunderstorm, continued roar of thunder without intermission for 1½ hours

Souris River
June 25: Violent thunderstorm, heavy rain
June 26-27: Thunder and rain
June 29-30: [night] Thunder and rain; [6 a.m.] heavy rain with rolling thunder, without intermission for 1 hour

Great Prairie
July 4: Rain
July 5: Lightening in the east, no rain

Assiniboine River
July 9: Rain

Fort Ellice
July 11: thunderstorm, hail, and heavy rain

Qu'Appelle Valley
July 13: Thunderstorm of unusual violence and sublimity
July 14: Thunder and rain [for 2 hours]
July 14-15: [night] Rain all last night; [6 a.m.] Rain
July 18: Heavy rain and thunder
July 19: Rain
July 22: Violent thunderstorm with heavy rain and hail
July 28: Rain in torrents

South Saskatchewan River
August 2: Heavy thunderstorm with rain
August 4: Thunderstorm, heavy rain
August 5: Heavy rain

Long Creek-Saskatchewan River
August 11: Violent thunderstorm:

Saskatchewan River
August 18: Thunderstorm, rain
August 25: Violent thunderstorm and rain

- Elsewhere in regions traversed by the Dawson and Hind Expeditions, water levels were characterized as low.

  June 1: ...in consequence of the very low state of the water this year, numerous small rapids were formed in rivers connecting Gun Flint Lake with Lake Seiganagah. In ordinary seasons these rapids are passed without difficulty, but this year they involved the portage of a portion of the baggage and the letting of the canoes down them by rope...Our guide preferred going by Loon's Narrows, fearing that the always dangerous Namenkam Rapids would be almost impassable for heavily laden canoes on account of the low stage of the water. (Hind, in (Dawson, S.J., 1859. Report on the Exploration of the Country between Lake Superior and the Red River Settlement, reprinted 1968, Greenwood Press Publishers, N.Y.)

  August: The waters on the rivers and lakes on the east side of the Height of Land, the Lake Superior water-shed, were high in 1858, while those on the west side, or the tributaries to Lake Winnipeg were unprecedentedly low. In many of the lakes recent water-marks, four and five feet above the present level, were frequently observed. This remarkable lowness of the water was attributed by the half-breeds and Indians to the very small quantity of snow which fell on the western slope during the winter. (Hind, H.Y., 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858, vol. I [reprinted 1969], Greenwood Press, Publishers, N.Y., p.75-76)

- In summary, the relatively small winter snowfall and very early spring produced a small, short freshet but this was probably offset by abundant summer rainfall from late May to the end of July. It is likely that overall runoff for the water-year was in the normal range.

1858-1859	NORMAL

- Rain or snow were reported on 7 days in October at Fort Ellice and on 6 days at Red River; temperatures were generally mild. Several of the falls were described as "heavy" but it is likely that total amounts were in the normal range for the month.

- The Red froze November 11-12. Cold weather predominated from about November 8 to mid-February, with only short mild intervals. Reports of snowfall appear to have been normal for these months.

- Mild weather began in mid-February and continued through most of March. Several heavy snowfalls occurred but the total numbers of days and probable amounts appear to have been within the normal range.

- From late March to late April, the weather was generally cold with the only significant precipitation being a heavy snowfall at both Fort Ellice and Red River on April 13-15 and again at Fort Ellice on April 17-19. Thereafter, no precipitation was reported at either site until early May.

  April 14: The weather still Cold blowing and drifting all day. (Fort Ellice Journal, HBCA B.63/a/4 1858/59)

  April 15: ...blowing a gale with snow and drift. (Winnipeg Journal, HBCA B.235/a/16 1858/60)

  April 16: ...a clear day drifting all day and plenty of snow in the woods and very winter

like...no water to be seen standing on the ice yet. (Diaries of Samuel Taylor at Red River Settlement PAM MG2 C13)

April 17: Cold weather. Snowing all day. (Fort Ellice Journal, HBCA B.63/a/4 1858/59)

April 19: Snowing and Blowing a Gale in the morning. (Fort Ellice Journal, HBCA B.63/a/4 1858/59)

- No information is available from Fort Ellice after April 27. At Red River, a general thaw began on April 25 and the Red finally broke on May 3..
  April 27: ...a great quantity of snow thawed away...and the river covered with water–no water had been seen the day before on the ice. (Diaries of Samuel Taylor at Red River Settlement PAM MG2 C13)

- May was generally warm. The Red River rose until May 16 and water levels throughout the upper Red and adjacent upper Mississippi basins were very high.
  May 12: The whole country [along the upper Mississippi] is now much flooded, the water being higher than has been known since (I think) 1826...The Mississippi was in high flood, submerging most of the willows that grow on its banks... (The Earl of Southesk, 1875, Saskatchewan and the Rocky Mountains, James Campbell and Sons, Toronto, p. 7)

  May 25: ...[we stopped] when we reached the flooded stream of the Rice River...Every brook was a river, every swamp a lake, the road a swamp. (The Earl of Southesk, 1875, Saskatchewan and the Rocky Mountains, James Campbell and Sons, Toronto, p. 7)

  May 26: [Red Lake River] rolled on in heavy flood...and as I watched its swift a turbid current, I could not but wish that everything was safe across. (The Earl of Southesk, 1875, Saskatchewan and the Rocky Mountains, James Campbell and Sons, Toronto, p. 7)

- Heavy rain fell on numerous days in June and July but less frequently in most of August. Very heavy rain on August 31, Sept. 2, 3, and 10 injured the wheat crop and delayed the harvest.

1859-1860	Normal

- October at Red River was generally cold with little snow. The Red froze November 4 and the Assiniboine (at Red River) on November 6. Heavy snow fell in two storms on November 10-11 and 19-20.

- December temperatures alternated between severely cold and mild, with considerable snow before December 12 but little thereafter.
  December 28: Severe, indeed, was the cold of the early part of the month...To say that mercury became frozen, is the mildest form in which the case could be stated. Near the Lower Fort, the spirit thermometers registered 45 below zero; and within the walls of the Upper Fort, the mercury on the morning of the 7th instant, was down to 39-pretty nearly as low as it could go. The next day a sudden change took place, a 2 minus was the lowest point indicated. It gradually became warmer until the 12th, 13th and 14th, when we had another cold snap. Mild weather ensued from that date till the 18th, which was the first of six other cutting days of frost. Once more it moderated, and at the period at which we write, we are enjoying fine Christmas weather... (Nor' Wester Newspaper, December 28, 1859)

- January was unusually mild with only short cold periods. Little snow was reported in the Nor'Wester newspaper or other sources.

  January 28: The unusually fine mild weather noticed in our last issue has continued with but little variation during the fortnight. Cold weather has, indeed, become so rare of late that one might almost fancy the long icy winter of these northern latitudes had well nigh passed over. On but four out of the last fourteen days has the thermometer fallen below zero....The other ten days were warm and pleasant, the glass being usually from 20 to 32 above, in the morning, and still higher at noon. (Nor' Wester Newspaper, January 28, 1860)

- In February, severe cold and very mild periods alternated. Snow fell on 4 days.

- March was mild throughout with thawing temperatures beginning early in the month. After significant snowfall on March 1-2, very little was reported for the rest of the month. The snowpack was disappearing at both Red River and Fort Ellice by mid-March.

  March 14: very warm melting the snow fast. (Diaries of Samuel Taylor at Red River Settlement PAM MG2 C13)

  March 17: Wind S warm & the snow melting fast. (Winnipeg Journal, HBCA B.235/a/16 1858-60)

  March 18: ...the ground bare of snow everywhere & the water rising in the River. (Winnipeg Journal, HBCA B.235/a/16 1858-60)

  March 19: fine day. Thawing a good deal. The first Goose was seen yesterday. (Fort Ellice Journal, HBCA B.63/a/5 1858-60)

  March 28: During the present month, the weather has been delightful...Already the creeks are beginning to run, the roads are getting mushy and the winter highway of ice on the river is becoming unsafe... (Nor' Wester Newspaper, January 28, 1860)

- Snow and rain fell at Fort Ellice on April 4, 7, and 11. By April 14, much of the snowpack had disappeared in the vicinity of Red River and although the river was rising, concerns about low water were expressed. The Red opened on April 18 and was reported to be low by the end of the month.

  April 4: A heavy fall of snow. Snowing all day. (Fort Ellice Journal, HBCA B.63/a/5 1858-60)

  April 14: The snow is nearly all away, and there is every prospect of the river being free of ice in a few days. The final disruption commenced about a week ago. The water has been rising for a long time past, and navigation may speedily be resumed...We are informed on the authority of parties lately arrived from Georgetown-at the mouth of the Buffalo river-that there are indications of the main river being unusually low this season. They say that to the south the snow has been almost entirely melted and that many of the creeks which supply the river are already dry; notwithstanding which the water is below the average depth. Their statement as to absence of snow is confirmed by the fact that as early as last month they were able to travel from Georgetown to within a short distance of Pembina by means of oxen and carts. But we hope they may be mistaken in regard to the shallowness of the river. (Nor' Wester Newspaper, April 14, 1860)

  April 18: River opens by dissolving the ice, the water being very low there has been too little strength of current to remove it a very unusual case. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

  April 28: The ice has disappeared before the advancing heat of the summer. The far-famed

red River of the North glides sluggishly at our feet...For the last fifteen or twenty years, the river has not been lower at this season than it is at present. The quiet flow of ice contrasted strongly with the customary rush, crash and splash of former years. How the steamboat is to discharge her important duties this year we cannot imagine. (Nor' Wester Newspaper, April 28, 1860)

- May was cool and relatively dry until the 17th when heavy rain fell at Red River (but not at Fort Ellice). Heavy rain also fell at Red River on the 25th.

May 14: [American travellers] repeat the universal story regarding the shallowness of the water, of which three or four detentions on sand-bars afforded them practical illustration...Of late, the weather has not been so pleasant as the fitness of the opening spring had led us to expect. For the season, the winds have been cold, and since we last wrote on this topic, we have been visited by two or three smart snow storms... (Nor' Wester Newspaper, May 14, 1860)

May 28: ...Dry weather prevailed during the whole of the seed-time, and just as the farmers began to call out for rain, the rain came down... (Nor' Wester Newspaper, May 28, 1860)

- The rain which began in late May continued into June which was very wet. The Red River rose throughout the month. Abundant rain also fell at Fort Ellice between June 3-21; on June 14, 16, 17, 19 and 21, it rained "all" or "most part of the" day.

June 14: On all hands it is admitted that a season more favourbale than the present for the growth of the wheat crop has never been known in Red River. Showers are plentiful, and sunshine abundant...The river continues to rise rapdily though for the season it is unusually low. (Nor' Wester Newspaper, June 14, 1860)

June 17: ...A very great quantity of water has fallen, the valley in our field was so filled with water that it produced quite a rapid current. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

June 28: The present has been a rainy month. We have had showers throughout at short intervals. The first week rain was very much required, and was welcome, even the second; but framers think that during the last fortnight we could have dispensed with it advantageously for sunshine and clear sky. If the wet weather continues much longer, the potato crop will suffer...The water has risen steadily during the present month, and is now higher than at any time, previous this year...If the rain continues, there will be abundance of water for the Anson Northrup. At present she has enough and to spare... (Nor' Wester Newspaper, June 28, 1860)

- The first half of July continued wet and the rivers were high.

July 14:In our last, we stated that the month of June was more than usually rainy. By the close of the month there was more rain than was necessary for a healthy vegetation. The first half of July, we regret to say, has been a continuance in an aggravated form of the same wet season....If we have as frequent rains for the next fortnight, very serious damage will be done to our farming interests. (Nor' Wester Newspaper, July 14, 1860)

July 28: Mr. McVicar [carrying mail from Fort William and Fort Francis] found the rivers greatly swollen by the heavy rains, and he and his party were compelled to swim several of them with the mail bags on their backs...Per contra the river is falling all the way from Georgetown to Fort Garry. (Nor' Wester Newspaper, July 28, 1860)

- August was comparatively dry and the Red River fell to a "low" level but nevertheless had sufficient water to allow the steamboat Anson Northrup to continue to operate until the end of August.

August 28: ...On arriving at Georgetown with the boat last trip we found the water so low ... (Nor' Wester Newspaper, August 28, 1860)

August 31: I hear many people say that they never remember such a summer for rain, it is indeed been wonderful all through... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- In summary, the freshet was small in April and most of May but abundant rain in June and July caused the river to rise and even though it was again low in late August, it is likely that overall runoff in the Red River during the water-year was in the low range of normal. Little is known about the state of the Assiniboine but the weather at Fort Ellice seems to have been similar to that at Red River and it is concluded that overall runoff in the Assiniboine basin was also similar to that of the Red, i.e. normal.

1860-1861	Very High

- The probability of flooding in the Assiniboine in 1861 and the conditions in the Assiniboine and Red River basins during the winter of 1860-61 are discussed in PART THREE.

1861-1862	Low

- October, November and the first half of December were mild at both Red River and Fort Pelly, with normal precipitation. The Red froze November 9-11.

- Distinctly colder weather began in mid-December and continued through January and February. Snowfall was only moderate and possibly below average.

- March was relatively mild with thawing from mid-month onward. By the last week, much of the winter snowpack at Red River had disappeared. No information is available from Fort Pelly after March 20.
  March 23: ...a fine warm day some parts [of] the roads are getting bad now, and the fields are getting bare... March 29: the snow is melting now...fast. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

  April 2: Spring is opening upon us in right earnest. The weather is delightfully genial. The snow is off the ice for the most part, and the creeks are beginning to run. Carolling by land is at an end, and will soon cease upon the ice, too. (Nor' Wester Newspaper, April 2, 1862)

- Colder weather in April with additional snow and rain delayed river breakup and the full onset of spring until late April-early May.
  April 16: Still winter, lingering, chills the lap of spring. Three weeks ago there was every indication of summery weather. The air was mild-snow had totally disappeared in many places-the liberated streamlets were brawling in their haste riverward...But Easter is late this year, and it appears that we are to have a late spring too. Snow again mantles the ground and the air is chill...The river ice is yet set fast, and here travellers in sleighs and cutters find

the only passable road just now. (Nor' Wester Newspaper, April 16, 1862)

April 22: the River is still strong... April 26: the ice broke up...down below the rapids...but Mr. Thomas Bunn came across the river on his horse...April 28: I walked across the river on [a] horse...April 29: as we came home the River began to break up opposite the school and downwards...April 30: the water rose over Thomas Fidler's bank when the River broke but it soon fell... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

May 2: The ice is now leaving the river here. (Journal of Abraham Cowley, HBCA MG7 B2 CMS A87)

- The first half of May was warm and dry at Red River. Some rain fell in the second half of the month (and snow on May 16) but overall, May precipitation was below average and by the end of May, the crops were beginning to suffer.
  May 25: rain is now much needed...May 29: hardly any rain to be seen now the weather is dry dry and warm now... June 4: the crops requires rain very much now the ground is so dry... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Hot dry weather continued in June. Despite some rainshowers, the month was dry overall and significant rain didn't fall until June 30.
  June 8: every person wishing for rain... June 19: it is remarkably dry ever since the river opened and hot hot... June 23: very hot dry weather... June 30: Plenty of thunder and lightening and heavy rain in the night... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Precipitation in early July removed the immediate threat to the crops but the water level in the Red was too low for the steamboat by late July.
  July 23: ...the low water kept [the International] two days and a half at Goose Rapids. (Nor' Wester Newspaper, July 23, 1862)

- These low water conditions continued throughout the rest of the summer.
  Our readers will recollect what trouble the International had last summer [1862] with the low water. (Nor' Wester Newspaper, April 13, 1863)

  September 11: We cannot be far astray, however, in supposing that [the steamboat] must be detained by the lowness of the river. (Nor' Wester Newspaper, September 11, 1862)

- In summary, the freshet in the Red River was small and summer flows very low. There is little information about the Assiniboine basin but the winter there seems to have been similar to that at Red River and there is nothing to suggest different conditions during the summer. Thus it is concluded that overall runoff was low.

1862-1863	Very Low

- October must have been cold at Red River because the Red froze October 18, broke up, and then froze again permanently by the 31st. Snow which fell in October and November melted in mild weather in November and little new snow fell in December. Temperatures were generally mild through December and January with only short cold periods.
  November 4: Of late, the weather has become quite cold. The river froze over on the 18th

October but afterwards broke up and again set fast on the 31st. Snow first fell on the 23rd October and that fall had almost disappeared when a second fall on the 30th seems to have ushered in a permanent coating. (Nor' Wester Newspaper, November 4, 1862)

November 17-19: such fine pretty clear weather nearly all the snow is thawed away... [20th] the road is covered with water owing to warm weather. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

December 19: a pretty day and clear hardly any snow bad hauling...[28th] a fine mild dark day still little snow. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Mild temperatures also dominated in February at both Red River and Fort Ellice (where records began on the 16th]. Snowfall must have been greater since the snowpack at Red River was reported as "pretty deep now" on February 16 (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13).

- Mild weather continued throughout March. Fort Ellice reported thawing on March 15 and snow on March 20, 22-23.

- By late March, thawing had become general. Mild weather continued until mid-April.
March 31: Fine warm day. the Snow is rapidly disappearing from the Hills across the River. Several flocks of geese were seen passing northwards. (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

April 1: The Snow is disappearing at a great rate. The river is beginning to overflow [probably means that the water is flowing on the ice since breakup had not yet occurred). (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

April 3: Fine mild day. Wind South...a good quantity of Snow disappeared today. (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

April 4: Mild day...the river is getting hard to cross... (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

April 13: people still crossing [Red] river on ice here. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

April 13: Spring has fairly set in. The weather has been very fine and mild. The snow has almost entirely disappeared...The very limited quantity of snow that fell during the past winter has had something to do with this as well as with the moderate flow of our creeks and rivulets. The ice will probably break up in the course of the present week. (Nor' Wester Newspaper, April 13, 1863)

April 14: Fine mild day. The River is nearly clear of ice. (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

April 17: rain after 7 o'clock...cold & raining [Red] river running clear. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

- The Nor'Wester comment on April 13 above indicates that winter snowfall was "very limited" and spring runoff was small. By the end of April, the unusually low state of the Red River was confirmed.
April 27: Our readers will recollect what trouble the International had last summer [1862] with the low water. It is to be feared there will be still greater embarrassment this year for the river

is extremely low just now...On Wednesday the 15th instant, the river-ice broke up and began to drift down current. On the 18th and 19th we had very bad weather-snow and sleet with a very heavy north-easterly wind. Last Monday, it cleared up and with the reappearance of the sun, the roads became almost impassable...It is feared that the season will be a very dry one. The river has been unusually low for the season and the creeks are almost dry. (Nor' Wester Newspaper, April 27, 1863)

- May was very dry at Red River with only a "little rain" on two days until the 30th when "a fine shower" occurred (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13). The Fort Ellice Journal reported rain on 6 days but there is no indication of a large amount.

- Rain fell at Red River at the end of May and in early June, and periodically later in the month, but by the end of June the weather was still considered very dry. The Red River was very low at the end of June. Information from Fort Ellice ended June 6.

June 2: At length we have had rain. Since last Thursday there have been several refreshing showers and it is still cloudy. Having had five weeks of dry weather, this rain is very much needed. (Nor' Wester Newspaper, June 2, 1863)

June 30: dry, dry the weather was never seen people says so long without rain, it thunders often and yet no rain, sometimes it is very hot, it gets very rainy like sometimes but it clears off and there is no rain. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

June 30: Add to [the Indian troubles] the troubles of extreme low water [in 1863] and the last of June found the International "safely moored [at]... Abercrombie". (Bill, F.A., 1947. Life on the Red River of the North, 1857 to 1887. Wirth Brothers, Baltimore, Maryland, p. 63)

- July and August were also exceptionally dry at Red River.

July 8: The want of rain is becoming a serious matter with farmers. The season thus far has been a very dry one and cereal crops look parched. On Saturday last the thermometer registered 101° in the shade. (Nor' Wester Newspaper, July 8, 1863)

July 17: ...low water in the river. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

August 24: Most all the wheat was very short this year owing to the want of rain, people had to cart water to the hay making and reaping... 30th Winderful dry weather still...A great deal of fires running now... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Considerable rain fell in September but water levels remained low.

September 7: [boats from Norway House] came up the river...they could not proceed for want of water... 19th: the Watermills are all dry and will not be able to grind this fall. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Although there is little information about the runoff conditions in the Assiniboine, the Red River had a small freshet and very low water throughout the summer. The drought in 1863 and in the following year was widespread: in Itasca State Park, Minnesota, and Boundary Waters Canoe Area (east of Lake of the Woods), the forest fires in 1863 and 1864 were the largest between 1790 and 1870 and among the largest in the last 300 years (Heinselman, 1973; Swain, 1973). There is no evidence for greater snowfall in the Assiniboine basin, the freshet was early and

probably low, and it seems likely that the drought conditions would also have extended into the Assiniboine basin, producing very low overall runoff during the water-year.

1863-1864	Very Low

- October was relatively cold at Red River. Ice was running in the Assiniboine there on October 21 (Diaries of Dr. William Cowan, PAM MG2 C15 M154) and the Red River froze on October 22 (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13). Snow which fell at Red River, Fort Ellice and Fort Pelly in late October was removed by mild temperatures but additional snow fell in the last half of November, particularly at Fort Pelly.

- Considerable snow fell at Fort Pelly and Fort Ellice in the first half of December.
  December 8: ...a great deal of snow fell last night. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

  December 9: ...Snowing all day. (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

  December 13: ...[the men from the Touchwood Hills] complain of bad travelling from the depth of snows... (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

- January began cold at Fort Ellice and Fort Pelly but became very mild during the last half. Snow or rain fell on 5 days at Fort Pelly and strong thawing conditions prevailed at both posts from the middle to the end of the month.
  January 21: ... A fine day; it rained a little early this morning and thawing all day. (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

  January 22: [the buffalo] are all moving out from the continued mild weather we have [had]. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

  January 24: wind west, fine mild weather; the weather has now more than a fortnight been extraordinary mild being in fact more like March weather than January. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

- Mild weather continued throughout February and although additional snow fell, much of the snow cover melted. Similar conditions occurred at Red River, with rain on the 29th.
  February 3: ...clear & mild, a regular thaw in fact took place to day; pools of water forming in all parts of the yard... (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

  February 6: Very mild weather...the snow has nearly disappeared in places from the recent thaws &...if the weather continues warm for a few days longer dog sled travelling near the Touchd. Hills will be almost impracticable. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

February 14: snowing more or less all day. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

February 21: clear & very mild, pools of water were collected in all parts of the yard as in spring... (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

February 23: Beautifully mild weather, the snow has so much melted away the past two days that the Country around is beginning to have quite a spring appearance. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

- March was also very mild. Heavy rain fell at Fort Pelly on the 11th and the snow had gone from the plains. Snow remained in the wooded areas, however. Late March was colder.

March 5: The snow is disappearing and we expect an early spring. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

March 11: cloudy with a regular downpour of rain from 12N which turned to snow towards evening... (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

March 18: ...there is not much snow & the Horses...will have some difficulty to bring their loads unless some snow falls soon. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

March 21: ...the snow having nearly all disappeared long ago. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

March 29: [they] were obliged to leave the cart & load at the White Mud River from there being so much snow through the woods on the other side of the Devil's Creek; & on this side again of Sand Creek its too bare for sledge travelling. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

- Thawing continued at Fort Pelly and Fort Ellice in April but spring advanced more slowly at Red River. The Red didn't break up until the 26th.

April 6: thawing the Snow wasting away very fast. (Fort Ellice Journal, HBCA B.63/a/6 1862-63)

April 12: The transforming process [of spring] has been an unusually gradual one this year. We have had fine warm, sunny days and then again the icy breath of winter has chilled us by a cold north wind, which prevailed steadily for more than three weeks. Here and there the cattle feed on small patches of the prairie where the snow has melted off. At the Long Lake, we believe, the cattle have been at large on the plains for weeks past. But winter still lingers in the lap of spring... (Nor' Wester Newspaper, April 12, 1864)

April 26: Early this week the ice commenced to break up and float lakewards in a compact body, which in a few days became broken up into innumerable fragments. The river is higher than anticipated though the rise of water has not been so sudden or so great as in previous seasons. The days are warm, bright and pleasant... (Nor' Wester Newspaper, April 26, 1864)

- Although the Red rose higher than anticipated, it evidently wasn't high in absolute terms and low water was reported in the Swan River near the upper Assiniboine.

April 20: ...the Swan River very shoal & no appearance of the water rising yet & the ice is still as solid as ever. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

April 27: ...from the shoal state of the water in the Swan River no pieces can be taken in the boats all the way to the Store. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

May 6: owing to the shallow state of the water in the Swan River they could not take any Pieces in the Boats beyond the Beaver Dam. (Long, W.H., 1987. Fort Pelly Journal of Daily Occurrences 1863. The Regina Archeological Society, Regina, HBCA FC 3213.9 P4)

- Little precipitation was reported at Red River or Fort Pelly in April or May (apart from snow at Fort Pelly on May 3). May was cool and the levels of the Red River and other streams near the Red River Settlement were very low.

May: [9th] ...this spring the Watermills cannot grind for want of water... [15th] we had a few drops of rain, nearly the first this spring yet... [20th] a hot day, the weather is dry dry now, very rare to find any water in any swamp now, this is so far gone of the third dry summer...The steam boat made one trip about two weeks ago–but she will not run more for want of water if no rain comes. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- The drought was broken somewhat in June by periodic significant rain but worries about dry conditions continued and the Red River continued to be low.

June 21: The crops. Where are they? Burning, drying, withering in the ground! Ten days more of this increasing 'Drought' and the question is dismally put at rest. We shall have none...Since the above was in type, we were thankfull to say, a fine rain has fallen all over the Settlement. (Nor' Wester Newspaper, June 21, 1864)

June: [4th] it rained pretty heavy all night and [on the morning of the 5th] it rained... [16th]: water low in the river, the best shower we have had in this settlement perhaps this two years back fell on the [18th]...we had a fine shower on [the 19th]...a heavy shower of rain on the 28th ... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Rain also fell periodically in July but the summer was very hot and the crops and vegetation developed poorly, partly because of dryness but compounded by grasshoppers.

July 13: ...The steamer International has beyond doubt made her last trip to the Settlement this year; and it is to be regretted should be her only one for the season of 1864. Long before she steamed to Fort Garry, on the 1st of May, the river was open to navigation, and despite the dryness of the season, there was quite enough water for her to have made several trips up to that time...She now lies stranded on Goose Rapids... (Nor' Wester Newspaper, June 21, 1864)

July 23: On the 20th the hay cutting ...usually commences but as the growth of the grass this year was retarded by drought the 27th was fixed upon as a better time for the commencement. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

August 8: The oldest inhabitant does not remember a summer of such extraordinary long-continued heat as we have experienced this year in Assiniboia...That this is the case will readily be believed when we say that the thermometers have indicated 87 to 90, 97, and even 100 degrees in the shade! Within the past 40 or 50 years, such a summer of heat and wind has never been known in Rupert's Land...Despite some smart showers in June and July, there is barely enough herbage on the plains to feed the cattle. (Nor' Wester Newspaper, August 8, 1864)

August: The last harvest was so poor, that it must have come far short of meeting the ordinary wants of the community. (Minutes, Council of Assiniboia, January 12, 1865, in Oliver, E.H., 1914. The Canadian North-West: Its Early Development and Legislative Records. Publications of the Canadian Archives, No. 9, Government Printing Bureau, Ottawa, p. 550)

August: The heat of the summer of 1864 at Red River was so extreme that nobody in the settlement remembered such another. The thermometer sometimes continued for a considerable portion of the afternoon to stand at 100 degrees in the shade. The river sank and the International made only one trip...The droughts prevailed until the middle of July, when rain for the first time visited the parched ground. (Hargrave, J.J., 1871. Red River. Reprinted 1977, Friesen Printers, Altona, Manitoba.)

- In summary, the drought of 1863 continued into 1864 although it was broken by rain in June and July. After a modest freshet, the Red River was low throughout the summer. As was noted above, large forest fires occurred in Minnesota and northwestern Ontario in this summer as well and it is likely that these conditions also extended into the Assiniboine basin, and that water levels there were very low.

1864-1865	Normal

- October was mild and relatively dry at Red River. The Red froze on November 8-10 and the Assiniboine was "very much choked with ice" at Fort Ellice on November 7. Cold and mild weather alternated in the second half of November. Heavy snow fell at Fort Ellice on November 6 but little fell at Red River until November 16.
  November 16: ...Very little snow has up to this time fallen in the Settlement, so that wheeled vehicles still are seen on the highway, and cutters and carioles have not yet been taken out. The weather is too unusually mild for the time of year. This morning, as we were going to press, five or six inches of snow lay on the ground and it was come down steadily. First day of sleighing, 16th. (Nor' Wester Newspaper, November 16, 1864)

- Rain fell at Red River on November 27 and mild weather removed much of the previous snow cover.
  November 28: we had such mild weather towards the close of last week that the snow has all but disappeared off the roads and sleighing is abandonned. There was a heavy fall of rain yesterday evening which, followed by the hard frost of last night has sheathed the roads in ice. (Nor' Wester Newspaper, November 28, 1864)

- December began with cold weather and snow at Red River and Fort Ellice. Few observations are available at either place until December 24 when the weather became "very mild" at Fort Ellice with heavy snow on the 25th.
  December 3: The weather has again become cold & wintry; the heavens overcast & dull. A considerable quantity of snow covers the ground. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

  December 25: Snowing heavily all day. (Fort Ellice Journal, HBCA B.63/a/8 1864/65)

- Cold and mild weather alternated in January at Red River and Fort Ellice reported "mild weather" January 27-28. At Red River, Taylor reported "the snow is pretty deep in the woods now [January 22nd)" (Diaries of Samuel Taylor at Red River

Settlement, PAM MG2 C13).

- February was mild at Red River, with rain on the 2nd and considerable snow from the 19th to the 21st.
  February 21: A heavy snow storm, a large addition to our winter's stock. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

- Considerable snow fell at Red River in early March but there is no information from the Assiniboine basin. Mild temperatures prevailed from March 14 to the end of the month and the snow pack was being reduced.
  March 4: There has been a great storm & fall of snow this week. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

  March 11: ...there was a lot of snow fell a.m. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C130

  March 29: the snow was all off in some places, and in some places it was deep... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Much precipitation fell at Red River in the first week of April.
  April: [3rd] ...it began to rain about 11 0'clock a.m....and rained heavy all night and next day... [4th] it began to rain a little before dinnertime...and rained heavy all night and all the next day until nearly the evening when it began to snow... [6th] the worst day we had the whole winter for snow and drift, and had a regular storm of wind...sometimes I could not see the woods at each side of the Road... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

  April 6: The snow storm on the 6 is believed to have been the most severe occurring here for 20 years. There was a perfect hurricane for twenty-four hours, and the snow flew in clouds, so that it was immpossible to see twenty yards in any direction out-doors. Both before and since this storm, the weather has been mild and spring-like. (Nor' Wester Newspaper, April 17, 1865)

- The Red broke up April 22-23 and the freshet seems to have been strong, continuing into mid-May.
  April 17: The mail carrier states that a freshet had occurred at Pembina the water rising four feet so suddenly that the people there could not save their fishing nets. Considerable freshets has also occurred along the Mississippi, sweeping away the telegraph poles and wire at some points and doing other damage. (Nor' Wester Newspaper, April 17, 1865)

  May 13: Plenty of water is reported [by the steamboat company] all along [the Red River] - there being on the most dangerous bar (the Goose Rapids) some eight feet of it. (Nor' Wester Newspaper, May 13, 1865)

- May was hot and rather dry but heavy rain fell at Red River throughout June.
  June 1: it began to rain after dinner, but in the evening it began to Thunder and there was the heaviest fall of rain that has been for three or four years back and wonderful bright. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

  June 8: Vegetation never looked better than it has since the late heavy rains... (Nor' Wester Newspaper, June 8, 1865)

  June 16: I went up [to St. Clements]...a good deal of rain the roads heavy. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

June 18: ...showers now and then...there has been a great deal of rain this week...24th a rainy day...25th a dark cloudy rainy like day the ground wet... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- Little rain was reported in July and August at Red River but early September was very wet at Fort Ellice and the "River" (almost certainly the Assiniboine) was high and rising at mid-month.

September 2: High wind from the East and heavy rain. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

September 8: Cloudy and Raining all day. rained a very great deal. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

September 9: Raining all day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

September 10: ...Raining all day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

September 11: Raining all day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

September 12: Rainy weather. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

September 16: [The Assiniboine] River is very high owing to the late heavy rains. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

September 17: The [Assiniboine] River still Rising. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- The evidence of the strong freshet on the Red, rainfall in June at Red River, and very heavy rainfall at Fort Ellice in September causing high river level in the upper Assiniboine suggests that overall runoff was (conservatively) at least normal and may well have been high, considered over the entire water year.

1865-1866	Normal

- At Fort Ellice, the Assiniboine froze October 27-29, and the Red froze October 29-31. Mild weather in the first half of November re-opened both rivers by November 14-16 and they did not refreeze again until the end of November.

- Snow or rain were reported on 5 days in November at Fort Ellice but on only two at Red River and because of continued mild temperatures, there was little snow cover until new snowfalls at the end of November and early December.

November 15: Raining hard all day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

November 17: Quite mild. The most part of the snow disappeared. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

November 22: there is not a spoonful of snow yet. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

November 23: The weather more like summer than what might be expected at this time of year. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

November 28: A considerable quantity of snow fell last night so we may reckon the winter to have fairly set in. (Journal of Abraham Cowley, PAM MG7 B2 CMS A87)

December 2: The weather Cloudy, after Snowing a good deel last night. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

December 3: ...plenty of Snow on the ground. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- December was generally cold with little new snow reported. Information is sparse for January but again little snow appears to have fallen and thawing weather late in the month greatly reduced the snowpack.

January 30: ...They left their loads at the Pipe Stone River there not being enough Snow to fetch them. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- Temperatures were generally cold in February until the last week when thawing occurred at both Fort Ellice and Red River.

February 28: ...the three last days of [this] month was very clear weather and melted the snow away very much. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- March was alternately cold and mild. A major snowstorm occurred at Red River March 1-2 and it is assumed to have affected Fort Ellice as well where the weather was described as "bad" on these days. Comments later in the month indicate a deep snow cover at Red River at least through March.

March 1: ...it began to snow before bedtime, and it snowed and drifted most of three days, the snow is deep now. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

March 15: the weather is still keeping cold the snow is deep... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

March 25: ...snow deep deep now. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- On March 27, strong thawing conditions began and continued into April. Despite additional snow at Fort Ellice on April 2, 3, 4, 8, the snowpack was greatly reduced by April 9.

April 9: Thawing hard...They were unable to bring any thing for want of snow. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- Significant rain and snow fell on several days in April at Fort Ellice. The Qu'Appelle River was high at Fort Ellice on April 23 (but began falling the next day).

April 10: Thawed hard all day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

April 11: Very disagreeable weather. Last night rain turned to snow which continued till night... (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

April 17: Snowing in the morning but cleared up at noon. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

April 23: The river all most clear of ice. Mr. Watt arrived at the Quappelle river was was [stopped] on account of the highth of the River. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

April 24: Mr. Traill...succeeded in crossing Mr. Watt. The River fell 4 feet during the day. All the Ice off the river. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

April 26: Raining hard in the morning. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

April 27: Raining in the morning. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- Information for early May is slight for both Red River and Fort Ellice but heavy rain fell at Fort Ellice on May 14 and 18-20 and the Qu'Appelle was still high on May 17.
  May 14: Heavy storm of rain & hail accompanied by thunder & lightening. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  May 17: ...they left [3 carts] on the other Side of the Qu'Appelle the water being too high to get them across. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  May 18: Raining the greater part of the day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- A great deal of rain (and snow) fell in June at both Fort Ellice and Red River.

FORT ELLICE (Fort Ellice Journal, HBCA B.63/a/9 1865/67)	RED RIVER (Diaries of Samuel Taylor, PAM MG2 C13)
June 8: Singular weather for the time of year. Raining hard all morning which turned to Snow about noon & continued till the present time...Snowed all after noon with hard Frost at night. June 9: Snowed all night and till about 8 A.M. this morning. Froze hard last night. Very cold all day. June10: Raining torrents all day. June 11: Rained hard till about 10 A.M. June 23: Heavy rain. June 25: Several severe Thunderstorms.	June 4: ...heavy rain June 5: ...heavy rain. June 6,7: rain and thunder June 9: the ground covered over with snow, and snowing thick now and again during the day June 20: terrible thunder and bright lightening and heavy rain, and hail... June 23: some big hail fell amongst the rain June 30: ...this whole week has been windy sometimes rain and thunder bright lightening

- The weather in July, August and September was normal.

- The reports of high water in the Qu'Appelle River in mid-April and mid-May, and the abundant precipitation in June suggest that runoff was at least in the high range of normal and if the precipitation affected the upper Assiniboine basin as well, overall runoff in the water-year may have been high.

1866-1867	High

- October at Fort Ellice was relatively cold. The Assiniboine froze October 27-30 and heavy snow fell at both Fort Ellice and Red River October 28-30. Very mild weather in the first half of November melted the snow and weakened the river ice at Fort Ellice, and opened the Red River.

- Cold weather began December 7 but December continued to have intermittent mild weather, with heavy rain at Red River on December 22.
  December 22: ...there was a heavy rain a.m. the 22nd and then after breakfast it snowed thick. (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

- January at Fort Ellice was cold with abundant snow on 11 days (10 days between January 8-23). At Red River, snow was mentioned by Taylor on only 1 day.

- February was generally cold at Fort Ellice with considerable snow in the last week.
  February 22: Snowing hard last night and this morning cleared up towards evening and drifting hard ever since. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  February 22: ...a good deal of snow fell... (Diaries of Samuel Taylor at Red River Settlement, PAM MG2 C13)

  February 28: Snowing hard all day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- March was cold and no new snow was reported at either Fort Ellice or Red River after the first week.

- Thawing began in early April and considerable rain or snow fell at Fort Ellice in the last half of April.
  April 17: Raining a little at night. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  April 19: Raining at intervals all day. The river was clear of ice. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  April 20: Cold rain which at times turned to snow towards night. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  April 21: Snowing all day. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  April 23: We have had a beautiful spring so far. The snow has all melted and the ground is fast drying up. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  April 28: ...High wind with rain & snow... (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- The Assiniboine broke up at Fort Ellice April 15-19 and began to rise quickly. The freshet was strong (possibly greater than bankfull) and continued into the first week of May. The April 23 comment implies that both the Assiniboine and Qu'Appelle were high.
  April 23: The rivers both rising rapidly. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  April 27: The river still continues to rise and is nearly flush with the banks. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  April 28: The river still rising... (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

  May 9: The water sinking fast. (Fort Ellice Journal, HBCA B.63/a/9 1865/67)

- No further information is available from Fort Ellice after May 9. Travelling between Fort Qu'Appelle and Fort Ellice, probably in early June, Walter Traill encountered wet cold weather, and later reported that the summer at Fort Qu'Appelle was very wet.
  June: The weather was unusually rainy, there not being a day throughout the trip [from Fort Qu'Appelle to Fort Ellice] without rain at some time during the twenty-four hours. (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 80-81)

August: We had little warm weather in June, with snow on the thirteenth on my boat trip to Fort Ellice. We have had a miserable wet summer [at Fort Qu'Appelle]... (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 86)

- The strong freshet in (apparently) both the Assiniboine and Qu'Appelle basins and the subsequent wet summer suggests that overall runoff for the water-year was high.

1867-1868	Normal

- Cowan reported the "rivers fast" on October 31 at Red River but mild weather opened them subsequently since people were "crossing river in canoes" on November 9.
- Information is sparse for December, January and early February but Traill experienced a heavy snowstorm between Fort Ellice and Fort Pelly about December 20, and again on his return journey January 1. The Nor' Wester Newspaper reported deep snow cover in the upper Red River basin.

December 20: The first day we covered more than a third of the distance of one hundred and twenty miles but that night there came a terrible snowstorm which continued as a blizzard all the next day [between Fort Ellice and Fort Pelly]. (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 107)

January 1: We would have made the trip in three days had it not been for a snow storm on New Year's Day which became so heavy that we were forced to lie in camp [between Fort Pelly and Fort Ellice]. (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 109)

January 19: All the slays are now in from Abercrombie, the unusual depth of snow has however compelled many to leave whole or parts of loads on the way down. (Nor' Wester Newspaper, January 19, 1868)

- Cold weather dominated the last half of February and most of March at Red River. Very little snow fell in this period.

March 30: ...Hardly a particle of snow has felled since [the 15th of February] and the amount of snow has been sufficient to ensure good sleighing until within the last two weeks. (Nor' Wester Newspaper, March 30, 1868)

- Strong thawing began March 27 at Red River and the snow began to disappear quickly.

March 29: ...plain road very bare, down by river good. (Diaries of Dr. William Cowan, PAM MG7 C15 M154)

March 30: ...The snow is rapidly disappearing and every indication betokens an early spring with no great amount of high water. (Nor' Wester Newspaper, March 30, 1868)

- April at Red River was mild, with some snow and rain, particularly on the 21st as the rivers were breaking up (which melted the next day), and on the 28th.

April 22: snowing ground white...snow on plains nearly 6 ins. (Diaries of Dr. William Cowan, PAM MG7 C15 M154)

April 28: ...raining heavily this afternoon. (Diaries of Dr. William Cowan, PAM MG7 C15 M154)

- May weather appears to have been normal. The level of the Red River was predicted to be low soon after breakup (see April 24 below) but the freshet seems to have been of normal length, with falling stages first reported on May 7, and high water was reported from the southern basin.

April 24: ...Bannatyne says river very low above does not believe steamer will run. (Diaries of Dr. William Cowan, PAM MG7 C15 M154)

May 7: ...river falling. (Diaries of Dr. William Cowan, PAM MG7 C15 M154)

May 23: The Steamer International arrived from Georgetown on Tuesday last week [Some persons] arrived on Thursday of last week from Fort Abercrombie with horses. They report the Rivers high, so much so as to necessitate rafts over all the streams except those above Grand Forks. (Nor' Wester Newspaper, May 23, 1868)

- By mid-June, the levels of the Red and Assiniboine were low - in the case of the Assiniboine, too low to attempt a trial steamboat run.

June 13: The water in the Red River is falling fast and the Steamboat people do not expect to get above Goose Rapids. (Nor' Wester Newspaper, June 13, 1868)

June 15: The boats had come down slowly owing to the low water which had prevented all thought of sending up the steamer [up the Assiniboine for a trial run] [Traill at Portage la Prairie]. (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 116)

- Abundant rain fell in July at Fort Ellice and Red River and the steamboat was still operating at the end of July.

July 2: Rained hard last night... (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

July 3; Rained hard last night but turned out fine until 3 P.M. when it rained again. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

July 5: Rained hard all night & today untill dinnertime... (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

July 11: Rained hard last night. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

July 18: The weather during the past week has been very hot and sultry, the thermometer ranging from eighty to ninety in the shade. We have had several heavy falls of rain during the week...Last Wednesday evening we had another heavy thunderstorm. (Nor' Wester Newspaper, June 13, 1868)

July 19: ...heavy rain & thunder at night. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

July 29: Rained very hard last night with Thunder & lightning. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

- The weather in August was normal. September may have had above-normal precipitation and was cold and wet with much snow in the last week at Fort Ellice.

September 15: Our equinoxial storms are some two weeks earlier this year than usual. We have had intermittent rains, of a few hours durations, for the last 10 days. We may look for a day or two longer of lowery weather. (Nor' Wester Newspaper, September 15, 1868)

September 22: ...Snowing the most part of the day. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

September 23: The weather much the same as yesterday. Snowing the most part of the day. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

September 25: ...raining a grate part of The day. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

September 26: the weather much the Same as yesterday raining in Showers. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

September 27: A fine day after raining last night. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

September 30: The weather has been unusually cold for this time of year. All the small lakes have been and are still frozen. There were eight inches of snow at Red River when Mr. McDonald left there with our carts, wand while coming up his servant got one of his feet frozen very badly, but it is too early for winter, surely [Traill at Riding Mountain House]. (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 116)

1868-1869	Normal

- The cold of September continued into early October. However, milder weather began on October 8 and cold and mild weather alternated for the rest of the month. The Red River froze in the first week of November. Rain or snow fell on 7 days at both Red River and Fort Ellice.

  October 6: In a few days the houses will be finished, I hope, for it is exceedingly cold with deep snow though it is not too late in the year to have some fine autumn weather... [Traill at Riding Mountain House]. (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 116)

- November began cold but became generally mild for the last 3 weeks and continued so into the first week of December. The Nor' Wester reported snow on 8 days at Red River but most seems to have melted by the end of the month.

- December was generally cold from the 7th onward. Several heavy falls of snow were reported in December at Red River but much less seems to have fallen at Fort Ellice and Riding Mountain House in December and January.

  December 24: Dr. Brown reports the late heavy fall of snow to be sufficient for the transportation of any freight requiring to be brought in from Abercrombie. It is badly drifted in some places, but as a general thing, the roads will be good. (Nor' Wester Newspaper, December 24, 1868)

  January 15: It is now well into January and we are having a beautiful winter [Traill at Fort Ellice and Riding Mountain House]. (Walter Traill, quoted in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill. McLelland & Stewart, Toronto, p. 136)

  January 31: Snowed last Night. This is the first fall of Snow worth mentioning that fell since fall. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

- February was alternately cold and quite mild with snow reported on only 4 days at Fort Ellice. By early March, the Nor' Wester Newspaper reported somewhat below-normal snow cover.

  March 6: The depth of snow [normally] varies from one to two feet on the level. It is about one foot this winter, and last winter it was about eighteen inches in depth. (Nor' Wester Newspaper, March 6, 1869)

- Cold weather dominated the first half of March but from March 16 onward thawing conditions prevailed. Snow was reported at Fort Ellice on only 1 day before March 27 and by the 25th, the snow cover there was small.

  March 25: Thawing a great deal. left very little Snow on the ground. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

  March 27: Spring seems to have set in in earnest; the snow is fast disappearing and water is standing everywhere in our streets... (Nor' Wester Newspaper, March 27, 1869)

- The thaw continued in April and apart from snow at Fort Ellice on March 27-28 and rain on April 1-2, little precipitation fell at either Fort Ellice or Red River. The Qu'Appelle was still "icebound" on April 15 but the Red and Assiniboine Rivers broke up at Red River April 19-22. Despite reports of overbank flow in the southernmost section of the Red River (see April 17 below), the river was falling at Red River Settlement and worries were expressed about low water. However, steamboat operations on the Red were apparently unaffected by May 1.

  April 17: We are informed that the Red River has overflowed its banks at Fort Abercrombie and that things up there are afloat generally. Very shortly after the river is clear of ice we may look for flat-boats...The snow had disappeared from our plains on the 17 inst., and the rivers are rapidly breaking up. The roads are getting dry and in another week the plows will be in the ground. (Nor' Wester Newspaper, April 17, 1869)

  April 26: the steamboat came up and got nearly all hands to work to get her lading on board so that the delay should be as little as possible as the river seems to be falling rapidly. (quoted in Ingram, G., Industrial and Agricultural Activities at Lower Fort Garry, in Canadian Historic Sites, Occasional Papers in Archeology and History, No. 4, p. 68)

  May 1: The flatboats and batteaux have been coming in pretty briskly during the past week from up river...[some boats] claim to have made the trip in 11 days from Abercrombie and it is said to be the quickest on record. (Nor' Wester Newspaper, May 1, 1869)

- The weather in May appears to have been normal. June was cool at Red River with apparently normal rainfall at Fort Ellice. Early July was dry at Red River until mid-month but Fort Ellice appears to have received somewhat greater precipitation.

  June 26: This is a remarkably cool summer for Red River. Many of our old settlers do not remember to have seen so cold. The crops present a very luxuriant appearance all over the Colony. (Nor' Wester Newspaper, May 1, 1869)

  July 17: We have been blessed during the past three days with copious showers of rain. This was much needed as owing to the dry weather of the past few weeks the crops and especially the gardens are beginning to suffer. Everything looks bright now however. (Nor' Wester Newspaper, July 17, 1869)

- Late July and the first half of August were also dry at Red River but, as in July, Fort Ellice received greater rainfall on 9 days spread throughout the month. Cowan

reported the "river said to have risen" on August 17, possibly referring to the Assiniboine. However, the Red River Settlement did receive heavy rain (2.54") from August 15-21 (Nor' Wester, August 24, 1869).

August 15: The long threatened rain commenced about two o'clock on Sunday morning [August 15], accompanied by a vigourous display of thunder and lightening, and poured down for the ensuing twenty-four hours in a quantity sufficient to satisfy the wishes of all growers of root crops. (Nor' Wester Newspaper, August 17, 1869)

- Rainfall in August and early September must have been greater in the upper Red River basin because the Red River rose in September and tributaries in the south basin experienced very high water.

September 13: A late and pleasant autumn is anticipated to make up for our unusually cool summer...There has been heavy rains somewhere up the country. The Red River has risen during the inst. week some two feet, and we learn that almost all of the bridges which crossed the small streams between this and Georgetown have been carried away. (Nor' Wester Newspaper, September 13, 1869)

- The last half of September was very wet at Red River (6 days of rain from September 14-24) and probably at Fort Ellice as well.

September 15: raining heavily all day. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

September 15: Raining all day. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

September 16: raining heavily all day. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

September 17: raining heavily. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

September 19: Raining all day [last entry from Fort Ellice]. (Fort Ellice Journal, HBCA B.63/a/10 1868-69)

September 21: The equinoctial gales are upon us and have been during the past week. A considerable amount of rain has fallen, being about two inches, mean depth, and there can be little doubt that some damage has ensued to the crops...This together with our cool summer retarded the grain somewhat in its growth... (Nor' Wester Newspaper, September 21, 1869)

September 23: rained heavily during the night...cold. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

September 24: rained heavily all night. (Diaries of Dr. William Cowan, PAM MG2 C15 M154)

September 28: Fine weather has once more set in and we trust it will continue for some time. The late "wet spell" has been very unfavourable for many of the farmers between this and Portage la Prairie, in getting in their wheat crop. (Nor' Wester Newspaper, September 28, 1869)

1869-1870	Normal

- There is no information from the Assiniboine basin in this water-year. At the Red River Settlement, the Red River froze on October 24, broke up on November 2, and refroze on November 7 (Fort Garry Journal of Occurrences, HBCA B.303/a/1).

- Relatively mild weather occurred throughout November and until mid-December at least, with only a moderate snowfall.

November 23, 1869: Although the weather has been cloudy for the past fortnight a very small quantity of snow has fallen. We have now about four inches in depth, and the sleighing will be tolerably good upon the highways. The ice upon the rivers is not yet sufficiently thick and continuous to afford a good road. (Nor' Wester and Pioneer Newspaper, November 23, 1869)

- After December 15 (when the weather was mild), there is no further information April, 1870. April began very warm, producing an early breakup and strong freshet in the Red. The following extracts from Alexander Begg's Journal summarize weather conditions and the state of the river from the beginning of the snow melt period through April.

Weather and River Conditions, Red River Settlement, April 1- April 29, 1870
(from Morton, W.L. (ed.), 1956. Alexander Begg's Red River Journal and Other Papers Relative to the Red River Resistance of 1869-70. The Champlain Society, Toronto)

April 1: Weather still warm and pleasant. A great deal of water on the ice. Snow rapidly disappearing. (p. 348)

April 3: Weather still continued fine and the ice on the river is beginning to look dangerous. (p. 350)

April 4: The weather was fine today and snow continuing to disappear rapidly. (p. 350)

April 6: The weather was very warm to-day and the river now looks and in fact is quite unsafe. (p. 351)

April 7: Weather fine and warm. River rising a good deal and the ice now quite impassable. (p. 352)

April 8: The weather today was fine with a very warm wind-the river rising rapidly and the ice breaking up. (p. 353)

April 9, 1870: The river open in front of St. Boniface. (p.355)

April 10: The water is high...Several bridges in the settlement have been injured from freshets but there seems to be no danger of a general flood. (p.355)

April 12: The river is now quite open and rose considerably to-day. (p. 356)

April 14: ...the river rose still more to-day. (p.357)

April 16: The weather today unlike yesterday was fine and bright and warm-the late fall of snow rapidly disappeared...River rising a little. (p. 358)

April 18: Weather very pleasant and warm without being too much so. No apparent change in the river to-day. (p. 359)

April 19: Weather today was beautifully warm and pleasant. The river rose perceptibly today. (p. 359)

April 21: Weather in the morning was cold and raw with rain- it cleared up towards noon and grew warmer- a warm shower fell in the afternoon and it cleared up altogether afterwards.

Mail bags came in empty today with a note from Cavalier at Pembina stating that the roads were very bad between here and Abercrombie and that there was great chances for a freshet. (p.360)

April 22: The river still continues to rise. (p. 361)

April 26: River still rising and the creeks now almost impassable. (p. 363)

April 27: River keeping about the same. (p. 364)

April 28: ...river seemed to have lowered a little to-day. (p.364)

April 29: River falling. (p. 364)

- Traill reported high water in Goose River (a western tributary to the Red in North Dakota) in mid-May.
  May 14: [The Goose River] was in flood and it was raining that afternoon when we made camp. (Walter Traill, in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill, McLelland & Stewart, Toronto, p. 181)

- Rain fell at Red River on several days between the 14th and the end of May, particularly on the 14th and 17th when Cowan reported "heavy rain" (Diaries of Dr. William Cowan, PAM, MG2 C15 M154).

- No information is available for June and the scattered accounts which exist for the summer at Red River are not entirely consistent. Some references in August and September suggest that the summer may have been wet
  August 28: When night again fell, the whole force had reached a spot six miles from the rebel fort. And what a night of rain and storm then broke upon the Red River Expedition!...the surface of the ground became ankle-deep in mud and water. (Butler, Sir W.F., 1923. The Great Lone Land. A Tale of Travel and Adventure in the North-West of America. Burns Oates & Westbourne Ltd., London, p.188)

  August 28: It has rained upon forty-five days out of ninety-four that have passed by since we landed at Thunder Bay, and upon many occasions every man has been wet through for days altogether. (Letter, Colonel Garnet Wolseley, Fort Garry, to the Regular Troops of the Red River Expeditionary Forces, quoted in Huyshe, Capt. G.L., 1871. The Red River Expedition, London, reprinted in Manitoba Pageant, vol. 5 (3), p. 20)

  September 16: People rave about the climate of Minnesota but so far I have not seen much to enjoy. The mosquitoes began on the 10th of May and have continued ever since. The weather is warm and wet, the most disagreeable summer I have seen since I left home. (Walter Traill, in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill, McLelland & Stewart, Toronto, p.224)

- An entry by Butler in mid-July *might* be interpreted as indicating that the Red was at or near bankfull in its southern reach but is too ambiguous to be certain.
  July 18: Riding quickly down this valley we reached...the edge of some water lying amidst tree-covered banks-the water was the Red River [Butler north of Georgetown]. (Butler, Sir W.F., 1923. The Great Lone Land. A Tale of Travel and Adventure in the North-West of America. Burns Oates & Westbourne Ltd., London, p.102)

- In contrast, Traill reported that low water interfered with steamboat operations on the Red in late August.

August 28: We are drawing near Frog point where the steamer stops- as the river is too low for it to go further. [Traill on steamboat about 39 miles north of Georgetown]. (Walter Traill, in Atwood, M., 1970. In Rupert's Land: Memoirs of Walter Traill, McLelland & Stewart, Toronto, p. 214)

- None of this information relates directly to the Assiniboine basin but given the high water in the spring freshet on the Red, possible flooding of western tributaries (see May 14), and the possibly wet summer, it is concluded that runoff for the water-year on the Assiniboine was probably at least normal.

PART FIVE

SUMMARY

FLOODS AND HIGH WATER EVENTS

The 17 years listed below were identified in PART THREE as having high flow and possible flooding during some part of the year.

1795	1825	1849	1856
1797	1826	1850	1861
1801	1829	1851	
1810	1830	1852	
1812	1831	1854	

Evidence from the Red River basin suggests that high water may also have occurred in the Assiniboine in some other years (eg. 1806, 1824, 1857). Of the 17 years, 11 fall within two short intervals. The first, from 1825 to 1831, contained 5 events and the river was probably also high in two other years (1824, 1828). The second interval, from 1849 to 1856, contained 6 events and high water may have occurred in 1855 and 1857 as well (see PART FOUR). The latter interval was notable for the number of years with high flows produced by abundant summer rainfall.

During the same period, a similar number of events (15) was identified for the Red River (Rannie, 1996) but the lack of comparable criteria (eg. clear reference to overbank conditions) makes direct comparison difficult. Furthermore, the two records are not independent because identification of some Assiniboine events was based primarily on conditions in the Red which were thought to have extended into the Assiniboine basin.

Although the total numbers of events in the two rivers are similar, only about half of the Assiniboine events corresponded to "flood" years in the Red, reflecting the considerable independence between the two basins discussed in PART ONE (Table 7). The largest Red River event not found in the Assiniboine record was in 1811 when letters describing a very large flood in the Red River explicitly stated that the Assiniboine flow was "not more swollen than usual".

Because there is no basis for estimating the discharge of the events, or even of ranking them in order of relative magnitude, the historical frequency cannot be compared with the modern record. Nevertheless, conditions in the Assiniboine during the two largest historical Red River floods, in 1826 and 1852, are of particular interest. Because the conventionally-accepted estimates of peak discharges for the Red in these floods are for the combined flows of the Red and Assiniboine, the Assiniboine's contribution is a critical variable in assessing the flow of the Red upstream of the confluence. Information from the Assiniboine basin is unfortunately slender but is sufficient to suggest that its flows in these years were probably among the largest 19th Century events. "Modern" flows exceeding 900 cms at Brandon/Holland have been estimated or measured on four occasions (1882, 1904,

1974, 1976 - see PART ONE); the average of these extreme floods was about 1100 cms. If this figure is assumed for discussion purposes, the Assiniboine may have accounted for about 17% and 24% of the calculated combined Red River flows in 1826 and 1852 respectively. In contrast, during the 1997 flood the controlled Assiniboine flow was negligible (<1%) and even the natural (i.e. uncontrolled) flow at the time of the peak on the Red was only about 7% (although had it not been diverted at Portage la Prairie it would have made a critical difference to the ability to manage the Red River's crest in Winnipeg). The 1997 flood is considered to have been comparable to the 1852 event but if the argument presented above is even approximately correct, it suggests that the 1997 flow on the Red River upstream of the confluence may have been significantly larger than in 1852. The Assiniboine was probably also high during the third of the well-known historical floods, in 1861. Because the calculated discharge of the Red for that flood was smaller than those of 1826 and 1852, the relative contribution of the Assiniboine was also probably more significant than in 1997.

RUNOFF

The annual classifications of water-year runoff are given in Table 11 and Figure 14. In 15 years, the data were considered insufficient to categorize runoff. For 9 of these years, however, observations did suggest a "most likely" category, shown by a letter in the appropriate cell in Table 11. The overall frequencies are summarized in Table 10 (bracketed values include the years with a "most likely" assessment).

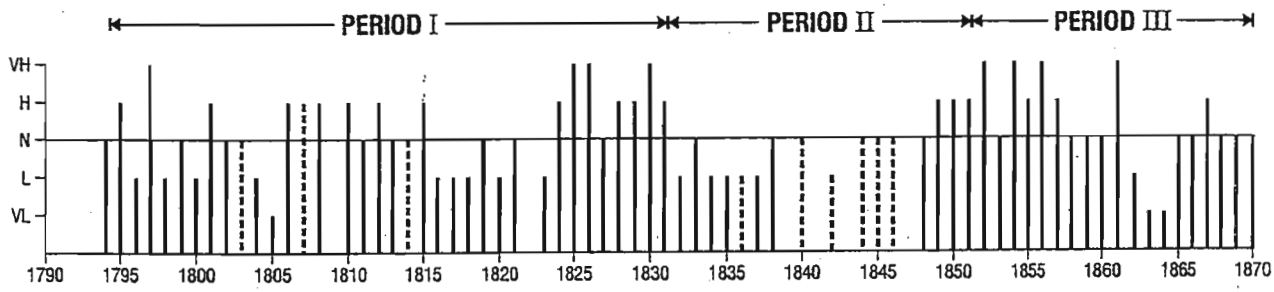

FIGURE 14: Runoff Category, 1793/94 to 1869/70 Water-Years (broken lines indicate "most likely" category).

Table 10
Frequency of Runoff Categories, 1793/94 to 1869/70

Very Low	Low	Normal	High	Very High	Insufficient Data
3	14 (16)	21 (28)	16	8	15

(bracketed figures include the years with a "most likely" assessment)

As would be expected, "Normal" years have the highest frequency. The slight bias toward above-normal categories is deceptive and not necessarily an indication of climate

Table 11
SUMMARY OF RUNOFF CONDITIONS, WATER YEARS 1793-94 TO 1869-70

Water Year	Runoff	Water Year	Runoff	Water Year	Runoff
1793-94	Normal	1819-20	Low	1845-46	Insufficient Data N
1794-95	High	1820-21	Normal	1846-47	Insufficient Data
1795-96	Low	1821-22	Insufficient Data	1847-48	Normal
1796-97	Very High	1822-23	Low	1848-49	High
1797-98	Low	1823-24	High	1849-50	High
1798-99	Normal	1824-25	Very High	1850-51	High
1799-00	Low	1825-26	Very High	1851-52	Very High
1800-01	High	1826-27	Normal	1852-53	Normal
1801-02	Normal	1827-28	High	1853-54	Very High
1802-03	Insufficient Data N	1828-29	High	1854-55	High
1803-04	Low	1829-30	Very High	1855-56	Very High
1804-05	Very Low	1830-31	High	1856-57	High
1805-06	High	1831-32	Low	1857-58	Normal
1806-07	Insufficient Data N	1832-33	Normal	1858-59	Normal
1807-08	Normal	1833-34	Low	1859-60	Normal
1808-09	Insufficient Data	1834-35	Low	1860-61	Very High
1809-10	High	1835-36	Insufficient Data L	1861-62	Low
1810-11	Normal	1836-37	Low	1862-63	Very Low
1811-12	High	1837-38	Normal	1863-64	Very Low
1812-13	Normal	1838-39	Insufficient Data	1864-65	Normal
1813-14	Insufficient Data N	1839-40	Insufficient Data N	1865-66	Normal
1814-15	High	1840-41	Insufficient Data	1866-67	High
1815-16	Low	1841-42	Insufficient Data L	1867-68	Normal
1816-17	Low	1842-43	Insufficient Data	1868-69	Normal
1817-18	Low	1843-44	Insufficient Data N	1869-70	Normal
1818-19	Normal	1844-45	Insufficient Data N		

conditions throughout the basin. As was noted in PART ONE, the Assiniboine flow is climatically buffered during dry years by runoff from the wetter Riding and Duck Mountains. Sub-basins such as the Qu'Appelle and Souris undoubtedly experienced more dry years with "Low" or "Very Low" runoff years than is apparent from Table 10. As an example from the modern record, during the 1930's when the average flow of the Assiniboine at Brandon was 44% of the long-term average and the smallest year was 20%, the average for the Souris was only 9% and the median runoff was less than1.5% of the average.

The study period can be divided into three intervals (Figure 14, Table 12) with temporal boundaries and characteristics similar to those identified for the Red River (Rannie, 1999).

Table 12
Frequency of Runoff Categories, by Time Period

	Very Low	Low	Normal	High	Very High	Insufficient Data
1793/94 to 1830/31	1	9	9 (12)	10	4	5 (2)
1831/32 to 1846/47	0	4 (6)	2 (6)	0	0	10 (4)
1847/48 to 1869/70	2	1	10	6	4	0
Total	3	14 (16)	21 (28)	16	8	15 (6)

(bracketed figures include the years with a "most likely" assessment)

Period I - 1793/94 to 1830/31: This period was one of highly variable runoff with a large frequency of extremes of both above and below-normal runoff. Years with "High" or "Very High" runoff occurred throughout the period but were particularly concentrated from 1824 to 1831 when seven of the eight years were in these categories. Below-normal years also occurred frequently, with 1803-05 and 1815-1820 being particularly dry. The emphasis here is on runoff over the entire water-year and thus does not preclude dry summers in years with a strong freshet which are otherwise characterized as "Normal". Three of the years classified as "Low" occurred in the 1790's but the Assiniboine basin shows less indication of extended drought in this decade than was identified by Case and MacDonald (1995) from tree-rings in southwest Alberta. There, "the most severe extended drought [in the 487-year tree-ring reconstruction] occurred over the decade 1791-1800, when there were 6 drought years in 10" (p. 274). This dry episode also appeared in the tree-ring reconstruction by Sauchyn and Beaudoin (1998) in the Maple Creek area of southwestern Saskatchewan. In the Assiniboine, the "Low" years were not contiguous and two summers, 1794 and 1795, probably had above-normal precipitation. As was noted in PART TWO, St. George and Nielsen's tree-ring record does not indicate abnormally dry conditions in southern Manitoba (personal communication).

Period II - 1831/32 to1846/47: This period is one of poor records, with 10 of the 16 years having insufficient data to classify runoff. However, when the "most likely" results are included, the period becomes one of normal to low runoff with no extremes. In the Red River study, these years were characterized as "stable" with no above-normal and only 2

"Low" runoff years. Nevertheless, the period 1832 to 1837 in the Assiniboine basin was relatively dry with "Low" runoff in 4 of the 6 years and another which was probably low.

Period III - 1847/48 to 1869/70: This period was one of very high runoff, especially from 1849 to 1861 when 9 of the 13 years were classified as above-normal and 4 were "Very High". As was noted above, a particularly striking feature was the concentration of apparently wet summers between 1849 and 1858, a phenomenon which also appears in the tree-ring record of St. George and Nielsen (personal communication). Despite the overall above-normal runoff for the period, however, three consecutive years of "Low" and "Very Low" runoff from 1862 to 1864 occurred during a severe and widespread regional drought.

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