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PROVINCE OF MANITOBA

PUBLISHED BY

DEPARTMENT OF MINES AND NATURAL RESOURCES

HON. J. S. McDIARMID, MINISTER

NOTES ON RED RIVER FLOODS

**WITH PARTICULAR REFERENCE TO
THE FLOOD OF 1950**

OCTOBER 1950

R. H. CLARK



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The Water Resources Division, Department of Resources and Development, Government of Canada supplied the data on stage and discharge at their permanent gauging stations in the Red River Basin.

Information on snow surveys and peak discharges of the Red River and its tributaries in North Dakota and Minnesota, as well as precipitation at the various stations maintained by the United States Weather Bureau in the Red River Basin was supplied by the Corps of Engineers, United States Army, St. Paul District.

Assistance in collecting hydrometric records and other related information was also rendered by the Department of Public Works, Government of Canada, the Meteorological Service, Department of Transport, Government of Canada, the Drainage Maintenance Board, Department of Public Works, Manitoba, the City of Winnipeg Engineering Office, the Water Resources Branch, the Surveys Branch, and the Deputy Minister's Office of the Department of Mines and Natural Resources, Manitoba.

Co-ordination of data as well as the selection and preparation of material for publication were carried out by R.H. Clark, M. Eng., Assistant Professor of Civil Engineering, University of Manitoba, who was engaged on this assignment by the Department of Mines and Natural Resources.

DEFINITION OF TERMS

The volume of water flowing in a stream - the "run-off" or "discharge" - is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups -- (1) those that represent a rate of flow, as cubic feet per second (c.f.s.), gallons a minute, and discharge in cubic feet per second per square mile; and (2) those that represent the actual quantity of water, as run-off in inches of depth on the drainage basin, acre-feet, and millions of cubic feet. The principal terms used in these notes are "cubic feet per second", "cubic feet per second per square mile", and "acre-foot".

"Second-feet" is an abbreviation for "cubic feet per second". "Cubic feet per second" is the rate of discharge of water flowing in a channel when the cross-sectional area is 1 square foot and the average velocity is 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Cubic feet per second per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly as regards both time and area.

An "acre-foot", equivalent to 43,560 cubic feet, is the quantity required to cover 1 acre to the depth of 1 foot.

"Stage-discharge relation" is an abbreviation for the term "relation of gauge height to discharge".

"Control" is a term used to designate the natural section, reach of the channel, or artificial structure below the gauge, which determines the stage-discharge relation at the gauge.

INTRODUCTION

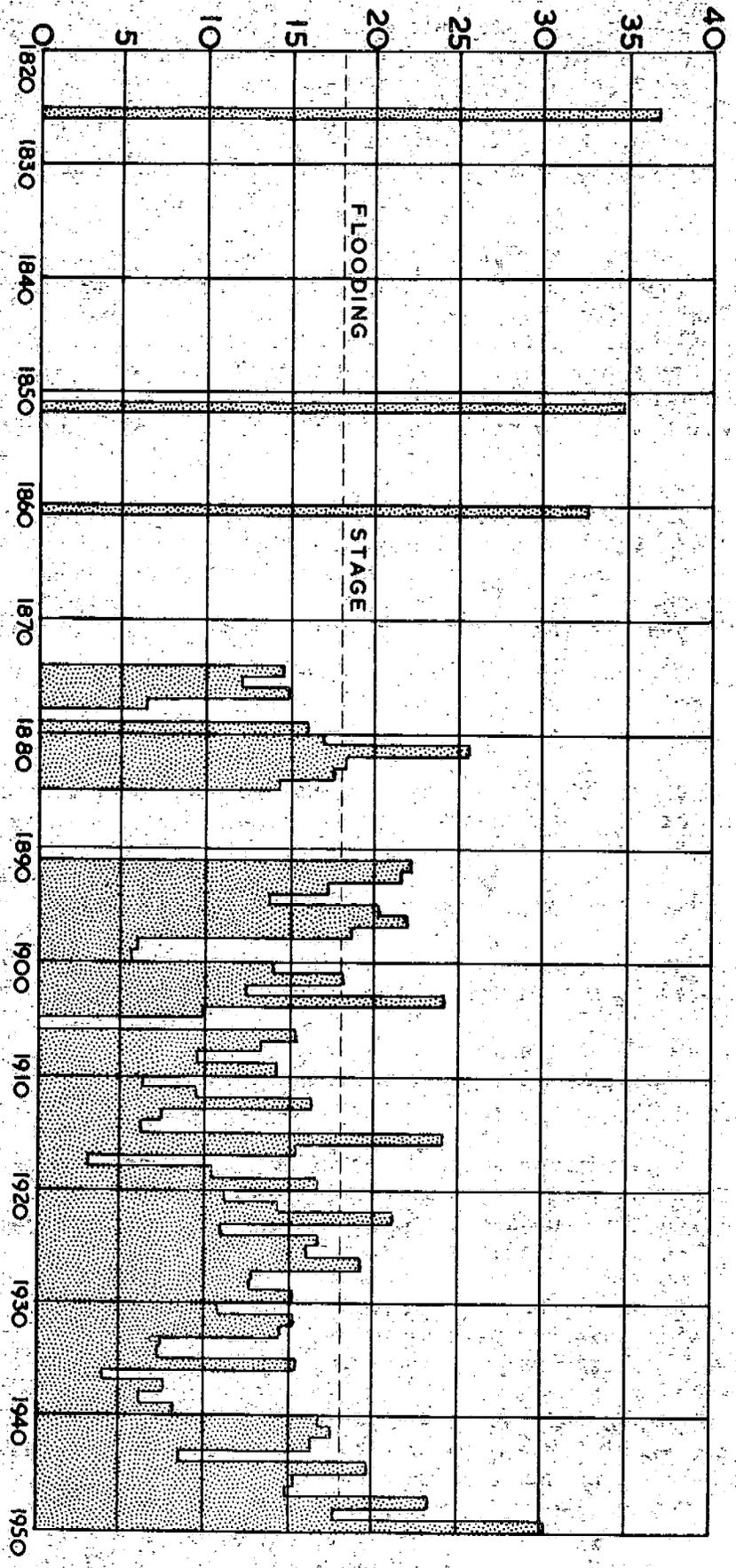
During the month of May 1950, the Red River Basin was ravaged by a flood which, in magnitude of discharge at Winnipeg, was greater than any flood which had occurred since 1861. The land inundated by the flood in the Canadian portion of the basin included about 640 square miles and many of the towns along the river were evacuated. One life was lost and the property damage was estimated in tens of millions of dollars.

As soon as the magnitude of the flood became evident, action was taken to collect and compile as much hydrometric data as possible so that the authorities charged with the responsibility of coping with the flood could be forewarned of impending flood crests at the earliest possible date and hydraulic data regarding the flood would be available for engineering studies on flood prevention. Through the co-operation of the various interested municipal, provincial and federal authorities, discharge measurements and water levels were obtained at various points along the Red River and its tributaries.

The purpose of these notes is to set forth information relating to flooding in the Red River Valley. This review presents a summary of the historical floods in the Red River Basin in Manitoba with a discussion of the hydrologic and physiographic conditions conducive to large floods. A general description of the 1950 flood including its hydrologic and hydraulic aspects is given with a summary of the forecasting system inaugurated during the flood. Studies involving the magnitude of past floods in the valley and the probable magnitude of future floods are included with a discussion on flood control methods such as may be applicable to the Red River Basin.

MAXIMUM FLOOD STAGE IN FEET

ZERO CITY DATUM = 727.57 G.S. OF C.(1929 ADJ.)



PROVINCE OF MANITOBA
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MAXIMUM ANNUAL FLOOD STAGES AT WINNIPEG
JAMES AVENUE PUMPING STATION

FIG. 1

HISTORY OF RED RIVER FLOODING

Considerable information is available with respect to the more serious historical floods in the Red River Basin. With the exception of eight years, continuous records of the peak spring flood stage at Winnipeg have been kept by the City Engineer's Office from 1875 to date. During this period the highest flood stage recorded prior to 1950 was 26.3 feet (City Datum), on May 6th, 1882.

Prior to 1875 there are records of the more serious floods only. The floods of 1826, 1852 and 1861 were chronicled by competent historians, and extracts of their accounts of these floods are included in Appendices 1 to 19. According to these reports the site of Winnipeg was completely covered with water and the whole valley appeared rather like a lake.

In May, 1826, the river rose to about elevation 37 feet (City Datum) according to the high water marks determined by Sir Sanford Fleming*. In "The Red River Settlement, Its Rise and Progress", by Alexander Ross, a work written before the 1852 flood, there is an eye-witness account of the flood of 1826, extracts from which appear as Appendix 1. Before this account had issued from the press, Mr. Ross was to witness the inundation of 1852, and he added a separate account of it in an appendix to his book. Extracts from his account of the 1852 flood appear in Appendix 7.

Donald Gunn also witnessed the 1826 flood and set forth an account of this flood in his book "The History of Manitoba", which was co-authored by C.R. Tuttle. This account is presented as Appendix 2.

Additional accounts appear as Appendices 3, 4, 5 and 6, which have been extracted from the journals, letters or diaries of persons who experienced the flood of 1826.

During the 1852 flood, which occurred in the month of May, the river rose over its banks and flooded the valley, reaching an elevation of about 35 feet (City Datum). Descriptions of this flood are presented in Appendices 7 to 16. In regard to this flood, Sir Sanford Fleming gives an account of an interview with Archbishop Tache of St. Boniface, as follows:

"His Grace was good enough to afford me the benefit of his local experience. In the year 1852, the river overflowed its banks and completely submerged the level prairie for several miles on each side. The water rose until it stood at least 3 feet 6 inches above the general surface of the ground around the Palace of St. Boniface, and it seemed like a vast lake, extending in all directions. The whole country was submerged from Minnesota north to Kildonan. The site of the City of Winnipeg was completely under water, and the nearest dry land in that neighborhood was at Burke's farm** some four miles away. The flood remained in this state for more than two weeks."

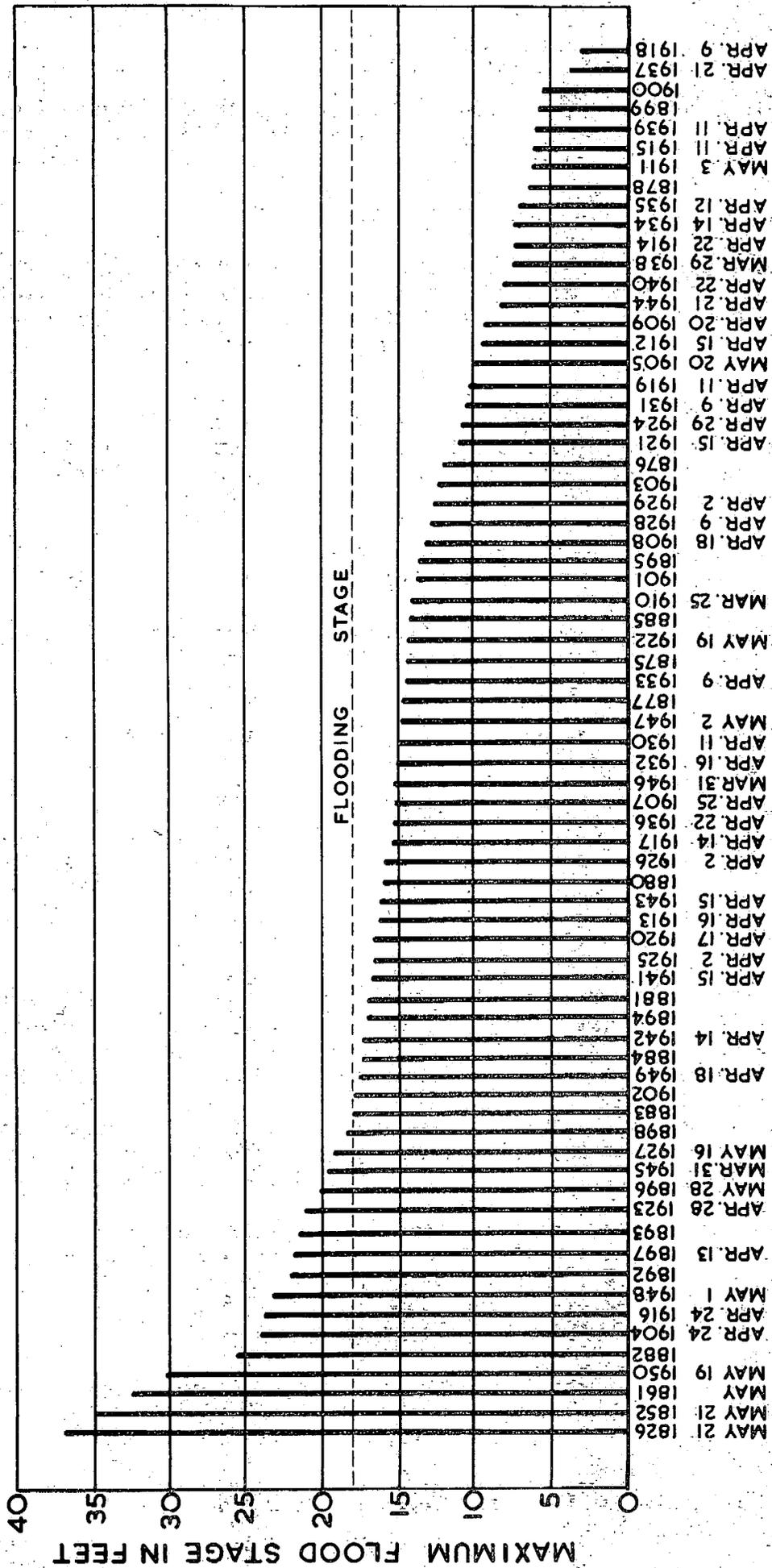
The separate accounts of the 1826 and 1852 floods are in close agreement and the facts are so presented that it is possible to note the marked similarity between these floods and that of 1950. A characteristic feature of these floods is the long duration of the peak and near-peak stages. The overflows lasted about six weeks, with the crest stages occurring at about the end of the third week in May.

The flood of 1861, to which reference is meagre, reached a level 4 feet below that of 1826, and was the last major inundation until 1950, when the water rose to within 2 feet of the 1861 level. Appendices 17, 18 and 19, contain brief sketches of the 1861 flood.

* Dominion of Canada, Vol. 13, No. 11, 1880 Sessional Papers No. 123 Appendix 16

** This is near Sturgeon Creek.

ZERO CITY DATUM = 727.57 G.S.OF C. DATUM(1929 ADJ.)



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MAXIMUM RED RIVER SPRING FLOOD STAGES

AT WINNIPEG

FIG. 2

READINGS TAKEN AT MAIN STREET BRIDGE PRIOR
TO 1908 CONVERTED TO CORRESPOND TO GAUGE
LOCATION AT JAMES AVENUE

PLOTTED FROM DATA SUPPLIED
BY CITY ENGINEERS OFFICE.

Figures 1 and 2, and Table 1 show the flood stages at Winnipeg of which record has been preserved by the City Engineer's Office from 1875 to date. The readings taken at Main Street Bridge prior to 1908 have been reduced to the present James Avenue Pumping Station location through the gauge relationship on Figure 14. High water marks of the 1826, 1852, and 1861 floods, from Winnipeg to Selkirk, were obtained by Sir Sanford Fleming, and the table as it appears in his report is reproduced here as Table 2. These data were obtained as accurately as possible by cross-checking the testimonies of local residents. Appendix 20, an extract from the "Manitoba Free Press" of 1882, compares the flood level of that year to the levels of the 1826-52-61 floods.

Information on the earlier floods is not available for the reach of the river between Winnipeg and Emerson, but high water marks of some of the later floods were obtained during the course of topographical survey work which was carried out along the Red River in 1912. These high water marks are recorded in Table 3 for some of the more important towns. A very brief account of the extent of the 1882 flood in this district is set forth in Appendix 21.

Although the 1826 flood is the largest that has been recorded, there is a possibility that a flood which occurred in 1776 was still larger. The following quotation is taken from Mr. Ross' discussion of the 1826 flood in the Red River Valley:

"The late Mr. Nolin, who was one of the first adventurers in these parts, assured the writer that when he first entered Red River in the year 1776 the flood was still higher than on the present occasion; he having sailed that way as he declared, from Red Lake River, round by way of Pembina, and down towards the colony; the whole country, therefore, being under water, and the river appearing to him rather like a lake. The Indians likewise mention a flood about the year 1790 and the natives now on the ground affirm that in 1809 the water rose unusually high."

The damages during these earlier floods were comparatively low because of the few people involved and the relatively small area under cultivation. The damage to property caused by the 1852 flood was estimated at 25,000 pounds sterling. Although the water covered the valley to a considerable depth, few lives were lost during these major floods. The accounts of the floods indicate the river was slow to rise once it had reached the top of the banks, thus enabling residents to retreat to higher ground.

Under exceptional circumstances, the water has been known to rise rapidly because of ice jams. However, these have occurred while the river was still within its normal banks or just reaching its secondary channel. An illustration of the rapid rise of the water is given by Mr. Ross in his account of the 1826 flood:

"The sudden rise of the water, when it once got over the banks of the river, may admit of more vivid illustration from the writer's personal experience. My boat was then drawn up at the house door, to be in readiness, when we were surprised by the rush of the water. I immediately ran out to lock a store door a few yards off, but before I could get back the water was knee deep, and the furniture afloat; nor could the door of the house be locked for the strength of the current."

Mr. Ross' house was below the secondary bank.

The ice jams occurring in the river may cause a rise of 8 or 9 feet in a day, but are not of long duration. In the Fleming report, there are signed testimonies by inhabitants who lived near Lower Fort Garry, stating that ice jams had never occurred at that location, but that practically every year they did occur near Sugar Point (just above Selkirk).

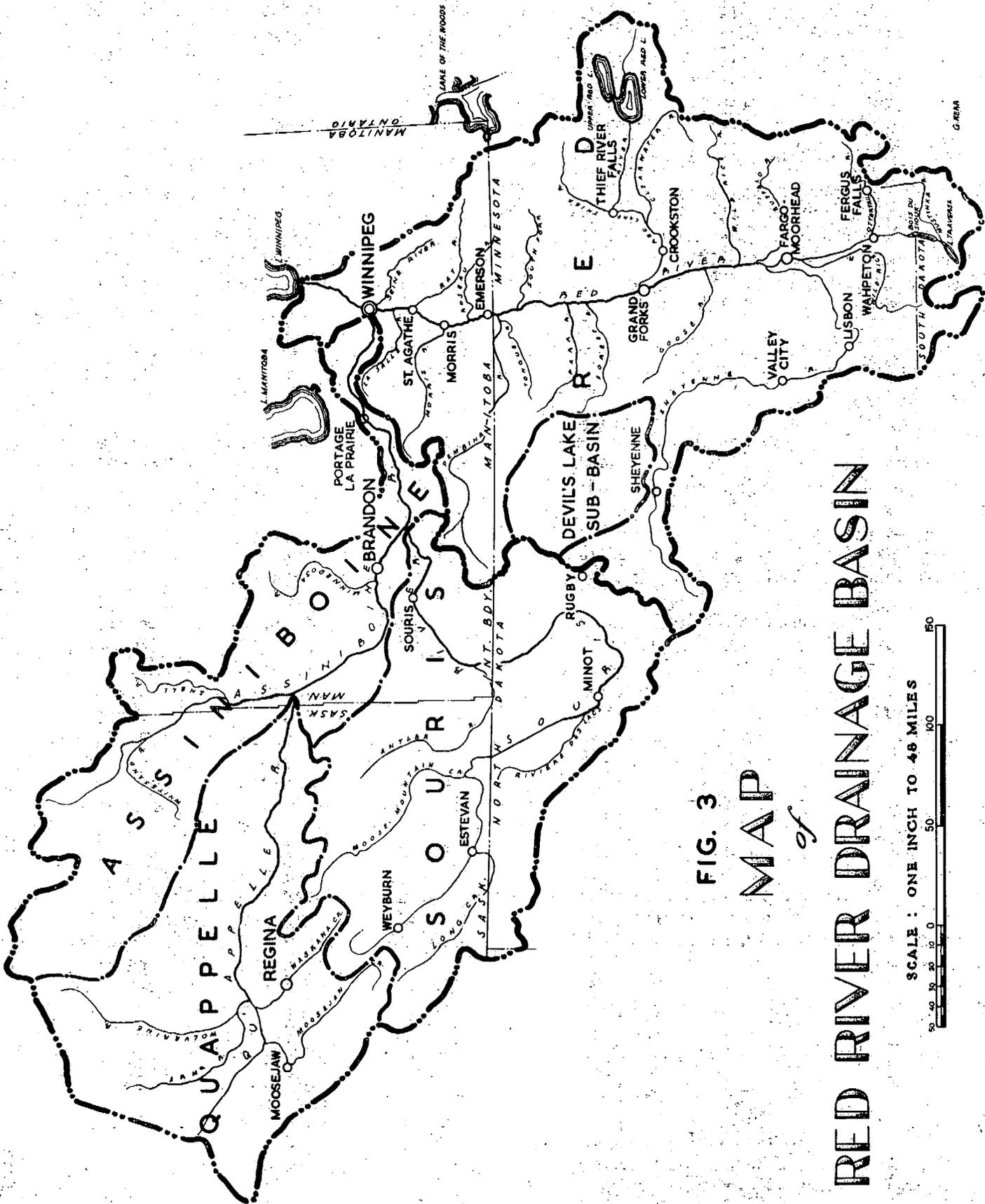
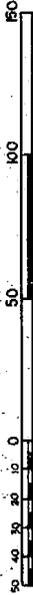


FIG. 3
MAP
of

RED RIVER DRAINAGE BASIN

SCALE : ONE INCH TO 46 MILES



Minor floods occurred in 1892, 1893 and 1897 when the water level in Winnipeg reached elevations of 22.5, 22.1 and 22.42, respectively.

In 1904, the river reached a flood-stage of 24.57 on April 24th. This high water was reported to have been caused by ice jams at Norwood Bridge. A very large ice jam also occurred at Sugar Point. Extensive flooding was reported in the Norwood and St. Boniface areas.

On April 24th, 1916, a maximum stage of 24.01 was recorded. Considerable flooding occurred in the low-lying districts of Norwood, St. Boniface, Elm Park and Riverview. It was estimated that 1000 homes had water over the first floor and many basements were flooded. The river south of Winnipeg overflowed at many points and was reported to be about one-half mile wide at St. Jean.

During the intervening years, from 1916 to 1948, the river never rose more than 3.2 feet above the minimum flood stage of 18.0 feet. On May 1st, 1948, the river reached an elevation of 23.4 feet. Most of the low-lying districts, which had by this time been built up, were protected by hastily constructed dykes. The extent of the flooding in the valley south of Winnipeg is outlined on Figure 15, which was drawn from a survey of the high water marks.

PHYSIOGRAPHY OF THE RED RIVER VALLEY

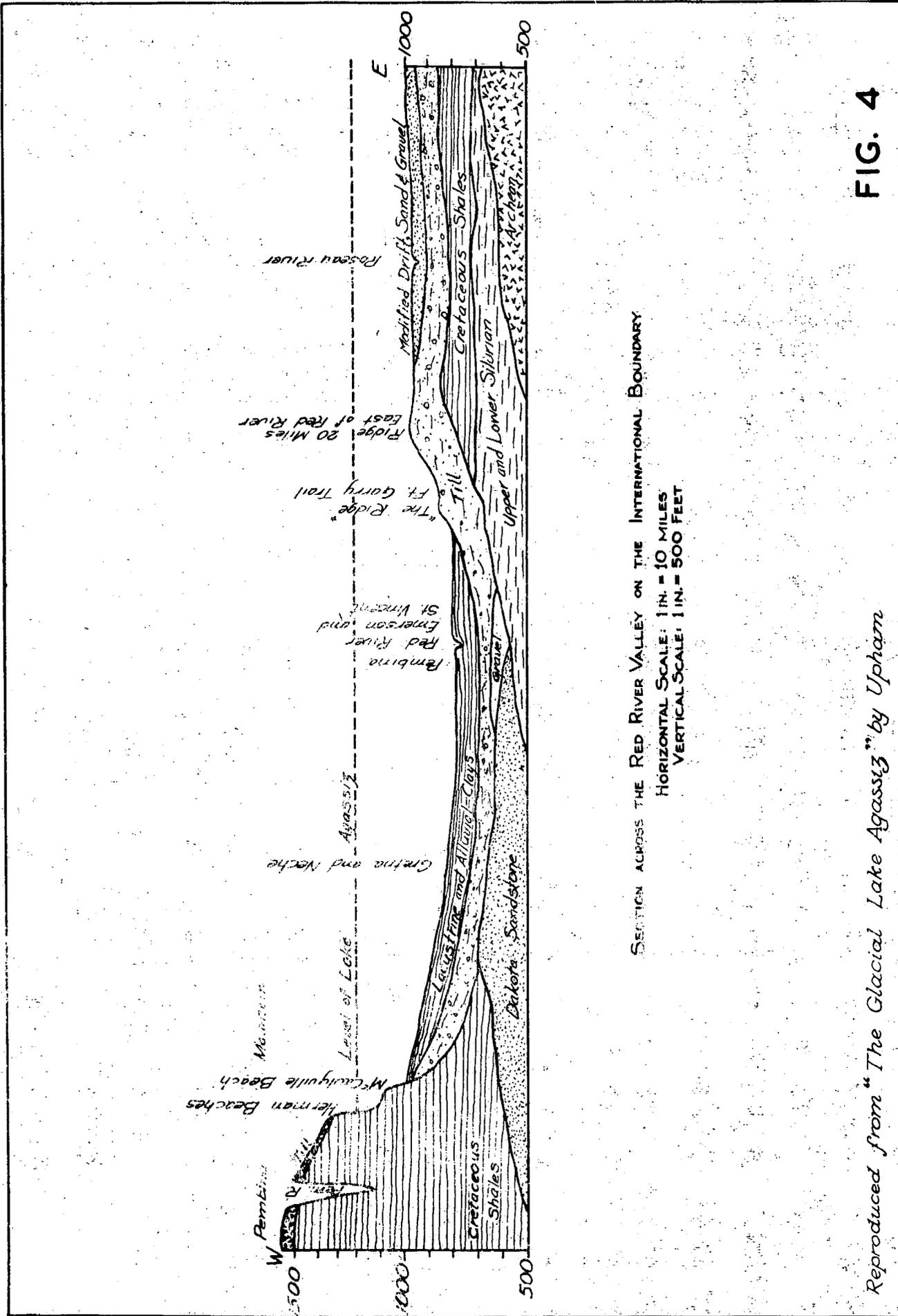
In order to gain a better understanding of the flooding potential of the Red River, a brief description of the physiography of the Red River Basin may be helpful. Figure 3 shows the total drainage basin of 111,000 sq. miles.

The drainage area of the Red River, excluding the Assiniboine Basin, is about 340 miles long and 210 miles across its east-west axis. The whole drainage basin is comprised of 40,200 sq. miles tributary to the Red River in the United States, and 8,300 sq. miles in Canada. The remaining 62,500 sq. miles is tributary to the Assiniboine River.

The Otter Tail River from the east, and the Bois des Sioux River from the south, combine near Wahpeton, North Dakota, and flow north as the Red River. The general course of the Red River is practically straight, and occupies the axial depression of a vast plain of glacial drift, lacustrine and fluvial deposits 40 to 50 miles wide and more than 300 miles long, stretching from Lake Traverse to Lake Winnipeg. The origin of these deposits dates from the glacial Lake Agassiz.

This lake was the largest of the many Pleistocene lakes of North America, some of which were formed by the barrier of the ice sheet during its recession while others were produced by increased rainfall in the great western arid region that has no drainage to the sea. From evidence collected by the United States Geological Survey,* it is apparent that as the glacial age in North America was ending, and as soon as the border of the ice had receded beyond the watershed dividing the Minnesota and Red Rivers, a lake fed by the glacial melting stood at the foot of the ice field and filled the Red River Valley up to the height of the lowest point over which an

* U.S. Geological Survey. Monograph XXV, 1896, Upham
"The Glacial Lake Agassiz"



SECTION ACROSS THE RED RIVER VALLEY ON THE INTERNATIONAL BOUNDARY

HORIZONTAL SCALE: 1 IN. = 10 MILES
 VERTICAL SCALE: 1 IN. = 500 FEET

FIG. 4

Reproduced from "The Glacial Lake Agassiz" by Upham

outlet could be found. Until the ice sheet had melted so that this lake could be discharged north eastward into Hudson Bay, its outlet was along the course of the Minnesota River. Lake Agassiz was finally reduced to Lakes Winnipeg, Manitoba and Winnipegosis, which are its lineal descendants and representatives.

Following a similar pattern, the Souris River became tributary to the Assiniboine after the waters of the glacial Lake Souris, at first flowing to the James and Sheyenne Rivers, had been wholly drained away by its outlet through the Pembina River.

The Red River flows along the lowest portion and slightly east of the central line of the old lake bottom. From Wahpeton, North Dakota to Lake Winnipeg, the Red has a fairly uniform continuous descent northward, averaging slightly less than one-half foot per mile. The channel varies in depth from twenty to fifty feet and meanders everywhere with minor bends, but nowhere departs more than four miles on one side or the other from its general northward course. Thus its length from Wahpeton, North Dakota, to Lake Winnipeg, is about 550 miles, while the distance in a direct line is about 285 miles. The cross-section of the valley at the International Boundary, Figure 4, shows the size of the river channel with relation to the valley. The valley bottom rises gradually at a rate of about two or three feet per mile for the first ten or fifteen miles to the east and west of the Red River.

The most important tributaries to the Red River in the United States are: The Otter Tail and Bois des Sioux Rivers; which enter just below Wahpeton and the Wild Rice and Sheyenne Rivers from the west, with their outlets near Fargo. The Red Lake River, the largest tributary in the United States, empties into the Red at Grand Forks. Below Grand Forks, the Snake River from the east, the Park River from the west, and Two Rivers from the east, enter the Red. The Pembina River from the west joins the Red about three miles above the International Boundary.

In Manitoba, the Roseau River from the east enters the Red near Dominion City; the Rat River from the east near St. Agathe; the Sale River from the west at St. Norbert; and the Seine River from the east at Winnipeg. The Assiniboine River, the largest tributary, enters the Red River from the west within the City of Winnipeg. Table 4 presents the drainage areas of the principal streams.

The tributaries have a fairly rapid descent into the valley, where their slopes are reduced to little more than that of the Red. The flatness of the valley does not permit erosive velocities so that the Red River and its tributaries have not been able to cut adequate channels through the old lake bottom to carry flows at the high stages.

ELEMENTS OF HIGH FLOOD HAZARD

The climatological conditions responsible for the great floods in the Red River Valley are aptly stated by Mr. Ross following his account of the 1826 flood:

"The cause of this disaster has been the subject of many conjectures which, however, will not bear investigation. We prefer to state the only conclusion that appears to us perfectly natural and consistent with well-known facts. The previous year had been unusually wet; the country was thoroughly saturated; the lake, swamps and rivers, at the fall of the year, were full of water; and a large quantity of snow had

fallen in the preceding winter. Then came a late spring, with a sudden burst of warm weather, and a south wind blowing for several days in succession; the snow melted at once, and Red Lake, Otter Tail Lake, as well as Lake Traverse, all overflowed their banks. To these causes must be added the large quantities of ice carried down by the Red River, which came so suddenly in contact with the solid ice of Lake Winnipeg; and thus stopping the current, seems to have caused the great overflow of back water on the level surface of the plains, this opinion is strengthened by the fact that as soon as the ice of the lake gave way, the waters began to fall, and it fell as rapidly as it rose."

In attempting to account for the height and duration of the flooding, Mr. Ross has stated that it was the ice on Lake Winnipeg which prevented the free flow of the water. This statement is not consistent with the drop of more than 40 feet between Winnipeg and the lake at flood stage. The conditions that account for the exceedingly large flows may be summarized as follows:

1. A wet autumn.
2. Very severe and continued frosts before the snow falls, sealing up the marshes, lakes and saturated ground.
3. Heavy snow fall during the latter part of the winter.
4. A late and sudden spring.
5. Above normal rainfall during the break-up, over the entire drainage basin.

Any one of these conditions alone would not produce a spring freshet out of the ordinary, but a combination of all the causes would provide large volumes of water such as were experienced during the 1826, -52, -61, and 1950 floods.

An examination of the physiographic conditions of the valley will indicate certain features which influence the peak stages and prolong the flooding. The tributaries which originate in the rolling hills to the west and the high flat marsh plains on the east have steep slopes of entrance to the valley. Upon reaching the ancient lake bed these slopes quickly flatten out and, since the channel through the plain has not sufficient capacity to carry the flows, the water quickly tops the banks and spreads over the valley. The volume of water brought down by the tributaries and contributed to the Red River quickly increases the stage of the river to bank full and above.

The south to north direction of the river and the east-west course of the tributaries are additional features in increasing the spring flood hazard. The break-up occurring in the headwaters of the Red and the warm weather advancing north at the same rate as the peak flow, will cause the water to rise rapidly and steadily on its northward course. The tributaries lying to the east and west of the river will contribute large volumes of water which may coincide with the advancing peak flow on the Red River. However, within the period of records, the peak of the Assiniboine River has only coincided with the Red River peak about fifteen per cent of the time; for seventy-five per cent of the time its peak has followed that of the Red; and ten per cent of the time it has preceded the peak stage of the Red at Winnipeg.

Although draining about fifty-six percent of the total basin area, the Assiniboine River flows through that part of the country which is not subject to excessive precipitation. For the maximum record flood, the maximum yield of the Assiniboine River drainage basin is about one-third cubic foot per second per square mile. The highest floods at Portage la Prairie and eastward rise only about fifteen

feet above the lowest stage and much of the surrounding country is submerged. At the highest stage* which the river reached and maintained from the 2nd to the 15th of May, 1882, it overflowed north in shallow winding water courses to Lake Manitoba. Although there are no records available on the Assiniboine River for the years corresponding to the historic floods on the Red River, it would be a fact that, had the flows of the Assiniboine been abnormally high, a portion of the flow would have found its way into Lake Manitoba, thereby lessening the flooding in Winnipeg at these times. In addition, high water on the Assiniboine has been known to find its way overland to the Sale River thus adding to the flooding south of Winnipeg. These two watersheds are separated by about two miles of very flat land seven miles east of Portage La Prairie.

The river bed and banks south of Winnipeg are subject to erosion by the elements and high velocities of the spring freshets. This action is evidenced by the meandering nature of the water course almost doubling the length of the river between Winnipeg and Emerson. From cross sections taken in 1950 and in 1912 near the ferry at Ste. Agathe, no significant change in the section at this location is evident. The banks here may be more unyielding than at points upstream and downstream and until further field evidence is obtained no definite conclusions can be drawn regarding the change in capacity of the river channel by the erosion or deposition of silt. However, by comparing photographs taken of the river channel in 1857** with the present channel, it is evident that the carrying capacity of the river has been diminished due to the more abundant tree and brush growth along and within the channel.

The course of the river from Winnipeg to the lake is remarkably straight, with very few meanders, which may be accounted for by the firm banks and the ledges of rock in the channel bed. An outcropping of limestone bed rock is visible in the channel at Lower Fort Garry. Through the Parish of St. Andrews to below Lower Fort Garry the river channel remains contracted and its appearance indicates that no appreciable change takes place from year to year.

The effect of this contracted waterway is to cause the water to accumulate in the river channel to the south. An examination of Tables 2 and 5 will show the increased water surface slopes in this vicinity resulting from the contracted channel. During the very high floods it has been reported*** that some water bypasses this contracted section and flows by way of Park's Creek into a marsh area west of the river and thus by Netley Creek into Lake Winnipeg. This natural diversion, and the high banks, account for the fact that this district has never been flooded.

The works of man have had little effect on flooding hazards. There may, however, be a slight tendency toward reducing the flooding potential through the construction of a drainage system in the marsh lands west of the Red River in Manitoba during the past 50 years. One of the effects of drainage is to create ground storage where none existed before, by keeping the land drained in the fall and thus providing some storage for the snow melt and spring rains.

Control dams constructed by the United States Corps of Engineers on the upper reaches of the tributaries of the Red River are of little effect in reducing the large flows in the Red, although they do compensate for the increased flows resulting from improvements to the river channel. The main purpose of these reservoirs is to increase the minimum flows in the Red River.

* Ibid. "The Glacial Lake Agassiz" Page 58

** Narrative of the Canadian Exploring Expedition of 1857 by H. Hinds, London, Longmans, 1860.

***Ibid. Sessional Papers No. 123, Appendix 16.

Reference to Tables 5, 6 and 7 will show that the effects of St. Andrews Dam and the bridges through Winnipeg are local in character only.

THE RED RIVER VALLEY AND THE 1950 FLOOD

General Description of the Flood

The flood of April-May, 1950, in the Red River Basin, had its immediate cause in a peculiar sequence of temperatures conducive to the production of floods from snow melt in this Basin. Snow surveys made by the United States Corps of Engineers, from March 13th to 22nd, revealed the water content of the snow in the upper reaches of the Red River Basin at least 35% higher than 1949. The water content of the snow in the North Dakota tributary basins was just about the same as in 1949, except the Souris River basin, where the water content was 50% less than in 1949. Possible flood hazard was recognized by the end of February, and by the end of March, run-off at or above minimum flood stages became a certainty. Freezing temperatures prevailed until the last week in March and the first week in April, when the maximum daily temperatures rose above 32° F., and allowed some release of the snow melt. The peak stage at Wahpeton was recorded on April 2nd.

The Red River continued to rise in North Dakota and parts of Minnesota flooding towns and villages and washing out highways. The river began to drop at Wahpeton and the ice to move at Grand Forks on April 5th. Below freezing temperatures were again recorded until April 13th, and about 6 inches of snow fell on April 8th and 9th from Fargo to Grand Forks. On April 10th, Grand Forks was alerted for the worst flood since 1897.

On April 11th, Winnipeg citizens were warned that a flood as severe as that of 1948 was imminent, and work began in many communities to bolster the dykes constructed during the 1948 flood and to mobilize equipment and crews to battle possible ice jams.

At this time the crest stage was expected in Winnipeg about the end of April. Daily flood bulletins were arranged to be phoned from the important river stations between Fargo and Winnipeg, and on the Assiniboine River from Brandon to Winnipeg. Serious flooding was not expected on the Assiniboine River because of the low snowfall over that basin.

On April 14th, aerial reconnaissance by the United States Corps of Engineers revealed a solid sheet of ice and snow blanketing the Red River Valley and tributary streams north of Grand Forks, with only a short stretch of open water on Red Lake. The freezing temperatures from April 7th to 13th prevented any further snow melt. However, a sudden burst of warm weather lasting until April 25th started the ice moving between Emerson and Winnipeg by the 21st. At this time the first flooding occurred in Winnipeg, and there was two feet of water in the north section of the town of Emerson.

The Red Lake River peaked on April 23rd, and then began to drop. South of Emerson the river stages began falling and it was thought that the peak flow had been experienced. During the last three days of April the maximum temperatures did not rise above freezing and thus prevented further snow melt. Another burst of warm weather accompanied by precipitation totalling one to two inches over the entire

Red River Basin between May 5th and 7th, brought the flood levels in the valley over the 1948 peak. With the warmer weather releasing the remaining snow, and with the additional run-off from the precipitation, higher peaks were experienced from Grand Forks to Emerson. This second peak stage was two feet higher at Grand Forks and 2.5 feet higher at Emerson than that which previously occurred in April. Only one crest reached Winnipeg due to the natural attenuation caused by the valley flooding south of the city.

The cold air over the valley in April retarded the flood, but it was realized that the longer these temperatures prevailed, the greater was the flood danger. It was quite evident that a sudden change to warm weather over the whole basin would bring down vast quantities of water which, quite possibly, would be accompanied by spring rains.

The flooding of the valley south of Winnipeg continued relentlessly. By May 3rd, the waters occupied 150,000 acres in the valley. On May 4th, Highway No. 75 was covered near St. Norbert and on May 5th, the river cut the last rail link to the ten towns south of the City. Morris was abandoned to the flood, and St. Jean isolated.

On May 6th, the Canadian Army was asked to take over the direction of all relief work during the emergency. Despite heroic efforts by the residents of Winnipeg and the suburban municipalities, the Wildwood dyke failed and the Riverview dyke broke after an all-night rainfall.

Evacuation of patients from four Greater Winnipeg hospitals began. By May 7th, there were 2,000 homes surrounded by water, and 4,000 citizens homeless. On May 7th, with the river stage at Winnipeg nine feet above the minimum flood stage, the Deputy Minister of the Department of Mines and Natural Resources, Manitoba, called a meeting to enlist the co-operation of the Department of Public Works and the Water Resources Division, Dominion of Canada; the Department of Public Works and the various Branches of the Department of Mines and Natural Resources, Manitoba; and the City Engineer's Office, to ensure that adequate hydrometric data be secured for flood control studies and to obtain sufficient information so that a reliable prediction of the crest stage and time of occurrence at Winnipeg could be made.

As a result of this meeting, a forecasting system was organized which effectively supplied the appropriate authorities with accurate forecasts of stage and time to enable them to plan their operations more efficiently. Aerial reconnaissance was also inaugurated on May 8th, and, until the flood had started to subside, several flights were made over the flood area south of Winnipeg in an attempt to map the flood area and keep under surveillance the shifting of the flood waters as the peak advanced to Winnipeg. Gauges were installed and operated at all strategic points in the river from Emerson to Selkirk. The location of these gauges is shown on a map of Greater Winnipeg, Figure 16, and the map of the Red River Basin, Figure 17 (in pocket).

It is interesting to note that on May 8th water began passing from the Red River to the Seine River, and on May 10th from the Red River to the Sale River, both of which had a noticeable effect on the ponded areas.

Aerial photographs of the flooded area were taken by the R.C.A.F. from Emerson to Lake Winnipeg on May 7th, and May 18th-20th, for flood studies. Figure 18, has been prepared from the mosaic made from the flight on May 18th-20th at the peak of the flood.



Fig. 5 TOWN OF MORRIS, May, 1950



Fig. 6 UNIVERSITY OF MANITOBA, FORT GARRY SITE, May, 1950



Fig. 7A ELM PARK BRIDGE, WINNIPEG, May 18, 1950
Upstream Side Looking Towards Kingston Crescent.



Fig. 7B NORWOOD BRIDGE, WINNIPEG, May 18, 1950
Looking Towards St. Boniface.



Fig. 8 WINNIPEG, DOWNTOWN SECTION, May, 1950
Note:- C.N.Ry. Freight Terminal Inundated and Junction
of Red and Assiniboine Rivers at Lower Right.

The tributary streams north of Emerson rose rapidly due to the rains and snow melt, and reached an aggregate peak on May 6th, of 28,000 cubic feet per second after which there was a gradual subsidence of the local inflow.

On May 11th, several streets and subways were closed to traffic and on May 12th, the Elm Park, Norwood, Provencher, and Provencher-Seine bridges were closed. It was estimated that, by May 14th, one-tenth of the city was flooded, Figure 16, and 65,000 residents had quit the city. In all, about 8,200 homes in Greater Winnipeg were flooded, with 5,500 having water over the first floor.

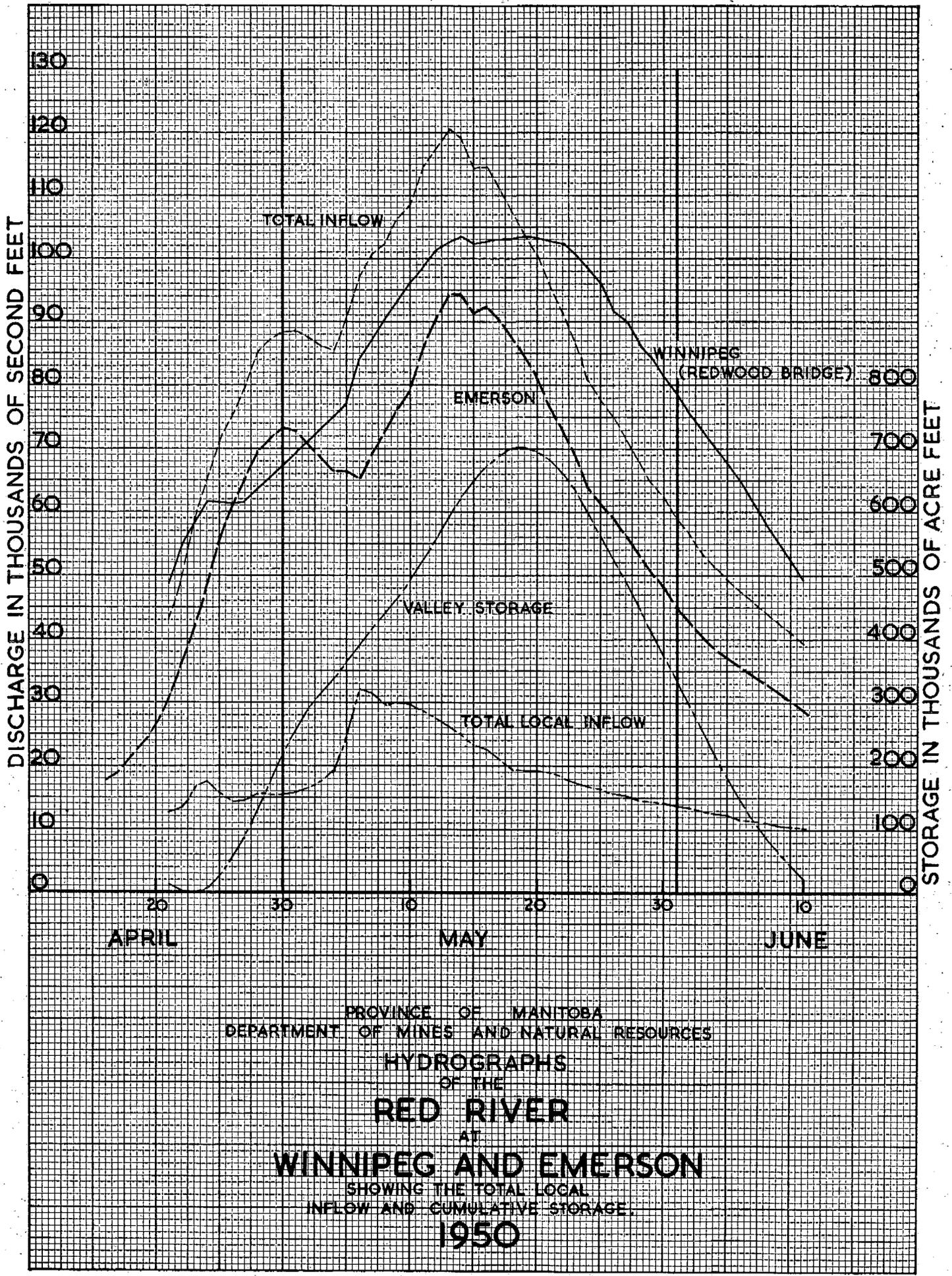
The Army relinquished command on May 31st, and Operation Rainbow, the plan for rehabilitation of the flooded areas, began.

Figures 5, 6, 7, and 8 show typical flood scenes in the Red River Valley in Manitoba. A critical feature of the 1950 Flood was the long duration of the peak and near-peak stages. In Winnipeg, the stage remained above 30 feet from May 13th to May 22nd, and above the flood stage of 18 feet for 51 days. The flood stages were prolonged by the coincidence of heavy rains and the warm weather with the high flow from the preliminary break-up in Minnesota and North Dakota.

In general, the channel capacity of the Red River was not adequate to carry the discharge during the high stages of the 1950 flood. The extent to which the channel capacities were exceeded is shown in Table 3. The channel capacities and excess flood flow will be among the determining features entering into any plan for flood control. The bankful channel capacity between Emerson and Ste. Agathe was less than 50 per cent of the 1950 peak discharge, while from Ste. Agathe to Winnipeg, the channel capacity was about 70 per cent of the crest flow. North of Winnipeg, the water was confined within the banks of the river.

Computations have also been made of the volume of water temporarily stored in the valley lands by determining the difference between the total inflow into the Red River between Winnipeg and Emerson and the flow recorded at Redwood Bridge. Eighty-eight per cent of the local inflow was gauged, the ungauged inflow being prorated according to the run-off of the gauged tributaries. The results of this study appear on Figure 9, which shows that the maximum storage in the valley between Emerson and Winnipeg increased to 702,000 acre feet on May 19th. The attenuation of the flow due to the natural retention reservoir above Winnipeg, quite effectively reduced the flooding at Winnipeg. Further evidence of the magnitude of the flooding south of Winnipeg may be seen on Figure 18.

Artificial obstructions in the channel had little effect on the flood levels. Through Greater Winnipeg the aggregate drop at the seven bridges was 1.66 feet at the peak stage, the Provencher and Norwood bridges accounting for 1 foot of this total. In the popular mind during the peak of the flood it was believed that the St. Andrew's Dam and Locks were effective in holding up the water at Winnipeg. An examination of the gauge records will show this to be false as the drop through the dam was only 0.4 feet at the crest discharge; the controlling factor in this vicinity being the contracted channel below the dam. Even so, the Public Works of Canada was forced by public opinion to open the lock gates on May 15th. The discharge through the canal, as obtained from a metering on May 19th, was 7,360 second feet, or about 7 per cent of the peak discharge. The effect of this increased channel capacity was rapidly lost in the contracted section above the dam.



PROVINCE OF MANITOBA
 DEPARTMENT OF MINES AND NATURAL RESOURCES
 HYDROGRAPHS
 OF THE
RED RIVER
 AT
WINNIPEG AND EMERSON
 SHOWING THE TOTAL LOCAL
 INFLOW AND CUMULATIVE STORAGE.
1950

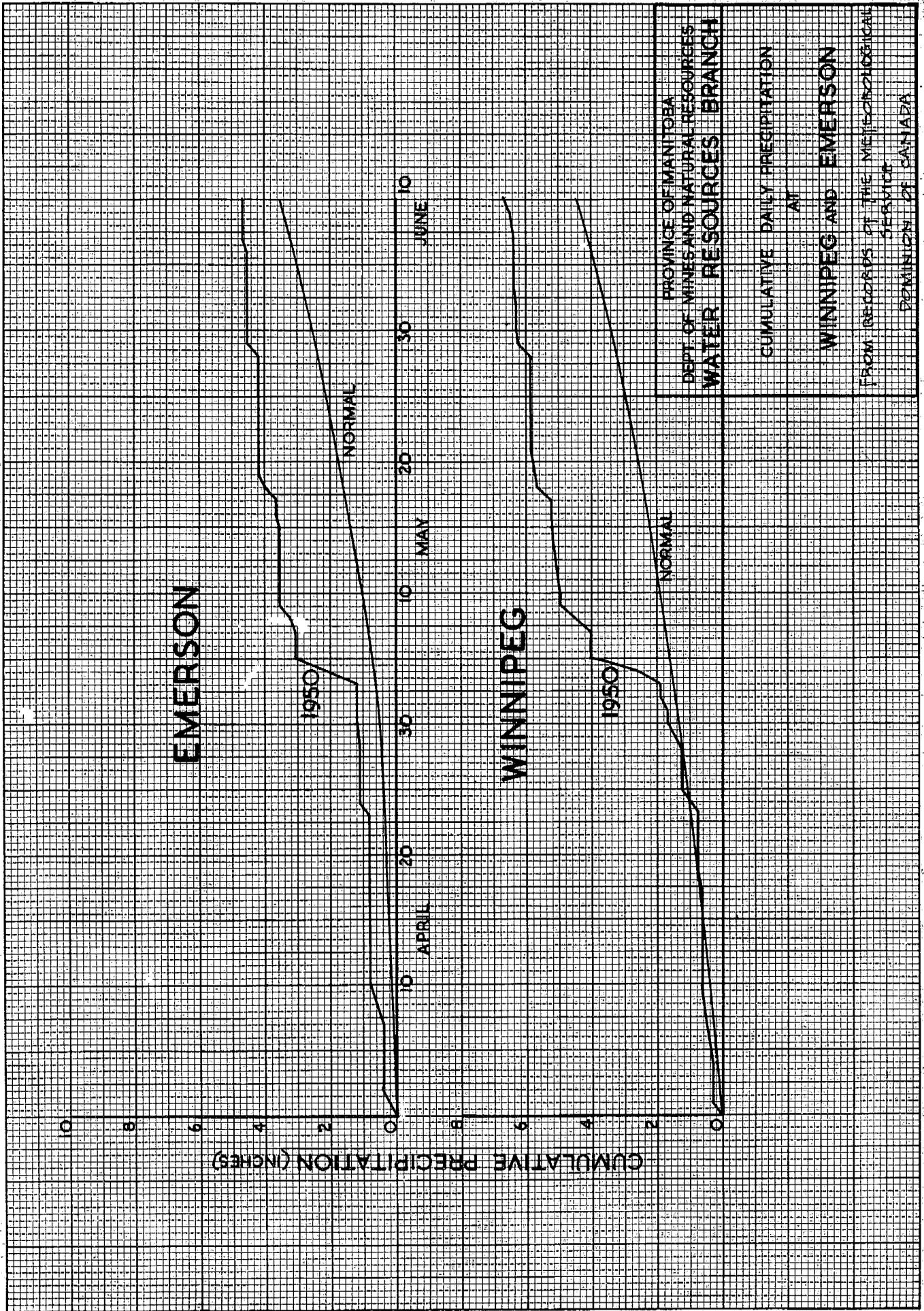


FIG. 10

PRECIPITATION

During 1949, precipitation on the Canadian portion of the Red River Valley was below normal up to the first week in October. Table 8 shows that during this month the precipitation varied from $2\frac{1}{2}$ to 4 times the normal, bringing the total precipitation from April 1st to October 31st, 1949, to about five per cent in excess of the normal for this period.

The water content of the snow as indicated by the snow surveys taken about the middle of March (Figure 19), showed an increase of one inch over almost the entire Red River Basin in the United States, from the snow survey taken one month previously, (Figure 20).

Precipitation during April and May, 1950, was no doubt a prominent factor in producing the flood. Tables 9, 10, 11 and 12 show the precipitation at selected stations throughout the Red River Basin during the break-up period. The precipitation for the periods indicated is about twice the normal. The greatest proportion of the precipitation fell during the first week in May, to coincide with the high temperatures and the rising stage of the river. Figure 10 shows the cumulative daily precipitation at Emerson and Winnipeg from April 1st to June 9th, 1950.

TEMPERATURE

Temperature was a major factor in producing the 1950 flood. Subnormal temperatures prevailed throughout the basin during April and May, preventing a normal snow melt. The freezing temperatures during the last few days of April arrested the run-off released by the previous two weeks of warm weather. Figure 21 presents the plot of the maximum and minimum temperatures during March, April and May, at Fargo, Grand Forks and Winnipeg.

The temperature with relation to the break-up period has been discussed in preceding sections.

STAGES & DISCHARGES

Figures 22, 23 and 24 present hydrographs and rating curves of the Red River and its major tributaries at selected stream gauging stations. Tables of stage and discharge at Emerson and Winnipeg and all the important tributaries in Manitoba are also appended.

With the co-operation of the Water Resources Division, Department of Resources and Development, Government of Canada, miscellaneous discharge measurements were taken at Elm Park Bridge, Redwood Bridge, and Ste. Agathe on the Red River and at La Salle on the Sale River, in addition to meterings taken at the regular gauging stations listed in the Water Resources Papers. These miscellaneous measurements are presented in Table 13. From the discharge measurements made at Redwood Bridge, a rating curve has been constructed, Figure 25, and the daily discharges presented in Table 17.

The maximum discharges recorded during the 1950 flood and the maximum discharges on record at all the stream gauging stations in the Red and Assiniboine River Basins, with their related information, are listed in Table 4.

FLOOD FORECASTING

Prior to May 7th, 1950, readings of the stage at Fargo, Grand Forks, Emerson, Morris and Ste. Agathe on the Red River were obtained by telegraph or telephone, as were also the gauge readings at Brandon, Portage and Headingley on the Assiniboine River. The forecasts of the stage at Winnipeg were based on crest-stage relationships to the peak stages at Grand Forks and Emerson. However, due to the character of the spring break-up and the exceedingly high stages that were being experienced between Grand Forks and Emerson, it was realized that these crest-stage relationships were inadequate for the prediction of the peak stage at Winnipeg.

On May 7th, a flood-stage forecasting system was inaugurated. Warning stations on the tributaries between Winnipeg and Emerson and on the Souris River, largest tributary of the Assiniboine, were contacted by telephone at least once a day to determine the trend of the run-off on these watersheds. These warning stations were located at: Dominion City on the Roseau River, Otterburne on the Rat River, St. Pierre on the Seine River, Carman on the Morris River, La Salle and Sanford on the Sale River, and Melita and Wawanesa on the Souris River.

The reports from the warning stations were interpreted by plotting on one sheet the hydrographs of the tributaries and the Red River at the various stations. The gauge readings on the tributaries were transposed into flows, and the changes in the tributary flow from day to day were translated to the station below its junction with the Red River, with the proper allowance for time of lag. The manner in which the changes in flow at Emerson affected the stations at Ste. Agathe and Winnipeg on the Red River were also noted. By analyzing the changes in flow from day to day on the tributaries and at the upstream stations on the Red River, a fairly accurate determination of the stage at Winnipeg was made three to four days in advance.

As was the case in 1950, floods of large magnitude occur in the late spring and as a consequence are usually accompanied by the spring rains. Close contact was maintained with the Meteorological Division, Department of Transport, which supplied the official 24-hour as well as tentative 48-hour forecasts of precipitation. The latter were of great assistance in analyzing the flood situation.

Although accuracy is the goal of any forecast, a compromise between accuracy and speed is usually made. A forecast made too late to permit evacuation of residents and movable properties is of little value. By May 10th, sufficient data had been compiled to tentatively set the crest stage at Winnipeg on May 15th at an elevation of 31.0 feet (City Datum). As more up-to-date information became available, a revised forecast was made on May 12th for a peak stage of 30.5 feet by May 15th. The actual crest recorded was 30.3 feet on May 19th. However, the near-peak stage of 30.2 feet lasted from May 14th to May 20th.

The co-operation of the Water Resources Division, Department of Resources and Development, Government of Canada, The City Engineer's Office and the various Departments of the Provincial Government greatly assisted in the collection and compilation of the necessary data for the preparation of the forecasts. The assistance of the Corps of Engineers, St. Paul District, United States Army, in providing the Department of Mines and Natural Resources with their forecasts of crest stages and times at Emerson on the International Boundary, facilitated the making of accurate forecasts of the stages at Winnipeg. Also, their advice on the organization of the flood forecasting system and the interpretation of the data, placed the Department's forecasts on a sounder basis.

Flood forecasting is an integral part of any flood control scheme. Depending upon the type of flood control methods that will be used in the Red River Valley, the success of these methods will depend for the most part on an organized, efficient, flood forecasting system.

PROBABLE MAGNITUDE OF FUTURE FLOODS

No flood control scheme can give either security or economy of protection if the flood for which it is designed is one of mere conjecture. A knowledge of the magnitude of the great floods that have occurred in the past, and the likelihood of their being exceeded in the future, is essential in the successful planning of any flood control project.

From a study of past records, it would be futile to believe that the sequence of meteorological conditions accounting for the large volumes of water in the Red River should not again be expected to occur in the future. Extensive studies by the Miami Conservancy District* in connection with the great flood on the Miami River in 1913, have shown that floods which occur on the average of once in a century or two have been exceeded in the course of many centuries. However, the amounts by which they are exceeded are usually small, being in the order of 15 to 20 percent greater in volume.

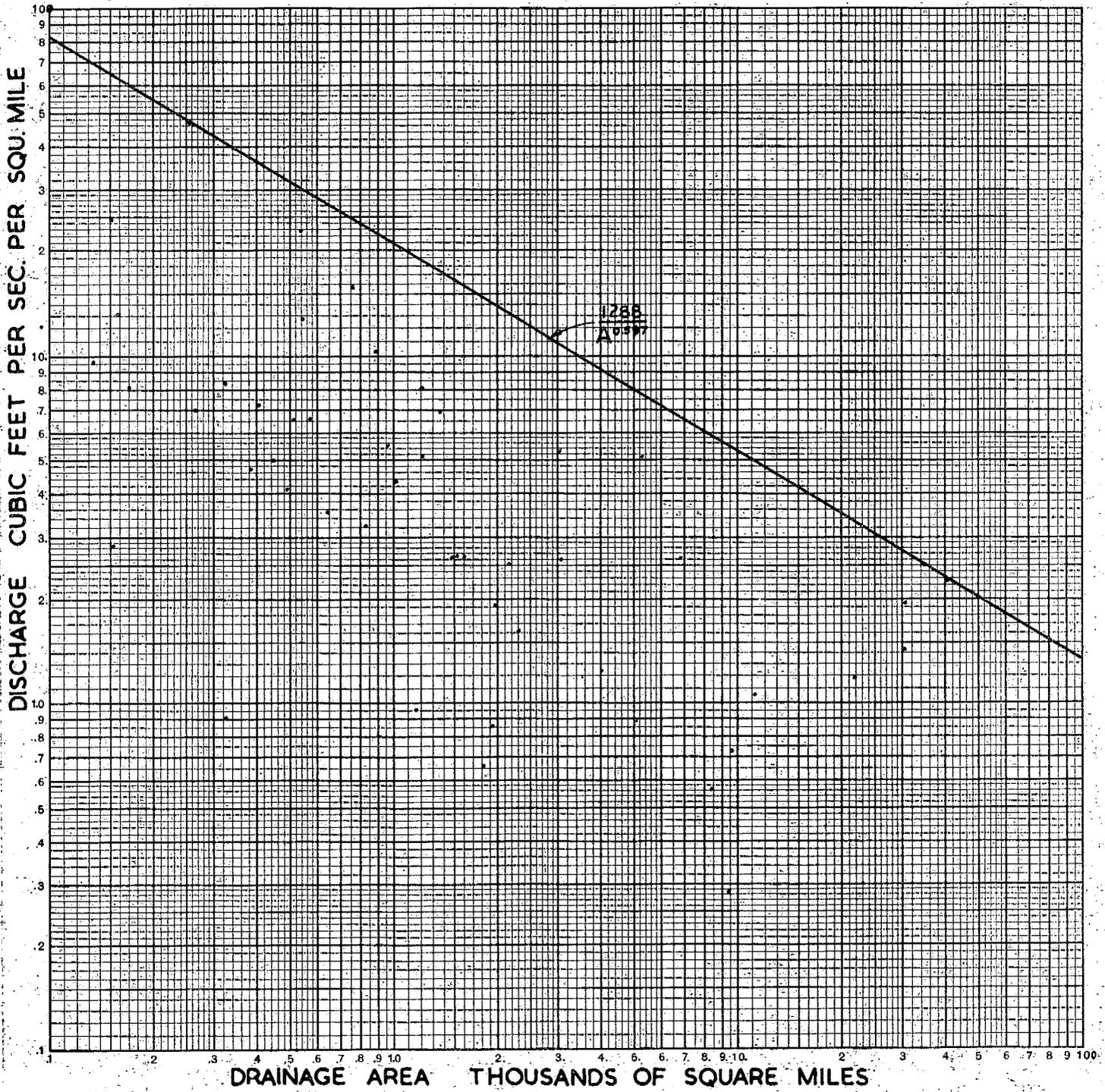
In the discussion of the flooding hazards, mention was made of the possible reduction in flooding potential due to drainage, the change in channel capacities due to scouring and bank slides, and the decrease in channel capacities from a greater tree growth along and within the river channel. It is difficult to evaluate these effects quantitatively. If the capacity of the river channel south of Winnipeg has increased, the effect will be local in character, provided that Listers Rapids and the contracted channel near Lower Fort Garry have not altered. If there has been no significant change in the physical conditions causing the prolonged accumulation of water in the valley, it is evident that floods equal to or greater than the magnitude of the 1950 flood may be expected in the future. However, the period of record is too short to give reliable estimates of the frequency of occurrence of the rarer floods.

For the determination of the magnitude of the historic floods of the Red River, it is fortunate that a record of the high water marks through the contracted channel below St. Andrew's Dam has been preserved. Recourse to slope-area calculations in this reach of the river has given discharges of 165,000 c.f.s. and 225,000 c.f.s. for the 1852 and 1826 floods respectively. The calculations were made from cross-sections taken by the Department of Public Works, Government of Canada, and the high water marks as shown in Table 2, and are based on the assumption that the sections have not altered. The 1852 profile is consistent, but there appear to be several inconsistencies in the 1826 profile which have been adjusted and the calculations made according to these changes.

A plot of the maximum flood peaks on record, against the drainage areas for the Red and the Assiniboine River Basins appears on Figures 11 and 12. The enveloping curve defines the maximum flows in terms of the drainage areas. The results of this study indicate that a flow of 2.08 cubic feet per second per square mile may be expected from the 48,300 square miles tributary to the Red, south of Winnipeg, and 0.60 cubic feet per second per square mile from the 62,500 square miles of the

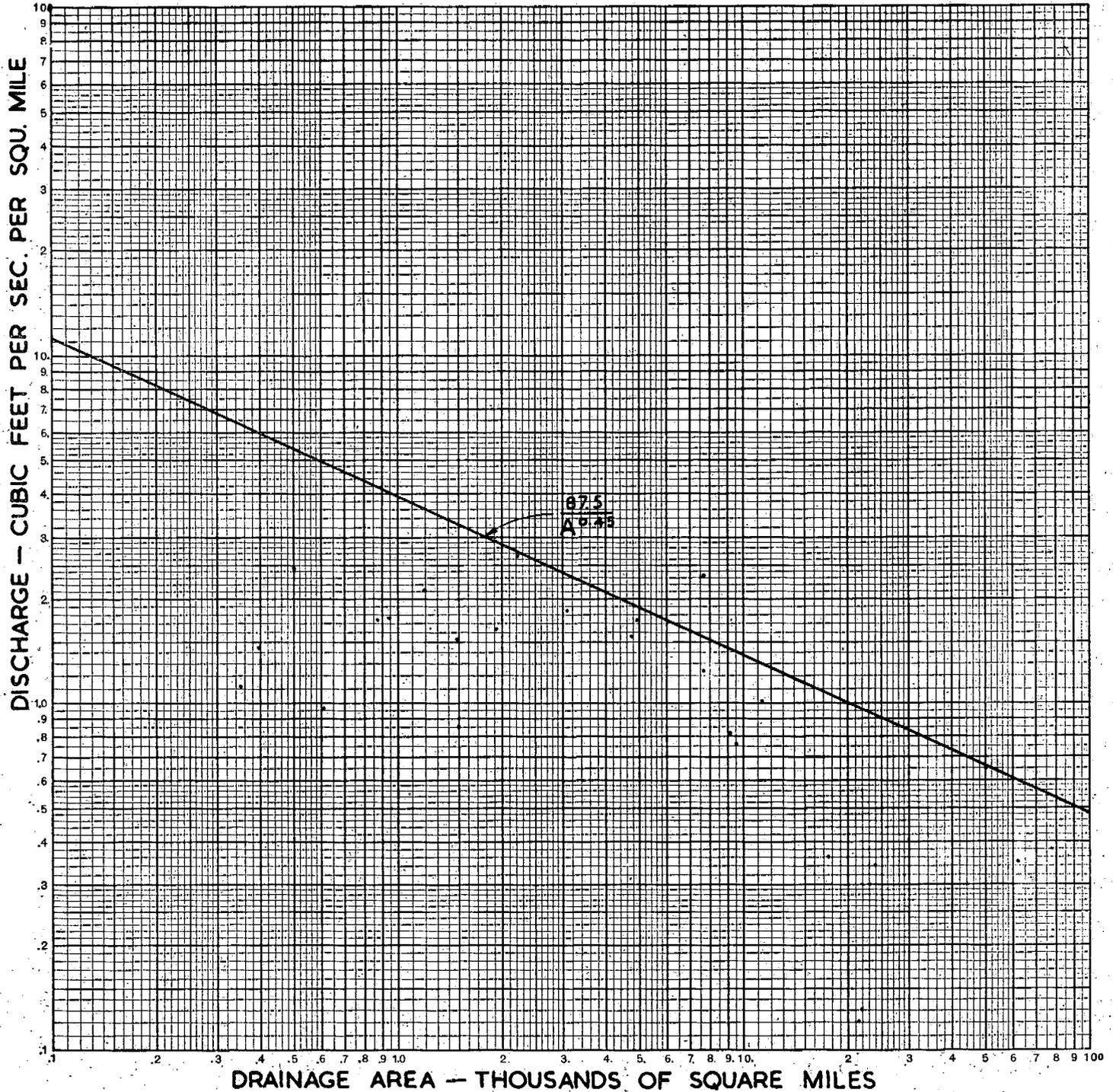
* Technical Reports, Part VII.

PROVINCE OF MANITOBA
DEPARTMENT OF MINES AND NATURAL RESOURCES
ENVELOPE CURVE
OF
EXTREME FLOODS
FOR
RED RIVER BASIN



PROVINCE OF MANITOBA
DEPARTMENT OF MINES AND NATURAL RESOURCES
ENVELOPE CURVE
OF
EXTREME FLOODS
FOR

ASSINIBOINE RIVER BASIN



Assiniboine River Basin, or a total flow of 138,000 c.f.s. through Winnipeg. However, this method does not define the appropriate frequency which will depend on the position selected for the envelope curve. Also, the basin characteristics, other than area, are neglected so that the envelope curve is influenced more by those areas with a high flooding potential.

Figure 13 has been prepared to graphically illustrate the magnitude of the 1852 flood. The 1852 hydrograph has been plotted from various references to the flood levels appearing in Appendices 3, 4 and 6. For the discharge of 47,000 c.f.s, corresponding to the 18-foot flood stage in Winnipeg, the necessary storage to limit the discharge to this flow through Winnipeg during the 1950 flood would have been 3,234,000 acre-feet, while the storage necessary for the 1852 flood would have been approximately 6,700,000 acre-feet, or a depth of about 10 feet on 1,000 square miles.

Although the limitations of the available data preclude accurate determinations of the magnitudes of these historic floods, there is sufficient evidence to prove that flood control schemes in the Red River Valley will have to provide for a flood flow at least double that of the 1950 flood if complete protection is the goal. The security and economy of any protection scheme, depending upon the design flood and its relative frequency of occurrence, is so very important that a more detailed, exhaustive study should be made.

FLOOD CONTROL IN THE RED RIVER BASIN

Flood control may be effected by reservoirs, levees, channel improvements, or diversions. These relief works are discussed with particular reference to the Red River Basin.

Reservoirs. Reservoirs will protect the areas downstream from the dam by holding back a part of the flood waters at the expense of submerging areas upstream. However, soil-tillage, pasturing, etc., may be continued in reservoir areas subject to varying degrees of interruption during every flood period. In dry years, there will be no flooding of the area, and during the wettest years, the reservoirs will contain water for only a few months. The reservoirs will reduce the crest stages of all floods at the expense of prolonging the duration of the intermediate stages.

The topography of the Red River Basin does not lend itself to reservoir sites that would provide a significant reduction in the flow. There are no suitable sites on the main stem of the Red River. On the tributaries, suitable reservoir sites are too close to the headwaters so that the impounded water would represent a very small proportion of the total flow. Reservoirs on the tributaries in Manitoba would not have significantly reduced the 1950 peak flow at Winnipeg. With most of the inflow to the Red from the tributaries in Manitoba held in channel and valley storage, the peak flow at Winnipeg was only about six per cent greater than the peak at Emerson. The flooding of the area south of Ste. Agathe effectively reduced disastrous flood stages in Winnipeg. This natural detention reservoir could be improved to protect Winnipeg from larger floods, but only at the expense of flooding more area to the south.

Levees. Local protection by levees is feasible on almost every stream. Levees protect the landward area by confining the flow. However, there may be a general

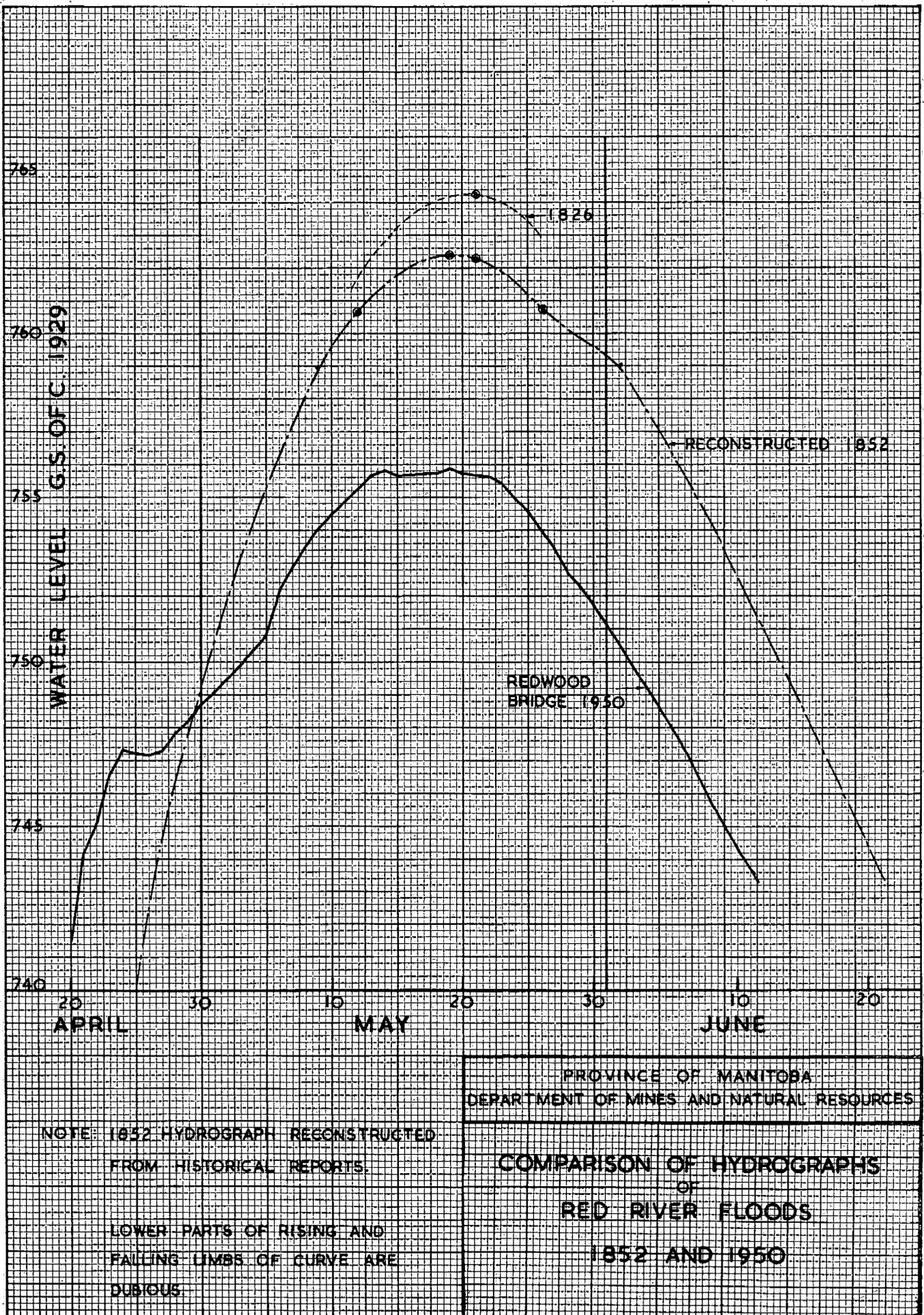


FIG. 13

raising of the river stages for a given flow, and damage may be increased upstream and downstream from the leveed reach. The levee tops can be used for railroad and highway right-of-way.

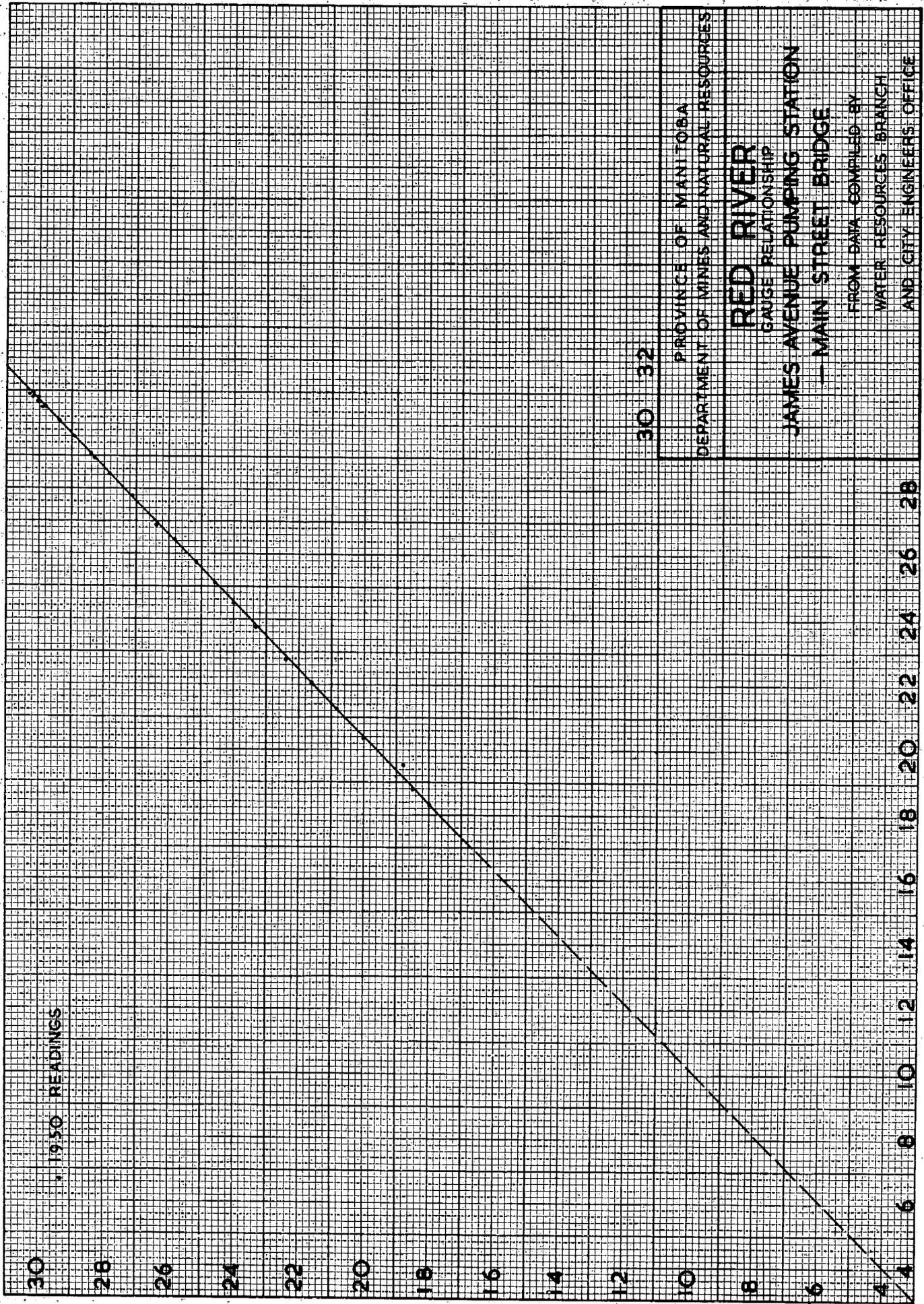
Local protection of the Greater Winnipeg area up to elevation 26.5 (City Datum) is being provided under the direction of the Greater Winnipeg Dyking Board. Protection from floods greater than the flood for which the levees are designed will have to be provided by other works. If the levees are over-topped and/or break, there will be a total loss of benefits to the protected area in addition to the damage caused by a sudden rush of water.

Channel Improvements. By deepening, widening and straightening a river channel, reduced stages for a given flow are provided adjacent to and a short distance upstream from the improvement. Under certain conditions, however, these improvements may increase the flood damages down stream by bringing the flood waters to the reach of the river below the improved section in greater quantities than can be removed by the unimproved sections.

Improving the channel of the Red River by deepening and widening is not economical. The river has already a fairly large channel so that significant improvements in the river stage could only be accomplished through enormous excavation. In certain localities, where the channel bed-slope or the banks are definite obstructions, dredging might prove feasible. Cut-offs and by-passes are usually applicable to a meandering stream such as the Red River.

Diversions. By transferring a part of the flood waters to another watercourse, areas adjacent to and downstream from the point of diversion are protected through a lowering of the river stage. In some cases, cultivation may be continued in the floodway area except when the project works go into action. There are several possibilities for diversions in the Red River Basin in Manitoba that will give protection to Greater Winnipeg, and to a limited extent, to some of the agricultural area to the south.

In order to provide security and economy of protection, flood control projects usually combine two or more of the above types of relief works.



30 32

PROVINCE OF MANITOBA
DEPARTMENT OF MINES AND NATURAL RESOURCES

RED RIVER
GAUGE RELATIONSHIP

JAMES AVENUE PUMPING STATION
— MAIN STREET BRIDGE

FROM DATA COMPILED BY
WATER RESOURCES BRANCH
AND CITY ENGINEERS OFFICE

CITY DATUM

MAIN STREET BRIDGE

FIG. 14

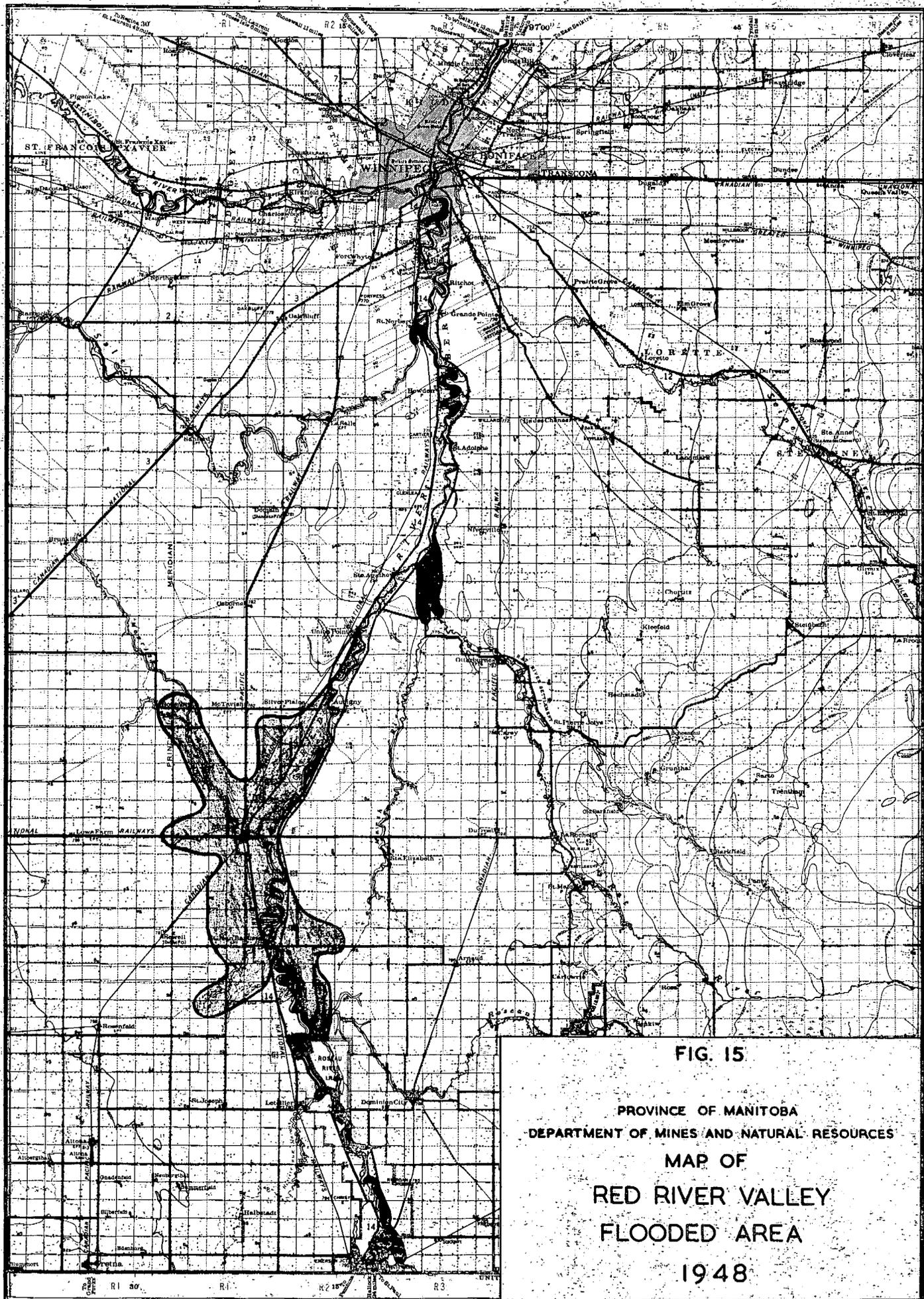




FIG. 16
 MAP OF
 THE CITY OF WINNIPEG
 AND ENVIRONS

LEGEND—Staff Gauge
 Flooded Areas
 Sewer Backup
 Dikes

AREAS IN GREATER WINNIPEG
 AFFECTED BY 1950 FLOOD

*Average winter level of ice in Red River
 at James St. Pumping Station.

*DATUM = 0 ft.
 FLOOD STAGE = 18 ft. above datum
 PEAK 1950 FLOOD = 30.3 ft.

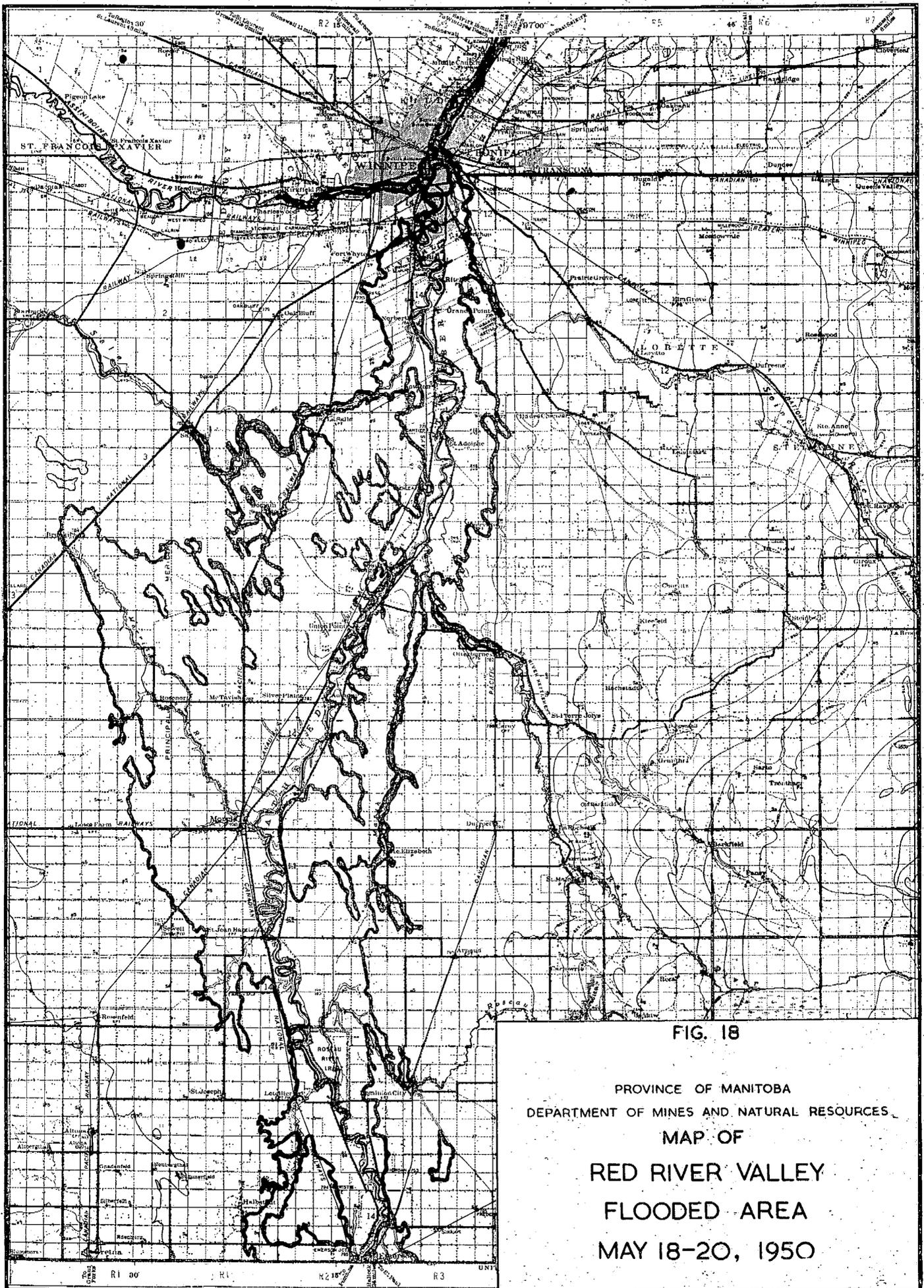
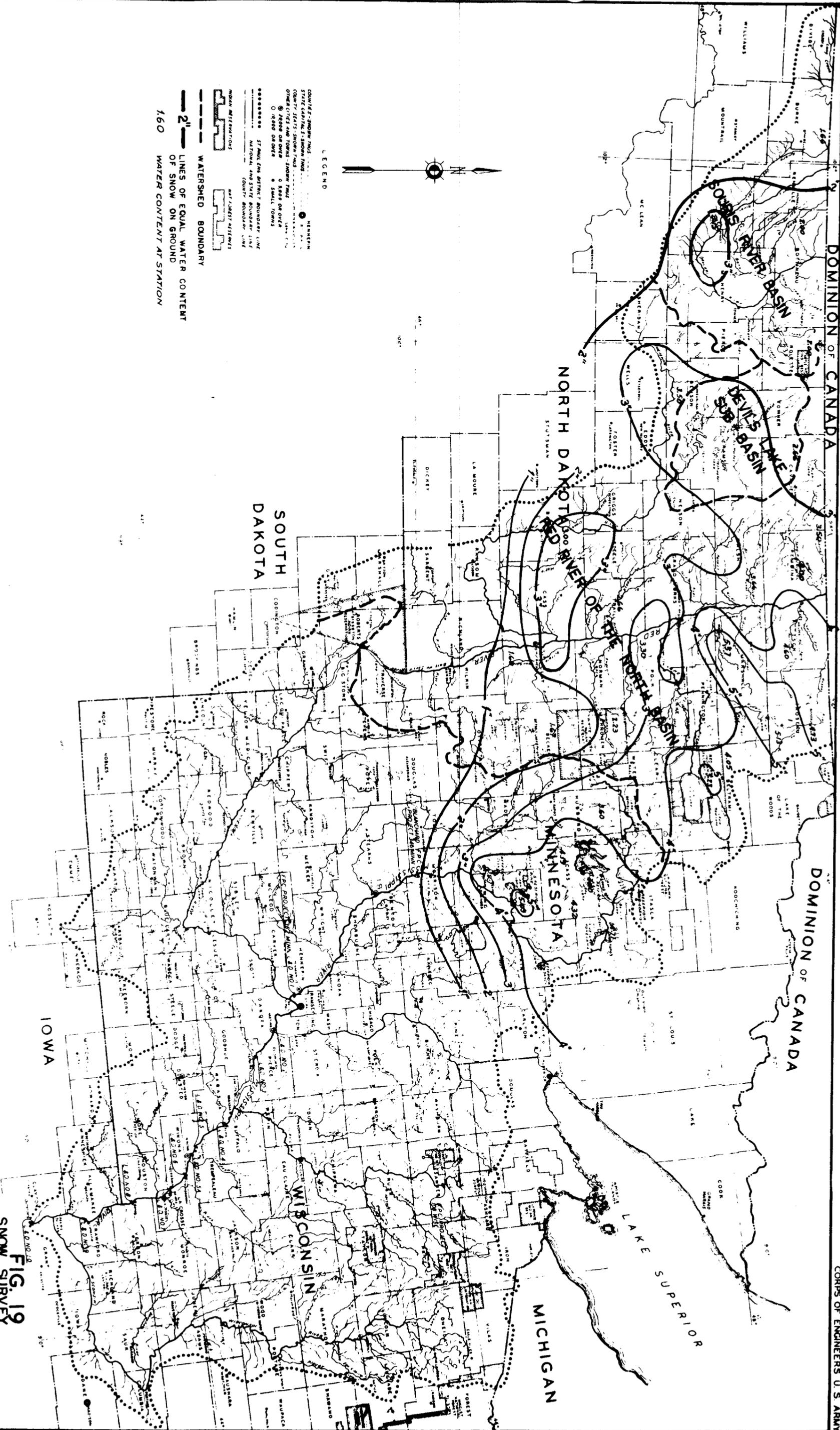


FIG. 18

PROVINCE OF MANITOBA
DEPARTMENT OF MINES AND NATURAL RESOURCES

MAP OF
RED RIVER VALLEY
FLOODED AREA
MAY 18-20, 1950



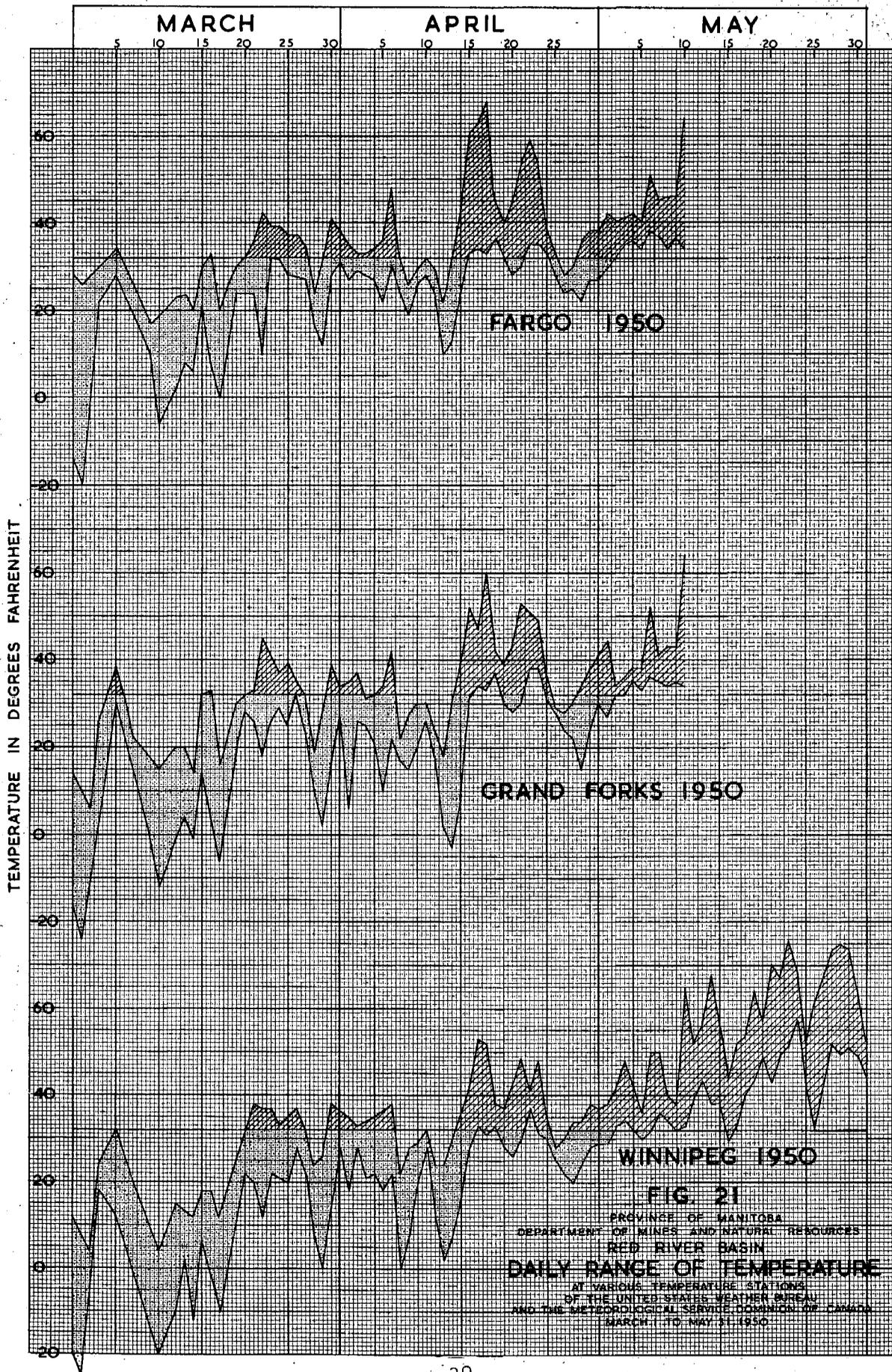
LEGEND

- MEMPHIS
- STATE CAPITALS - SHOWN THUS
- COUNTY SEATS - SHOWN THUS
- OTHER CITIES AND TOWNS - SHOWN THUS
- 70000 ON OVER
- 50000 ON OVER
- 10000 ON OVER
- SMALL TOWNS
- STATE AND DISTRICT BOUNDARY LINE
- NATIONAL AND STATE BOUNDARY LINE
- COUNTY BOUNDARY LINE
- NAT'L FOREST RESERVES
- NAT'L FOREST RESERVES
- WATERSHED BOUNDARY
- 2" LINES OF EQUAL WATER CONTENT OF SNOW ON GROUND
- 1.60 WATER CONTENT AT STATION

FIG. 19
SNOW SURVEY
13-22 MARCH 1950
RED RIVER OF THE NORTH BASIN
WATER CONTENT OF SNOW ON THE GROUND

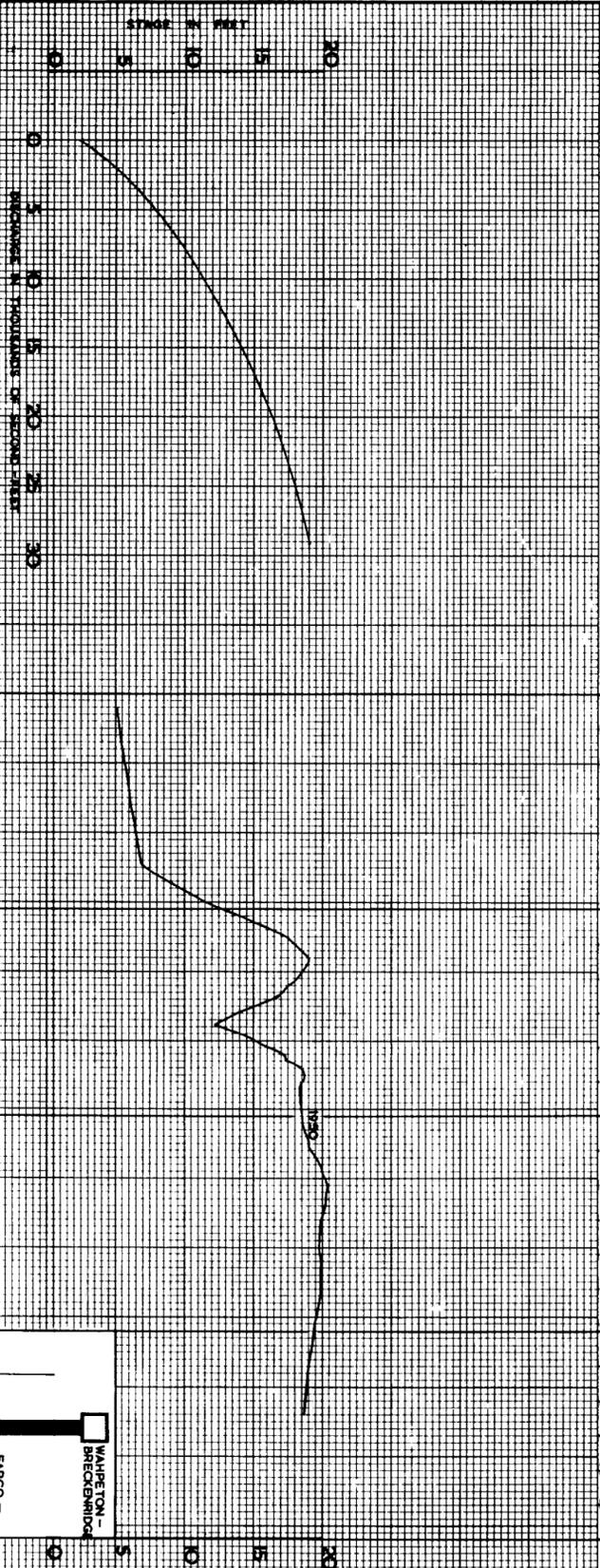
OFFICE OF THE DISTRICT ENGINEER
 ST. PAUL, MINNESOTA

10 0 10 20 30 40 50 MILES

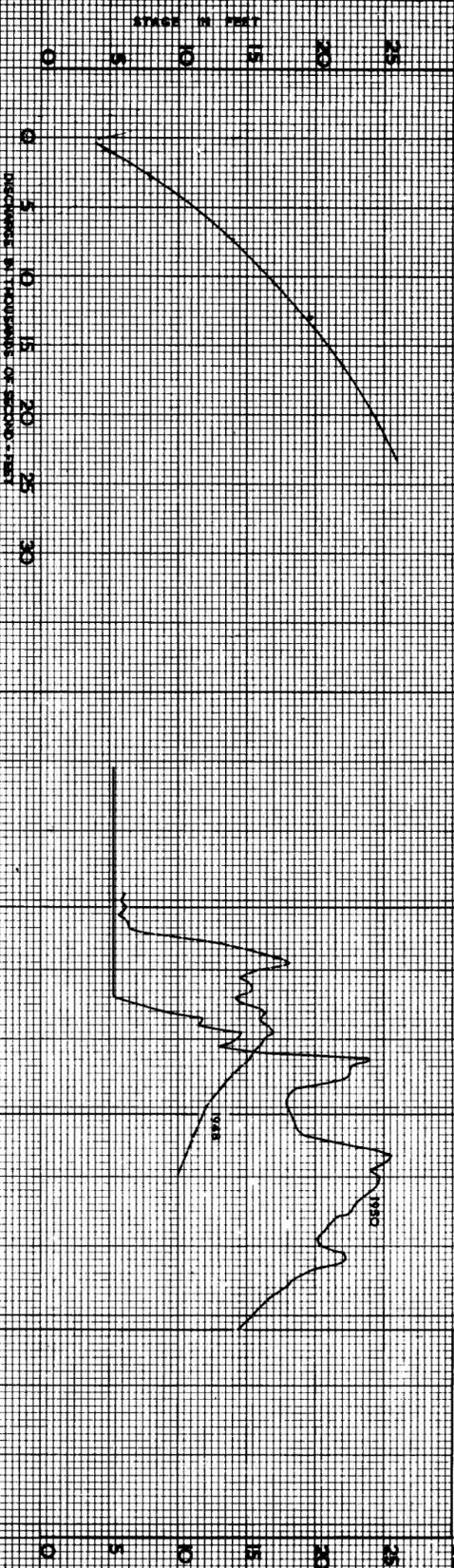
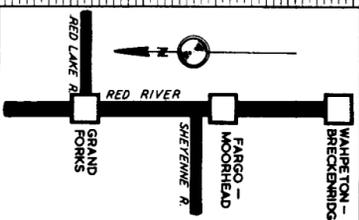


APPROXIMATE RATING CURVES

MARCH APRIL MAY JUNE



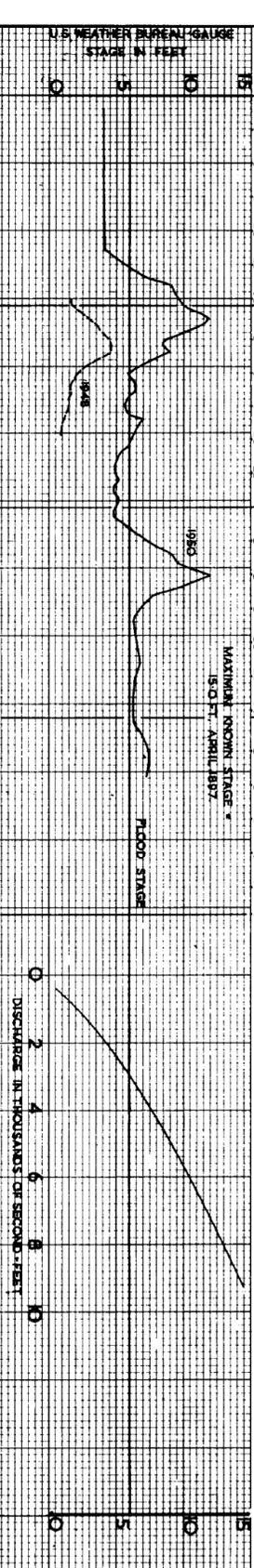
SHEYENNE RIVER AT WEST FARGO



RED LAKE RIVER AT CROOKSTON

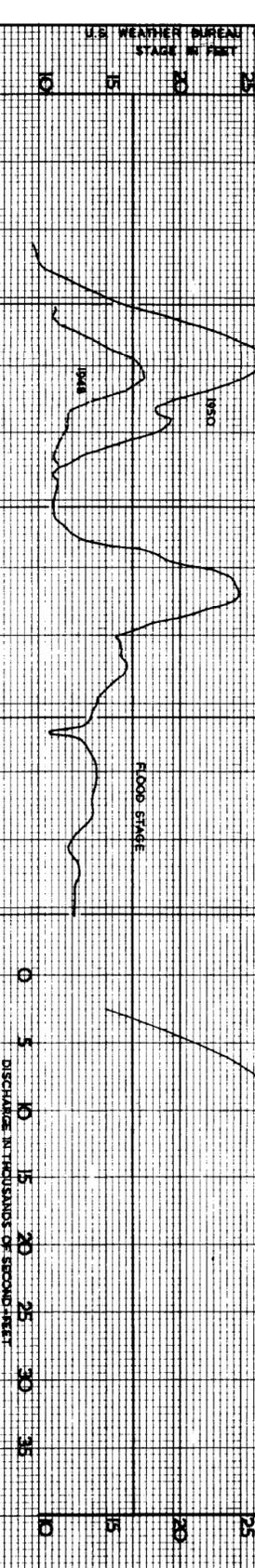
APPROXIMATE RATING CURVES

MARCH APRIL MAY JUNE



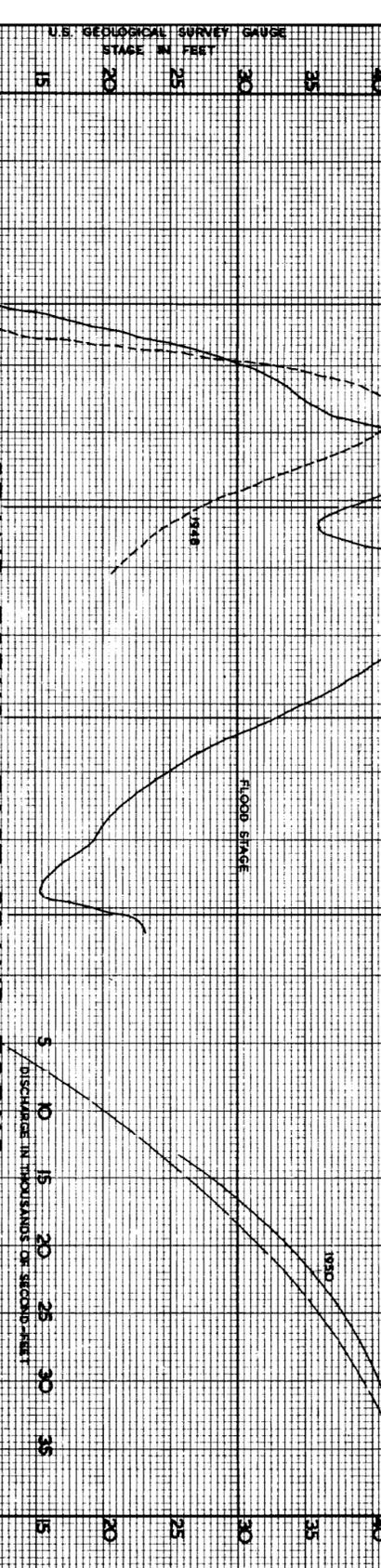
WAHPETON-BRECKENRIDGE

MAXIMUM KNOWN STAGE - 40.1 FT. APRIL, 1897



FARGO-MOORHEAD

MAXIMUM KNOWN STAGE - 50.5 FT. 10TH APRIL, 1897



GRAND FORKS - EAST GRAND FORKS

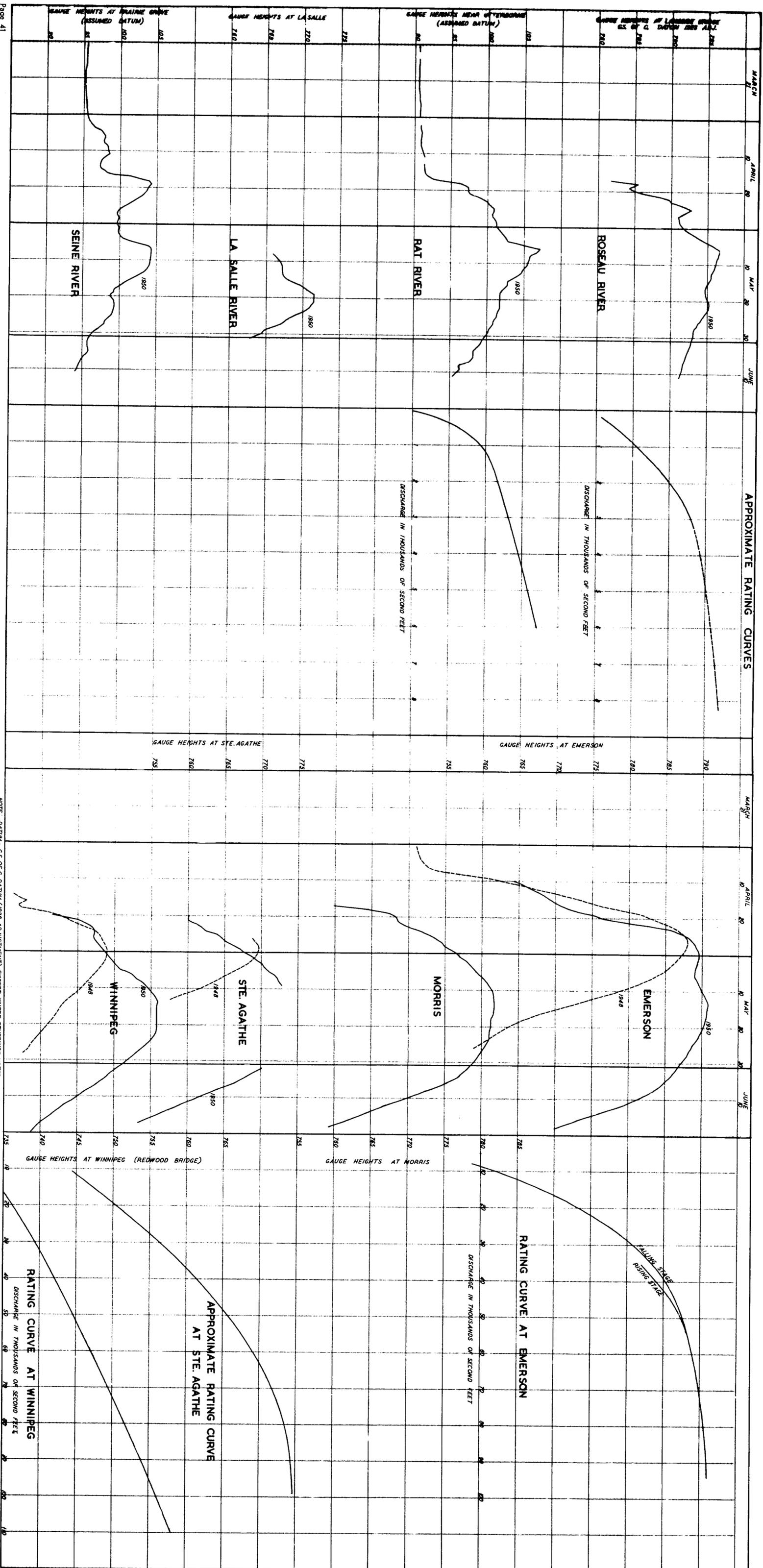
SHEYENNE AND RED LAKE RIVERS

RED RIVER OF THE NORTH

FIG. 22

FORM INFORMATION SUPPLIED BY ST. PAUL DISTRICT

RED RIVER BASIN

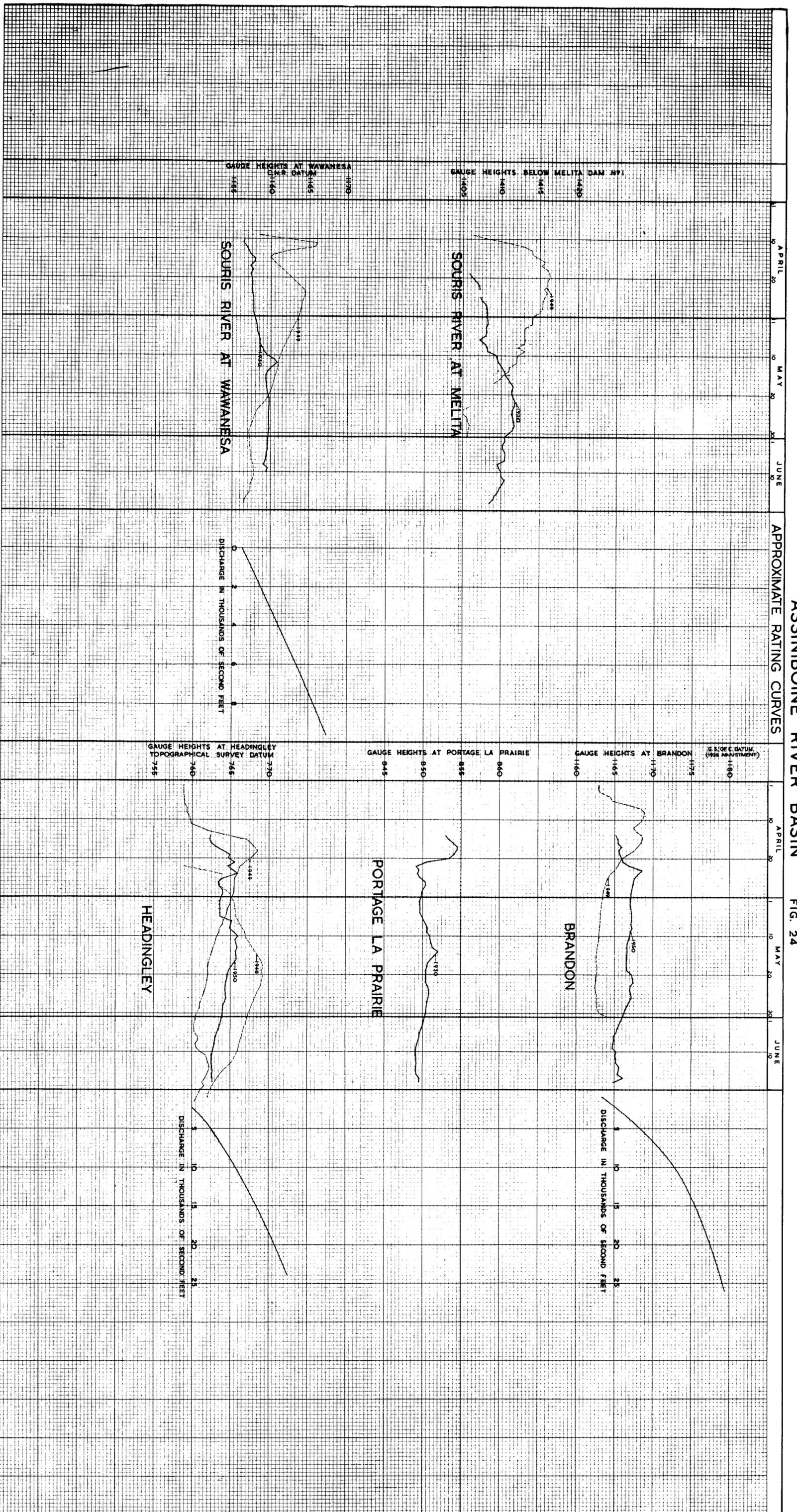


NOTE: DATUM - G.S. OF C. DATUM (1928 ADJUSTMENT) EXCEPT WHERE OTHERWISE NOTED.
 GEODETIC LEVELS BETWEEN EMERSON AND WINNIPEG ESTABLISHED IN 1850 TO G.S. OF C. (1928 ADJ.)

FIG. 23

ASSINIBOINE RIVER BASIN

FIG. 24



NOTE: DATUM - G.S. OF C. 1929 ADJUSTMENT EXCEPT WHERE NOTED.

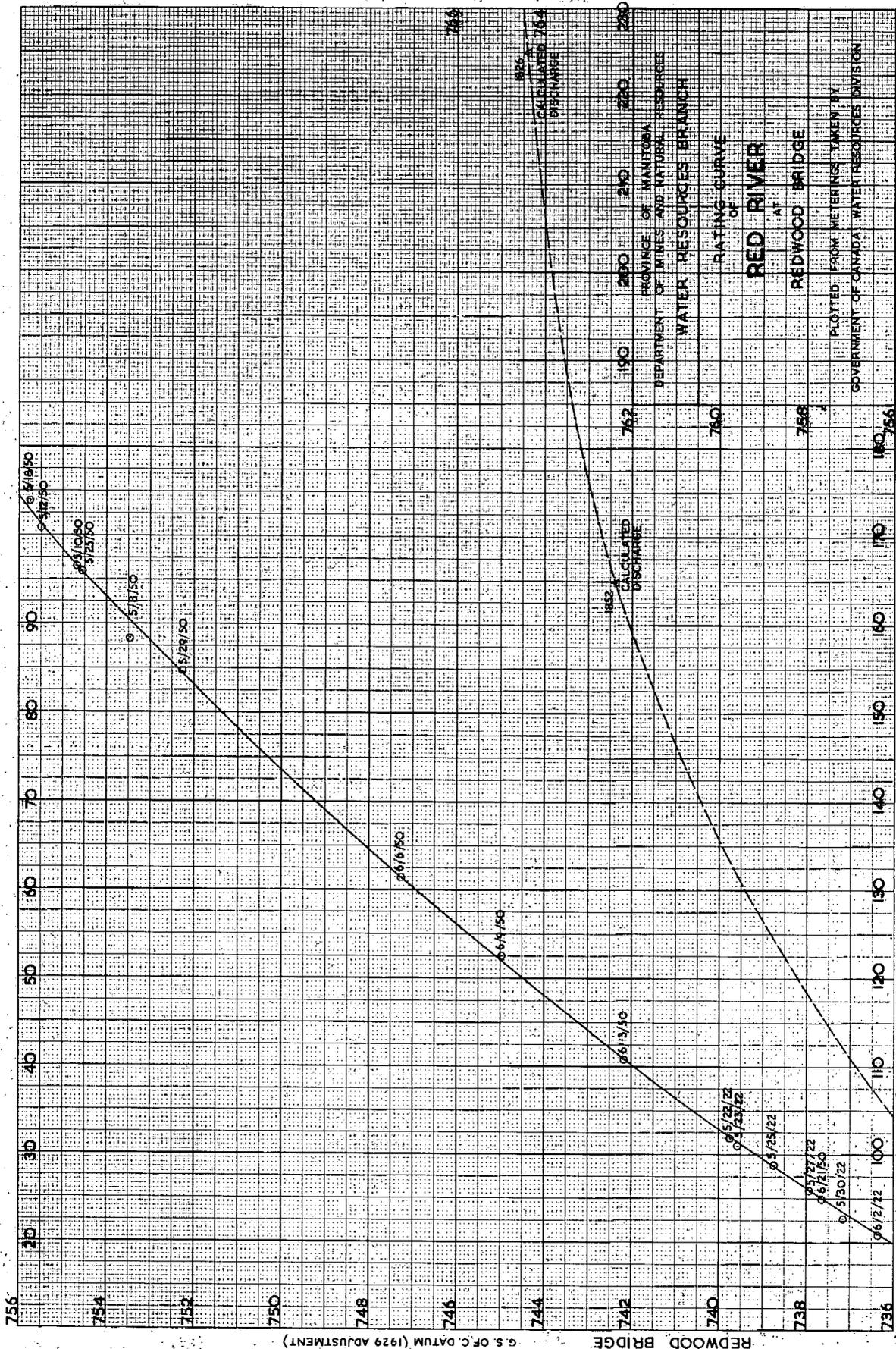


FIG. 25

DISCHARGE IN THOUSANDS OF SECOND FEET

g.s. of C. DATUM (1929 ADJUSTMENT)

TABLE 1

RECORDED MAXIMUM ELEVATIONS
DURING SPRING FLOODS
AT WINNIPEG *

Readings Taken At Main Street Bridge (Until 1908)
Readings Taken At James Ave. Pumping Station (After 1908)

NOTE: Readings taken at Main Street Bridge converted to
James Avenue location through gauge relationship
Zero City Datum = 727.57 C.S. of C. Datum, 1929 Adjustment

YEAR	MONTH	DAY	PEAK STAGE		
			CITY DATUM		G.S. of C. Datum 1929 Adj. James Ave.
			Main St. Bridge	James Ave.	
1826	May	21	36.75 *		764.3
1852	May	21	34.75 *		762.3
1861			32.5 *		760.1
1875			14.91	14.60	742.17
1876			12.36	12.15	739.72
1877			15.15	14.90	742.47
1878			6.61	6.50	734.07
1879			N.R.		
1880			16.31	16.00	743.57
1881			17.36	17.00	744.57
1882	May	6	26.3	25.72	753.29
1883			18.61	18.30	745.87
1884			17.91	17.60	745.17
1885			14.51	14.27	741.84
1886			N.R.		
1887			N.R.		
1888			N.R.		
1889			N.R.		
1890			N.R.		
1891			N.R.		
1892			22.50	22.07	749.64
1893			22.12	21.70	749.27
1894			17.47	17.15	744.72
1895			14.00	13.77	741.34
1896	May	28	20.73	20.32	747.89
1897	April	13	22.42	22.00	749.57
1898			19.00	18.66	746.23
1899			6.00	5.90	733.47
1900			5.76	5.65	733.22
1901			14.20	13.95	741.52
1902			18.47	18.12	745.69
1903			12.49	12.30	739.87
1904	April	24	24.57	24.07	751.64
1905	May	20	10.00	9.8	737.37
1906			N.R.		
1907	April	25	15.60	15.32	742.89
1908	April	18	13.50	13.25	740.82

TABLE I cont'd

RECORDED MAXIMUM ELEVATIONS
DURING SPRING FLOODS
AT WINNIPEG ★

YEAR	MONTH	DAY	CITY DATUM JAMES AVE. PUMPING STATION	G.S. of C Datum 1929 Adj. James Ave.
1909	April	20	9.50	737.07
1910	March	25	14.25	741.82
1911	May	3	6.4	733.97
1912	April	15	9.6	737.17
1913	April	16	16.35	743.92
1914	April	22	7.5	735.07
1915	April	11	6.1	733.67
1916	April	24	24.01	751.58
1917	April	14	15.4	742.97
1918	April	9	3.1	730.67
1919	April	11	10.5	738.07
1920	April	17	16.75	744.32
1921	April	15	11.1	738.67
1922	May	19	14.4	741.97
1923	April	28	21.2	748.77
1924	April	29	11.0	738.57
1925	April	2	16.8	744.37
1926	April	2	16.0	743.57
1927	May	16	19.4	746.97
1928	April	9	12.9	740.47
1929	April	2	12.8	740.37
1930	April	11	15.2	742.77
1931	April	9	10.8	738.37
1932	April	16	15.3	742.87
1933	April	9	14.6	742.17
1934	April	14	7.5	735.07
1935	April	12	7.3	734.87
1936	April	22	15.4	742.97
1937	April	21	3.9	731.47
1938	March	29	7.7	735.27
1939	April	11	6.1	733.67
1940	April	22	8.2	735.77
1941	April	15	16.9	744.47
1942	April	14	17.6	745.17
1943	April	15	16.3	743.87
1944	April	21	8.4	735.97
1945	March	31	19.8	747.37
1946	March	31	15.3	742.87
1947	May	2	14.9	742.47
1948	May	1	23.4	750.97
1949	April	18	17.8	745.37
1950	May	19	30.3	757.87

N.R. - No Reading

★ - Readings Taken By The City Engineer's Office.

* - Obtained from Historical Data. See History of Red River Flooding
Appendix 6

TABLE 2

Reproduced From Dominion of Canada Sessional Papers No. 123, 1880, Appendix 16

TABLE SHEWING THE HEIGHTS ABOVE SEA LEVEL, OF THE WATER AND BANKS OF RED RIVER, AT VARIOUS PLACES AND AT DIFFERENT TIMES

Locality	From mouth of Assiniboine River Miles	Height in Feet Above Sea Level						Difference between ice level and Flood of 1826	Flood of 1826 above Prairie level	Prairie level above flood of 1826	Remarks
		General Prairie Level	Ice Level of 1876	Flood Level							
				1875	1861	1852	1826				
Mouth of Assiniboine	0	764	732	750	765	767	769	37	5	..	District
Point Douglas	2	762	732	750	...	767	769	37	7	..	
North of St. John's Church	4	761	732	750	763	765	769	37	8	..	
North of Kildonan's Church	7	761	731	750	758	764	768	37	7	..	Submerged
South of Tait's Creek	12	759	730	747	...	759	766	36	7	..	
Near St. Andrew's Church	18	759	723	742	...	751	759	37	.	..	Contracted Channel with impetuous current during floods
About 2 Miles above S. Fort	20	760	...	...	...	748	755	..	.	5
Stone Fort	22	758	719	740	...	742	752	33	.	6	
About 2 Miles below S. Fort	24	753	...	736	...	737	748	..	.	5	
Selkirk	27	744	718	...	...	732	738	20	.	7
St. Peter's Church	31	736	...	...	...	725	730	..	.	6
Lake Winnipeg	40	...	716	...	...	...	...	..	.	.

NOTE: Subtract 4.5 Feet to bring to G.S. of C. Datum, 1929 Adjustment

TABLE 3

HIGH WATER MARKS AND CHANNEL CAPACITIES BETWEEN
WINNIPEG AND EMERSON

LOCATION	MAXIMUM STAGE			Approximate Channel Capacity c.f.s.	Channel Capacity to 1950 Peak Discharge in per. cent
	1882	1897	1950		
Emerson	788.9	790.9	790.89	38,000	40
Letellier	777.9	782.9	785.3	32,000	34
St. Jean	773.1	779.7	782.3	41,000	44
Morris	769.9	772.9	781.7	45,000	47
Ste. Agathe	767.9		773.2	71,000	74
St. Adolphe			★	69,000	72
St. Norbert		757.6	★	69,000	72
Winnipeg	753.9	749.6	757.87	47,000 ★ ★	47

★ - Peak Stage not recorded

★ ★ - Corresponds to 18-Foot Flood Stage

Note: All elevations in G.S.C. datum. Geodetic levels between
Winnipeg and Emerson established in 1950 to 1929 adjustment.

TABLE 4

RED RIVER OF THE NORTH
PEAK STAGES AND DISCHARGES

River	Station	Drainage Area Square Miles	Maximum Spring 1950			Maximum of Record to 1950			Date of Maximum Discharge	Discharge Second Feet	Maximum of Record of C.S.M.	Approx. Period of Record Years
			Stage Feet	Discharge Second Feet	Date of Maximum Discharge	Stage Feet	Date of Maximum Stage	Discharge Second Feet				
Red River	At Wahpeton, N.D.	4,010	11.92	4,300 (r)	4/2/50	14.75	4/2/43	5,000	4/2-6/43	1.25	9	
Red River	At Fargo, N.D.	6,800	21.3	7,750	4/7/50	28.4	4/7/43	18,000	4/7/43	2.65	49	
Red River	At Halsted, Minn.	21,800	31.62	21,600 (r)	4/11/50	34.00	4/17/43	26,000	4/17/43	1.19	10	
Red River	At Grand Forks, N.D.	30,100	45.7	54,000	5/12/50	50.2	4/10/97	43,000	4/10/97	1.43	69	
Red River	At Oslo, Minn.	30,500	31.96	60,000	5/10/50	31.96	5/10/50	60,000	5/10/50	1.97	11	
Red River	At Drayton, N.D.	34,800	41.6	88,000	5/12/50	41.6	5/12/50	88,000	5/12/50	2.53	11	
Red River	At Emerson, Man.	40,200	47.40	94,400	5/13, 14/50	47.40	5/13, 14/50	94,400	5/13, 14/50	2.34	40	
Red River	At Winnipeg, Man.	111,000	28.27	103,440	5/19/50	103,440	5/19/50	103,440	5/19/50	.93	38	
Mustinka River	Above Wheaton, Minn.	834	12.97	1,740	5/11/50	16.28 (b)	4/1/43	2,710	4/13/47	3.25	26	
Bois de Sioux River	Near White Rock, S.D.	1,160	7.98 (h)	880 (r)	6/20/50	9.28	6/23/44	1,120	5/24/43	0.97	9	
Rabbit Creek	At Campbell, Minn.	266	10.42 (h)		3/31/50	5.07 (b)	4/2/43	1,860	6/4/44	7.00	8	
Otter Tail River	Near Fergus Falls, Minn.	1,810	4.03 (h)		5/30/50	4.31	6/4/44	1,200	6/4/44	0.66	20	
Wild Rice (N.D.) River	Near Abercrombie, N.D.	2,170	15.92 (h)	2,620	4/4/50	21.02	4/2/43	5,500	4/2/43	2.54	19	
Sheyenne River	At Harvey, N.D.	1,980	5.95 (h)	848	4/16/50	6.46	4/18/48	1,200	4/18/48	1.92	5	
Sheyenne River	At Sheyenne, N.D.		7.00 (h)	2,280	4/19/50	8.40	4/19/48	3,800	4/19/48		15	
Sheyenne River	At Cooperstown, N.D.	8,360	18.77	8,000	4/17/50	18.77	4/17/50	8,000	4/17/50		6	
Sheyenne River	At Valley City, N.D.	9,460	14.60	3,350	5/5/50	17.52	4/27/48	4,700	4/27/48	0.56	15	
Sheyenne River	At West Fargo, N.D.	1,480	20.66	2,700	5/11/50	20.66	5/11/50	2,700	5/11/50	0.29	29	
Maple River	At Mapleton, N.D.	170	17.80 (h)	1,980	4/2/50	18.04	4/14/47	3,880	4/14/47	2.62	7	
Rush River	At Amenia, N.D.		6.59 (h)	516	4/7/50	10.2 (b)	4/8/48	1,380	4/14/47	8.13	5	
Buffalo River	Near Dilworth, Minn.	1,040	16.48	3,840	4/15/50	22.60	4/2/43	4,530	4/2/43	4.35	20	
Wild Rice (Minn.) River	At Twin Valley, Minn.	888	10.96	3,390	5/9/50	20.00	7/22/09	9,200	7/22/09	10.35	29	
Wild Rice (Minn.) River	At Hendrum, Minn.	1,600	25.09		4/8/50	27.70	4/15/47	4,250	4/15/47	2.66	7	
Goose River	Near Portland, N.D.	544	23.0	7,000	4/18/50	23.0	4/18/50	7,000	4/18/50	12.9	11	
Goose River	At Hilleboro, N.D.	1,200	14.88	9,700	4/19/50	14.88	4/19/50	9,700	4/19/50	8.09	20	
Marsh River	Near Shelly, Minn.	151	17.36 (h)	3,590	4/19/50	17.36	4/19/50	3,730	4/15/47	24.70	7	
Sand Hill River	At Beltrami, Minn.	324	5.97	292	4/18/50	5.97	4/18/50	292	4/18/50	0.90	8	
Sand Hill Ditch	At Beltrami, Minn.	324	11.60	2,670	4/19/50	11.60	4/19/20	2,670	4/19/50	8.24	8	
Sand Hill River	At Climax, Minn.	405	15.95	2,950	4/22/50	15.95	4/22/50	2,950	4/22/50	7.28	8	

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TABLE 4
cont'd

RED RIVER OF THE NORTH
PEAK STAGES AND DISCHARGES

River	Station	Drainage Area Square Miles	Maximum Spring 1950			Maximum of Record to 1950			Approx. Period of Record Years	
			Stage Feet	Discharge Second Feet	Date of Maximum Discharge	Stage Feet	Date of Maximum Stage	Discharge Second Feet		
Red Lake River	Near Red Lake, Minn.	1,930	6.79(h)	1,400	5/11/50	7.27	6/1/45	1,650	0.86	17
Red Lake River	At Highlanding, Minn.	2,300	12.43(g)	3,740	5/11/50	13.43	5/11/50	3,740	1.63	21
Red Lake River	At Crookston, Minn.	5,280	25.67	27,200	5/7/50	25.67	5/7/50	27,200	5.15	49
Thief River	Near Thief River Falls, Minn.	959	16.83	5,260	5/10/50	16.83	5/10/50	5,260	5.50	25
Clearwater River	Near Leosard, Minn. (c)	153				2.70	3--/45	435	2.84	13
Clearwater River	At Plummer, Minn.	512	11.33	3,350	5/6/50	11.33	5/6/50	3,350	6.55	11
Clearwater River	At Red Lake Falls, Minn.	1,370	11.28	9,500	5/6/50	11.28	5/6/50	9,500	6.94	24
Turtle River	At Manvel, N.D.		21.50	6,000	4/19/50	21.50	4/19/50	6,000		5
Forest River	Near Fordville, N.D.	491	14.36	10,000	4/18/50	14.36	4/18/50	10,000	4.06	11
Forest River	Near Minto, N.D.	538	8.93(h)	7,440	4/20/50	11.80	4/19/48	12,300	22.85	19
Park River	At Grafton, N.D.	753	20.13	12,000	4/19/50	20.13	4/19/50	12,000	15.92	19
South French Park River	Near Park River, N.D.	255	9.05(h)	3,780	5/7/50	12.42	4/18/48	12,000	47.10	11
Two Rivers	Below Hallock, Minn.	644	25.59		5/13/50	25.59	5/13/50	2,300	3.58	6
South Branch Two Rivers	At Lake Bronson, Minn. (c)	444				10.05	4/1/42	2,210	5.00	16
State Ditch No. 85	Near Lancaster, Minn.	95	5.90	1,160	5/20/50	5.90	5/20/50	1,160	12.20	19
North Branch Two Rivers	Near Lancaster, Minn.	32	6.25	970	5/20/50	6.25	5/20/50	970	30.30	20
North Branch Two Rivers	Near Northcote, Minn.	386		1,820	4/20/50	23.31(b)	4/25-28/48	1,820	4.71	8
Pembina River	Near Manitou, Man.	2,060		3,280	4/17/50		4/17/49	5,030	2.44	
Pembina River	Near Walhalla, N.D.	3,020	19.5	16,000	4/18/50	19.5	4/18/50	16,000	5.30	11
Pembina River	At Neche, N.D.	3,080	21.7	8,000	4/20/50	21.7	4/20/50	8,000	2.60	43
Tongue River	At Cavalier, N.D.	135	4.6	10,000	5/8/50	4.6	5/8/50	10,000	9.65	12
Roseau River Below S.Fk.	Near Malung, Minn.	570	22.51	3,750	4/24/50	22.51	4/24/50	3,750	6.60	21
Roseau River	At Rose, Minn.	1,210	18.19	6,200	5/12/50	18.19	5/12/50	6,200	5.12	22
Roseau River	Near Caribou, Minn.	1,530	11.81	4,100	5/19/50	11.81	5/19/50	4,100	2.68	22
Roseau River	At Langside Bridge, Man.	1,900	8.110	8,110	5/6/50	8.110	5/6/50	8,110	4.26	37
Mud Creek	Near Sprague, Man.	158	13.63	1,400	5/12/50	15.31	9/1/42	2,070	13.10	22
Pine Creek	Near Pine Creek, Minn.	73	10.14(h)		4/28/50	9.79	9/25/41	860	11.76	22
Rat River	Near St. Pierre, Man.	704		5,850	5/6/50		5/6/50	5,850	8.33	33
Seine River	Near Prairie Grove, Man.	495		2,860	5/7/50		5/7/50	2,860	5.78	7

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TABLE 4
cont'd

RED RIVER OF THE NORTH

Assiniboine River Basin

PEAK STAGES AND DISCHARGES

River	Station	Drainage Area Square Miles	Maximum Spring 1950		Stage Feet	Maximum of Record to 1950		Maximum Discharge of Record C.S.M.	Approx. Period of Record Years
			Discharge Second Feet	Date of Maximum Discharge		Date of Maximum Stage	Discharge Second Feet		
Assiniboine River	At Sturgis, Sask.	884	480	4/22/50			1,560	1.77	7
Assiniboine River	At Kamsack, Sask.	4,860	1,770	4/24/50			8,400	1.73	7
Assiniboine River	At Millwood, Man.	7,690	2,700	4/27/50			17,800	2.32	28
Assiniboine River	At Brandon, Man.	35,550	5,010	4/23/50			23,000	0.65	28
Assiniboine River	At Headingley, Man.	62,510	9,920(b)	5/16/50			21,700	0.35	27
Whitesand River	Near Canora, Man.	3,113	1,170	4/21/50			5,800	1.86	8
Yorkton, Creek	Near Ebenezer, Sask.	949	750	4/16/50			1,680	1.77	9
Qu'Appelle River	Near Tantalton, Sask.	21,400	800	4/17/50			2,530	0.12	20
Qu'Appelle River	Near Welby, Sask.	22,000	1,370	4/19/50			2,760	0.13	8
Kaposvar Creek	Near Tantalton, Sask.	616	104	4/16/50			598	0.96	9
Cutarm River	Near Spyhill, Sask.	395	245	4/18/50			585(r)	1.48	8
Minnedosa River	Near Rivers, Man.	1,490	2,080	5/24/50			2,280	1.53	6
Souris River	Near Estevan, Sask.	4,760	1,170	4/22/50			7,580	1.58	28
Souris River	At Oxbow, Sask.	9,395					7,760	0.83	8
Souris River	Near Sherwood, N.D.	9,570	1,680	4/18/50	23.80	4/28/48	7,400	0.77	20
Souris River	Above Minot, N.D.	11,300	1,340	4/28/50	21.9(e)	4/20/44	12,000(e)	1.06	43
Souris River	At Westhope, N.D.	17,570					6,400(f)	0.36	21
Souris River	At Wawanesa, Man.	24,150	3,790	5/11/50			8,280(b)	0.34	38
Long Creek	Near Estevan, Sask.	2,240	1,070	4/17/50			6,000	2.68	28
Moose Mountain Creek	Near Oxbow, Sask.	1,900					3,060	1.61	22
Antler River	Near Melita, Man.	1,221	620	4/21/50			2,610	2.14	7
Gainsborough Creek	Near Melita, Man.	521	495	4/21/50			1,300	2.49	7
Graham Creek	Near Melita, Man.	348	40	4/22/50			395	1.14	7
Pipestone Creek	Near Reston, Man.	1,540	1,100(f)	4/20/50			1,310	0.85	7

(a) 1950 data are provisional and subject to revision

(b) Stage affected by backwater

(c) Station discontinued in 1947

(e) At former site at Minot

(f) Estimated

(g) Zero lowered about 4 feet.

(h) Highest data available. May not be crest.

From Data Supplied By: Corps of Engineers, St. Paul District

and

Government of Canada, Department of Resources and Development, Water Resources Division.

TABLE 5

RED RIVER WATER LEVELS

Winnipeg to Mouth of Red River
May & June, 1950

Gauge No.	1	2	3	4	5	6	7	8	9	10	11	12	
Date													
May	1						729.90	729.20				712.77	
	2						730.20	729.70				712.83	
	3						730.50	730.10				712.97	
	4						730.80	730.40				713.00	
	5						731.20	730.80					
	6						732.30	732.00				713.20	
	7											712.96	
	8	751.51	751.49	749.75	747.75	743.53	738.90	733.10	732.90	728.12	724.98	722.95	712.92
	9	751.96	751.94	750.15	748.15	743.88	739.30	733.60	733.30	728.42	725.23	723.15	713.93
	10	752.66	752.49	750.70	748.65	744.33	739.80	734.10	733.80	728.82	725.58	723.40	712.84
	11	753.06	752.89	751.05	748.95	744.63	740.10	734.40	734.10	729.12	725.83	723.75	713.92
	12	753.36	753.24	751.35	749.25	744.93	740.35	734.50	734.30	729.32	725.88	723.80	713.94
	13	753.56	753.47	751.45	749.40	745.13	740.50	734.80	734.40	729.42	726.03	723.85	713.85
	14	753.71	753.59	751.65	749.48	745.18	740.54	734.80	734.50	729.47	726.03	723.85	713.62
	15	753.57	753.49	751.55	749.42	745.08	740.42	734.70	734.50	729.42	725.94	723.85	713.44
	16	753.61	753.49	751.55	749.43	745.03	740.33	734.70	734.40	729.42	725.93	723.85	713.44
	17	753.66	753.54	751.58	749.45	745.11	740.39	734.80	734.40	729.47	725.93	723.85	713.44
	18	753.66	753.59	751.60	749.45	745.11	740.38	734.90	734.30	729.47	725.93	723.75	713.57
	19	753.71	753.64	751.63	749.47	745.23	740.40	734.80	734.40	729.47	725.93	723.83	713.59
	20	753.73	753.63	751.60	749.45	745.18	740.35	734.70	734.40	729.52	725.93	723.70	713.64
	21	753.71	753.57	751.57	749.40	745.08	740.30	734.70	734.40	729.43	725.93	723.83	713.78
	22	753.55	753.44	751.45	749.30	744.98	740.20	734.60	734.40	729.37	725.90	723.70	713.97
	23	753.36	753.29	751.25	749.15	744.88	740.10	734.60	734.30	729.24	725.76	723.63	714.02
	24	753.01	752.94	750.93	748.83	744.53	739.77	734.40	734.00	729.02	725.67	723.53	714.79
	25	752.56	752.49	750.50	748.47	744.18	739.43	734.00	733.60	728.74	725.41	723.28	714.80
	26	752.13	752.01	750.05	748.07	743.83	739.04	733.70	733.30	728.45	725.16	723.10	713.68
	27	751.61	751.49	749.65	747.64	743.48	738.70	733.20	732.90	728.12	724.93	722.75	713.74
	28	750.86	750.85	748.95	747.00	742.98	738.10	732.70	732.32	727.62	724.53	722.53	713.92
	29	750.41	750.32	748.52	746.56	742.48	737.70	732.20	731.80	727.37	724.35	722.34	714.20
	30	749.88	749.74	747.95	746.05	741.98	737.30	731.82	731.60	727.02	724.08	722.03	714.50
	31	749.40	749.34	747.49	745.61	741.48	736.77	731.37	730.95	726.62	723.83	721.88	714.80
June	1	748.80	748.80	746.95	745.13	741.03	736.37	731.00	730.52	726.27	723.63	721.65	714.40
	2	748.26	748.24	746.50	744.66	740.53	735.87	730.60	730.10	725.85	723.40	721.42	715.50
	3	747.70	747.66	745.92	744.18	740.02	735.39	730.20	729.70	725.45	723.09	721.20	715.15
	4	747.02	747.03	745.34	743.64	739.53	734.87	729.60	729.20	725.10	722.78	720.90	715.20
	5	746.50	746.48	744.80	743.11	739.03	734.42	729.20	728.90	724.75	722.64	720.70	715.25
	6	745.85	745.75	744.19	742.56	738.48	733.81	728.80	728.30	724.27	722.24	720.38	714.80
	7	745.15	745.08	743.51	741.96	737.84	733.22	728.10	727.60	723.90	721.94	720.30	715.70
	8	744.37	744.30	742.80	741.26	737.18	732.70	727.60	727.20	723.33	721.44	719.88	715.45
	9	743.70	743.63	742.09	740.72	736.68	732.19	727.20	726.70	722.80	721.09	719.35	714.65
	10	743.10	743.06	741.59	740.17	736.18	731.87	726.70	725.70	722.30	720.72	719.07	715.35
	11	742.40	742.33	741.04	739.57	735.64	731.25	726.70	725.00	721.70	720.22	718.60	715.20
	12	741.80	741.73	740.49	739.02	735.14	730.89	726.80	724.30	721.10	719.64	718.07	715.05
	13	741.30	741.25	739.94	738.55	734.64	730.47	726.50	723.90	720.78	719.54	717.97	715.25
	14	740.64	740.64	739.36	738.03	734.24	729.97	726.20	723.20	720.20	719.04	717.47	715.15
	15	739.98	739.98	738.79	737.50	733.59	729.57	725.90	722.60	719.85	718.94	717.37	716.10
	16	739.33	739.33	738.24	736.95	733.14	729.47	725.60	722.40	719.78	718.99	717.47	715.60
	17	738.73	738.73	737.66	736.50	732.64	728.67	725.40	721.80	719.20	718.19	716.57	714.95

For location of gauges see Table 5(a)

Elevations in G.S.C. Datum, 1929 Adjustment

TABLE 5(a)

DESCRIPTION OF GAUGE LOCATIONS ALONG LEFT (WEST) BANK OF RED RIVER		
Gauge No.	River Mileage from mouth of Assiniboine R.	Location
1	6.3	Immediately above C.P.R. Bridge, Bergen Cutoff Line.
2	6.3	Immediately below C.P.R. Bridge, Bergen Cutoff Line.
3	9.2	Head of Listers Rapids at Middlechurch; foot of Marjorie Ave. North side of Street.
4	12.1	At Riverside on river lot line 45-46 Parish of St. Paul.
5	15.1	At river lot 22, Parish of St. Andrews.
6	17.6	Foot of Listers Rapids at old St. Andrews Church - river lot line 62-63, Parish of St. Andrews.
7	20.2	St. Andrews Lock and Dam, immediately above Dam.
8	20.2	St. Andrews Lock and Dam, immediately below Dam.
9	22.3	Lower Fort Garry-20 feet east of River Road $\frac{1}{4}$ mile below Fort on river lot 1, Parish of St. Clements.
10	27.5	Town of Selkirk - NE corner of Selkirk Navigation Co's office - foot of Manitoba Ave.
11	29.7	At mouth of Selkirk Slough on river lot 21 - Parish of St. Peters.
12	48.0	Dominion Water and Power Bureau's Automatic Gauge at Winnipeg Beach.
DESCRIPTION AND ELEVATIONS OF BENCH MARKS USED		
Gauge No.	Description	Elevation C.G.S. 1929 Adj.
1,2	Top of gauge board on bridge ties at eastern-most pedestal of main bridge - upstream side	767.93
3	6 inch spike in 20-inch elm - Old Folks Home at Middlechurch North side of road along fence line on Evelyn Ave.	754.18
4	6 inch spike in second tree from river on river lot line 45-46, 25 feet south of north boundary Sick-Benefit Cemetery - Riverside -	755.85
5	Top of triangular bar (concrete) north limit of lot 27 on river road - West Side	756.43
6	Top of triangular bar (concrete) at bend on west side of river road - Lot 62 - just south of St. Andrews Church.	746.59
7,8	Copper bolt set horizontally in west side of West Pier, St. Andrews Lock and Dam. March 1943 Geodetic M.D. 1	737.47
9	Copper bolt set horizontally in wall south of main gate at Lower Fort Garry - Geod. M.D. 11	760.02
10	Dominion Bank Building. Top of steps at entrance also top of bevel just above rough stone work.	743.97
11	Selkirk Shipyard - Top of bolt set vertically in concrete - N.E. corner of office building.	738.54
12	Top of copper bolt in concrete base, southeast corner of CPR Waterbank at Winnipeg Beach	726.45

TABLE 6

RED RIVER
GAUGE READINGS THROUGH GREATER WINNIPEG
1950

DATE	ELM PARK BRIDGE		MORWOOD BRIDGE		PROVENCHER BRIDGE		C.N.R. BRIDGE		JAMES AVE. PUMPING STN.		C.P.R. BRIDGE		LOUISE BRIDGE		REDWOOD BRIDGE	
	Time	Up Down	Time	Up Down	Time	Up Down	Time	Up Down	Time	Up Down	Time	Up Down	Time	Up Down	Time	Up Down
April 20	9:40	16.55 16.47	9:20	15.39 15.36	9:50	14.87 14.83	10:20	14.85 14.83	8:00	15.50	9:20	14.21 14.25	9:35	14.14 14.10	10:20	13.76 13.72
21	9:15	19.95 19.91	9:10	18.73 18.69	9:50	18.19 18.18	10:20	18.15 18.15	8:00	18.60	9:40	17.45 17.48	10:20	17.36 17.40	10:30	16.89 16.87
22	9:15	21.34 21.24	9:00	20.13 20.09	8:15	19.55 19.52	9:30	19.48 19.44	8:00	19.80	9:15	18.71 18.70	10:00	18.66 18.58	9:45	18.16 18.09
23									8:00	20.50						
24	9:30	23.28 23.00	8:50	21.81 21.73	9:10	21.16 21.13	9:30	21.10 21.07	8:00	21.40	9:30	20.60 20.57	10:00	20.21 20.06	10:20	19.72 19.6
25	9:45	23.16 23.00	9:10	21.72 21.66	9:40	21.24 21.22	9:55	21.17 21.11	8:00	21.40	9:30	20.48 20.48	9:45	20.08 19.96	10:15	19.61 19.55
26	10:00	23.12 23.04	10:15	21.56 21.52	10:45	21.12 21.10	11:30	21.06 21.05	8:00	21.20	9:45	20.35 20.40	10:15	20.00 19.85	11:00	19.35 19.30
27	9:25	23.28 23.20	9:45	21.72 21.68	10:00	21.27 21.24	10:15	21.20 21.18	8:00	21.30	10:35	20.48 20.46	10:45	20.10 19.95	11:00	19.50 19.42
28	9:30	23.75 23.70	9:45	22.20 22.17	9:52	21.72 21.70	10:05	21.68 21.66	8:00	21.80	10:20	20.90 20.85	10:30	20.57 20.43	10:40	19.93 19.83
29	9:10	24.30 24.24	9:45	22.69 22.66	10:00	22.23 22.20	10:10	22.18 22.14	8:00	22.20	10:30	21.40 21.38	10:37	21.05 20.88	10:45	20.42 20.38
30	11:03	24.82 24.77	11:25	23.17 23.13	11:40	22.68 22.66	11:50	22.63 22.60	8:00	22.70	12:10	21.80 21.76	12:20	21.50 21.30	12:45	20.80 20.76
May 1	9:25	25.37 25.31	9:40	23.68 23.62	10:00	23.20 23.17	10:10	23.14 23.12	8:00	23.30	10:30	22.32 22.28	10:45	21.89 21.78	11:00	21.30 21.25
2	9:25	25.92 25.84	9:50	24.14 24.11	10:00	23.67 23.63	10:10	23.62 23.61	8:00	23.70	10:45	22.76 22.75	10:55	22.38 22.23	11:10	21.85 21.80
3	10:00	26.50 26.40	10:20	24.68 24.58	10:35	Out	24.13 24.08	Out	8:00	24.10	11:00	23.22 23.19	11:15	22.87 22.70	11:25	22.28 22.25
4	9:50	26.96 26.86	10:05	25.08 24.98	10:15	24.56 24.53	10:30	24.49 24.47	8:00	24.50	10:35	23.64 23.61	10:45	23.24 22.96	11:00	22.67 22.58
5	11:25	27.58 27.48	11:10	25.65 25.54	11:00	25.12 25.10	10:50	25.08 25.06	8:00	24.90	10:15	24.30 24.24	10:10	23.80 23.60	9:55	23.15 23.10

Note - All elevations to City Datum: Add 727.57 for GS-C 1928 adjustment

Note - Gauges at Provencher and C.N.R. Bridges on Winnipeg side moved to St. Boniface side of River May 9.

Cont'd on next page

TABLE 6 cont'd

RED RIVER
GAUGE READINGS THROUGH GREATER WINNIPEG
1950

DATE	FT. GARRY OFF MGPL. HALL	ELM PARK BRIDGE		NORWOOD BRIDGE		PROVENCHER BRIDGE		C.N.R. BRIDGE		JAMES AVE. P. STN.	C.P.R. BRIDGE		LOUISE BRIDGE		REDWOOD BRIDGE		NORTH CITY LIMITS	
		Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.		Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.		
Day Time																		
May 6 8am										26.20								
7 "										27.10								
8 12 Mid										27.70								
9 8am		31.00	30.88	28.95	28.65	28.32	27.88	27.75		28.30	27.49	27.40	26.84	26.80	26.35	26.29		
12 n.		31.23	31.08	29.15	28.86	28.85	28.43			28.40	27.67	27.66	26.98	26.90	26.47	26.38		
4 pm		31.31	31.17	29.24	28.93	-	-				27.76	27.75	27.07	27.02	26.53	26.50		
12 mid		31.42	31.30	29.36	29.06	-	-			28.8								
10 8am		31.68	31.59	29.68	29.32	29.00	28.63	28.38										
12 n.		31.94	31.79	29.91	29.52	-	-			29.00	28.09	28.10	27.48	27.40	26.93	26.88		
4 pm		32.04	31.91	29.97	29.57	-	-			29.10	28.17	28.10	27.56	27.48	27.03	27.00	25.97	
12 mid		32.13	32.03	30.00	29.65	-	-			29.15	28.30	28.30	27.63	27.57	27.07	27.02	26.07	
11 8am		32.25	32.20	30.18	29.75	29.48	29.12			29.2	28.28	28.37	27.76	27.60	27.18	27.17	26.10	
12 n.		32.35	32.39	30.38	29.95	30.01	29.59			29.40	28.56	28.58	27.94	27.84	27.34	27.32	26.32	
4 pm		32.63	32.48	30.41	30.05	30.06	w.0.			29.50	28.67	28.67	27.97	27.97	27.47	27.40	26.38	
12 mid		32.71	32.57	30.46	30.08	30.16	29.65			29.50	28.71	28.70	28.05	27.98	27.49	27.44	26.43	
12 8am		32.86	32.72	30.60	30.23	29.98	29.42			29.7	28.17	28.78	28.17	28.02	27.63	27.63	26.52	
12 n.		32.97	32.85	30.75	30.35	30.40	29.89			29.80	28.85	28.82	28.25	28.20	27.76	27.65	26.63	
4 pm		33.01	32.91	30.77	30.37	30.41	29.91			29.80	28.93	28.92	28.33	28.28	27.76	27.73	26.69	
12 mid		33.07	32.97	30.86	30.42	30.50	29.98			29.90	29.06	28.95	28.38	28.31	27.83	27.77	26.72	
13 8am		33.16	33.02	30.92	30.52	30.28	29.70			30.0	29.15	29.03	28.47	28.40	27.93	27.90	26.82	
12 n.		33.18	33.07	31.02	30.60	30.64	30.09			30.05	29.17	29.09	28.50	28.41	27.90	27.88	26.87	
4 pm		33.25	33.14	31.05	30.62	30.67	30.15	29.97		30.10	29.20	29.17	28.57	28.45	27.98	27.95	26.88	
12 mid		33.33	33.19	31.11	30.65	30.72	30.19	30.05	29.66	30.15	29.23	29.19	28.62	28.50	28.02	27.98	26.92	
14 8am		33.36	33.20	31.15	30.70	30.46	29.93			30.2	29.41	29.33	28.70	28.55	28.10	28.03	27.01	
12 n.		33.28	33.20	31.12	30.70	30.75	30.24	30.14	29.69	30.20	29.30	29.28	28.68	28.55	28.05	28.00	26.98	
4 pm		33.23	33.08	31.02	30.63	30.72	30.18	30.12	29.63	30.20	29.35	29.25	28.68	28.55	28.03	27.98	26.96	
12 mid		33.17	33.07	31.00	30.56	30.30	29.93			30.1	29.13	29.12	28.52	28.45	27.92	27.90	26.88	
15 8am		33.21	33.08	30.98	30.50	30.64	30.12	30.02	29.58	30.10	29.23	29.13	28.56	28.46	27.96	27.90	26.86	
12 n.		33.26	33.12	30.98	30.59	30.64	30.12	30.01	29.58	30.10	29.17	29.16	28.55	28.45	27.96	27.88	26.87	
4 pm		33.27	33.15	31.03	30.63	30.67	30.14	30.01	29.61	30.10	29.17	29.17	28.56	28.46	27.97	27.88	26.87	
12 mid		33.27	33.18	31.02	30.62	30.37	29.82	29.66	29.66	30.15	29.13	29.12	28.60	28.49	27.98	27.95	26.88	
16 8am		33.30	33.18	31.07	30.66	30.70	30.18	30.08	29.63	30.15	29.16	29.14	28.60	28.50	28.02	27.94	26.87	
12 n.		33.33	33.20	31.06	30.66	30.71	30.21	30.07	29.65	30.15	29.24	29.14	28.60	28.50	28.02	27.98	26.90	
4 pm		33.31	33.19	31.10	30.69	30.71	30.21	30.08	29.68	30.20	29.25	29.20	28.62	28.52	28.02	27.98	26.90	
12 mid		33.34	33.24	31.13	30.71	30.43	29.90	29.70	29.68	30.2	29.22	29.21	28.65	28.54	28.05	28.04	26.92	
17 8am		33.40	33.27	31.09	30.70	30.74	30.23	30.09	29.69	30.20	29.28	29.26	28.65	28.56	28.06	28.02	26.92	
12 n.		33.40	33.28	31.15	30.70	30.75	30.25	30.10	29.72	30.20	29.26	29.22	28.65	28.56	28.06	28.02	26.93	
4 pm		33.40	33.29	31.11	30.71	30.76	30.25	30.10	29.72	30.20	29.28	29.24	28.66	28.55	28.06	28.02	26.94	
12 mid		33.45	33.33	31.05	30.70	30.44	29.94	29.78	29.78	30.25	29.31	29.27	28.72	28.61	28.14	28.06	26.95	

* Taken at 09.30

Note: Norwood Bridge Downstream gauge #1 was located in strong back eddy during peak flows
Gauge #2 placed 300 feet below bridge is more reliable for the higher flows

Cont'd on next page

TABLE 6. cont'd

RED RIVER
GAUGE READINGS THROUGH GREATER WINNIPEG
1950

DATE	FT. CARRY OFF MCEP. HALL	ELM PARK BRIDGE		NORWOOD BRIDGE		PROVENCER BRIDGE		C.N.R. BRIDGE		JAMESAVE. P. STN.		C.P.R. BRIDGE		LOUISE BRIDGE		REDWOOD BRIDGE		NORTH CITY LIMITS
		Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	
May 18	8 am	35.51	33.47	31.14	30.74	30.95	30.28	30.15	29.74	30.25	29.30	29.24	28.70	28.58	28.10	28.05	26.97	
	12 n.	35.49	33.38	31.14	30.72	30.94	30.28	30.17	29.71	30.25	29.30	29.26	28.70	28.58	28.10	28.05	26.98	
	4 pm	35.56	33.40	31.16	30.76		30.30	30.18	29.74	30.30	29.33	29.28	28.75	28.63	28.13	28.08	26.99	
19	8 am	35.53	33.36	31.15	30.75	30.94	30.25	29.80	29.74	30.30	29.37	29.27	28.75	28.64	28.17	28.08	26.97	
	12 n.	35.49	33.40	31.17	30.74	30.94	30.25	30.32	29.74	30.30	29.35	29.29	28.73	28.62	28.13	28.10	27.00	
	4 pm	35.46	33.33	31.15	30.72	30.93	30.29	30.18	29.72	30.30	29.33	29.27	28.72	28.62	28.12	28.08	26.99	
20	8 am	35.43	33.30	31.11	30.70	30.85	30.25	29.77	29.71	30.25	29.28	29.27	28.70	28.58	28.13	28.05	26.96	
	12 n.	35.45	33.29	31.21	30.70	30.80	30.24	30.13	29.69	30.20	29.30	29.23	28.68	28.57	28.09	28.00	26.95	
	4 pm	35.46	33.43	31.22	30.69	30.81	30.24	30.12	29.69	30.20	29.28	29.23	28.68	28.57	28.09	28.00	26.95	
21	8 am	35.42	33.30	31.24	30.65	30.84	30.24	29.77	29.33	30.20	29.28	29.25	28.70	28.58	28.08	28.05	26.95	
	12 n.	35.41	33.27	31.21	30.69	30.81	30.21	30.11	29.67	30.20	29.28	29.20	28.64	28.59	28.09	28.02	26.89	
	4 pm	35.41	33.34	31.19	30.66	30.78	30.20	30.06	29.65	30.15	29.29	29.21	28.66	28.58	28.07	28.02	26.91	
22	8 am	35.29	33.28	31.11	30.60	30.84	30.20	29.65	29.20	30.15	29.24	29.12	28.64	28.52	28.00	27.95	26.86	
	12 n.	35.27	33.25	31.07	30.53	30.67	30.11	29.97	29.55	30.05	29.20	29.12	28.57	28.49	28.03	27.99	26.82	
	4 pm	35.24	33.23	30.95	30.51	30.60	30.08	29.95	29.52	30.05	29.12	29.05	28.51	28.44	27.96	27.90	26.79	
23	8 am	35.10	33.09	30.89	30.42	30.63	30.04	29.46	29.04	30.00	29.05	28.93	28.42	28.32	27.89	27.80	26.68	
	12 n.	35.05	33.02	30.76	30.30	30.40	29.84	29.70	29.28	29.80	28.95	28.83	28.31	28.24	27.72	27.70	26.60	
	4 pm	34.96	32.94	30.70	30.25	30.37	29.80	29.65	29.23	29.75	28.92	28.80	28.28	28.21	27.69	27.67	26.55	
24	8 am	34.65	32.76	30.59	30.10	29.85	29.32	29.16	28.70	29.60	28.60	28.60	28.12	28.01	27.54	27.50	26.44	
	12 n.	34.55	32.55	30.36	29.93	30.06	29.48	29.34	28.90	29.40	28.60	28.58	27.96	27.90	27.43	27.41	26.26	
	4 pm	34.55	32.44	30.31	29.87	30.00	29.44	29.26	28.83	29.35	28.56	28.55	27.89	27.81	27.34	27.32	26.19	
25	8 am	34.11	32.00	30.02	29.62	29.88	29.19	29.01	28.60	29.10	28.20	28.19	27.60	27.56	27.07	27.07	25.93	
	12 n.	34.11	31.91	29.85	29.44	29.55	29.02	28.83	28.40	28.95	28.40	28.39	27.49	27.38	26.91	26.89	25.75	
	4 pm	34.11	31.85	29.71	29.30	29.41	28.86	28.67	28.25	28.75	27.86	27.83	27.32	27.23	26.85	26.81	25.63	
26	8 am	33.77	31.72	29.56	29.13	29.10	28.64	28.53	28.09	28.65	27.68	27.68	27.19	27.05	26.70	26.58	25.46	
	12 n.	33.58	31.50	29.32	28.95	29.05	28.42	28.32	27.90	28.40	27.52	27.51	27.00	26.90	26.44	26.44	25.30	
	4 pm	33.58	31.37	29.15	28.80	28.89	28.30	28.17	27.75	28.30	27.37	27.34	26.86	26.74	26.34	26.28	25.11	
27	8 am	33.10	31.15	28.98	28.60	28.89	28.09	27.98	27.55	28.10	27.25	27.20	26.70	26.58	26.15	26.10	24.96	
	12 n.	33.10	30.84	28.65	28.30	28.40	27.82	27.76	27.29	27.85	26.92	26.91	26.44	26.35	25.96	25.91	24.74	
	4 pm	32.83	30.60	28.50	28.15	28.26	28.12	27.51	27.06	27.65	26.78	26.78	26.28	26.20	25.80	25.74	24.55	
12 mid		30.30	28.26	27.95		27.94	27.45	27.38	26.86	27.45	26.58	26.61	26.08	26.01	25.55	24.35		

Cont'd on next page

TABLE 6 cont'd

RED RIVER
GAUGE READINGS THROUGH CHEAVER WINNIPEG
1950

Date	FT. GARRY OFF. MCPL. HALL		KIM PARK BRIDGE		NORWOOD BRIDGE		PROVENCER BRIDGE		C.N.R. BRIDGE		JAMES AVE. P. STN.		C.P.R. BRIDGE		LOUISE BRIDGE		REDWOOD BRIDGE		NORTH CITY LIMITS
	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	Upstr.	Dnstr.	
May 28 8 am	32.22	30.00	27.99	27.65	27.84	27.26	27.70	26.62	27.15	26.37	26.37	25.83	25.77	25.35	25.31	24.14			
4 pm	32.05	29.74	27.71	27.45	27.61	26.94	27.49	26.48	26.95	26.16	26.16	25.64	25.55	25.15	25.11	23.95			
12 mid		29.47	27.50	27.25		26.74	26.24	26.50	26.70	26.00	25.96	25.42	25.36	24.95		23.73			
29 8 am	31.53	29.33	27.21	26.77	27.08	26.49	26.96	26.64	26.40	25.71	25.70	25.20	25.10	24.75	24.70	23.53			
8 pm		28.94	26.93			26.17	26.64	25.90	26.10	25.38	25.41	24.88	24.82	24.32	24.32	23.21			
30 8 am	30.75	28.48	26.54	26.37	26.45	25.80	26.34	25.80	25.85	25.19	25.18	24.59	24.52	24.04	24.01	22.95			
8 pm		28.18	26.27	26.12		25.58	26.00	25.50	24.85	24.85	24.88	24.29	24.20	23.73	23.70	22.73			
31 8 am	30.06	27.84	25.90	25.73	25.79	25.42	26.00	25.50	25.20	24.47	24.47	24.00	23.92	23.44	23.41	22.46			
8 pm		27.50	25.60	25.50		25.25	25.42	24.90	25.00	24.28	24.47	23.65	23.55	23.18	23.16	22.02			
June 1 8 am	29.38	27.05	25.29	25.13	25.18		24.80		24.60	23.91	23.90	23.36	23.26	22.85	22.85	21.95			
8 pm		26.87	25.05	24.93		24.55	24.80	24.27	24.35	23.65	23.65	23.10	23.00	22.60	22.58	21.81			
2 8 am		26.60	24.70	24.38	24.26		24.41	23.98	24.00	23.36	23.35	22.71	22.69	22.30	22.29	21.50			
8 pm		26.20	26.00	24.38	24.26	24.05	24.15	23.65	23.70	23.03	23.05	22.45	22.38	22.05	22.05	21.25			
3 8 am	27.88	25.90	24.02	23.87	23.93	23.25	23.40	23.33	23.35	22.73	22.73	22.14	22.06	21.73	21.70	20.93			
8 pm		25.51	23.68	23.58		22.78	23.10	22.66	23.05	22.38	22.34	21.54	21.44	21.10	21.05	20.31			
4 8 am	27.00	25.20	23.33	23.20		22.45	22.78	22.35	22.40	22.05	22.02	21.22	21.15	20.84	20.72	20.00			
8 pm		24.80	23.00	22.90		22.05	22.37	22.05	22.00	21.72	21.72	21.22	21.15	20.84	20.72	20.00			
5 8 am	26.30	24.40	22.29	22.53		21.71	22.00	21.94	22.00	21.40	21.39	20.90	20.80	20.46	20.38	19.70			
8 pm		23.98	22.25	22.14		21.28	22.00	21.62	21.60	21.40	21.40	20.48	20.43	20.10	20.00	19.38			
6 8 am	25.43	23.57	21.83	21.70		21.18	21.60	21.20	21.20	20.64	20.62	20.14	20.05	19.78	19.70	19.00			
8 pm		23.10	21.40	21.28		20.74	21.60	21.20	21.20	20.64	20.62	20.14	20.05	19.78	19.70	19.00			
7 8 am	24.42	22.53	20.95	20.84		20.43	21.18	20.80	20.90	20.20	20.20	19.75	19.66	19.36	19.36	18.60			
8 pm		22.44	20.95	20.84		20.74	21.18	20.80	20.90	20.20	20.20	19.75	19.66	19.36	19.36	18.60			
8 8 am		21.68	20.10	20.00		19.85	20.29	19.90	20.40	19.77	19.74	19.30	19.24	18.98	18.90	18.20			
8 pm		22.20	20.57	20.44		19.55	20.29	19.90	20.05	19.38	19.35	18.92	18.88	18.60	18.52	17.80			
9 8 am	22.48	21.30	19.74	19.57		19.16	19.48	19.10	19.60	18.92	18.89	18.49	18.41	18.16	18.09	17.40			
8 pm		21.30	19.74	19.57		19.03	19.48	19.10	18.80	18.11	18.10	17.84	17.75	17.43	17.37	16.69			
10 8 am	21.60	20.40	19.25	19.12		18.71	18.71	18.33	18.50	17.75	17.78	17.45	17.28	17.05	16.99	16.34			
8 pm		19.89	18.82	18.77	18.32	18.22	18.71	18.33	18.50	17.75	17.78	17.45	17.28	17.05	16.99	16.34			
11 8 am			18.47	18.32		17.90	18.22	17.88	18.00	17.34	17.32	17.00	16.90	16.64	16.50	15.91			
12 8 am	19.57	18.18					16.57		16.50	15.77				15.23		14.51			
13 am	18.70	17.42	16.34				15.98		15.80	15.26				14.68		13.92			
14 am	18.11	16.63	15.40				15.19		15.00	14.54				13.88		13.22			
15 am	17.49	15.86	14.68				14.51		14.30	13.90				13.06		12.65			
16 am	16.63	15.09	14.05				13.80		13.50	13.27				12.40		12.04			
20 am		12.36					11.18		11.04	10.56				10.35		10.07			
23 am		10.78					9.75		9.62	9.14				8.96		8.66			
27 am		9.12					8.18		8.15	7.79				7.66		7.36			
30 am		8.90					7.98		7.92	7.60				7.50		7.20			
July 4 am							9.43		9.41	8.98				8.87		8.57			
									9.4	8.98				8.87		8.57			

TABLE 7
 ASSINIBOINE RIVER
 Gauge Readings Through Greater Winnipeg
 1950

DATE		St. Charles Country Club	Conway Street	St. James Bridge	Main Street Bridge	
Day	Time				Upstr.	Dnstr.
May 9	8 am				28.96	28.97
	12 n.				29.05	29.05
	4 pm				29.17	29.17
May 10	12 mid			29.86	29.38	29.30
	8 am			30.09	29.63	29.64
	12 n.			30.17	29.74	29.74
May 11	4 pm			30.24	29.83	29.83
	12 mid			30.33	29.91	29.91
	8 am			30.48	30.10	30.10
May 12	12 n.			30.55	30.16	30.16
	4 pm			30.64	30.24	30.23
	12 mid			30.74	30.38	30.32
May 13	8 am			30.87	30.49	30.50
	12 n.			30.92	30.53	30.53
	4 pm			30.97	30.60	30.60
May 14	12 mid			31.06	30.72	30.72
	8 am			31.12	30.76	30.76
	12 n.			31.15	30.79	30.80
May 15	4 pm			31.17	30.84	30.84
	12 mid			31.24	30.88	30.88
	8 am			31.18	30.85	30.84
May 16	12 n.			31.16	30.85	30.84
	4 pm			31.24	30.88	30.88
	12 mid			31.08	30.76	30.76
May 17	8 am			31.10	30.76	30.78
	12 n.			31.11	30.77	30.79
	4 pm			31.14	30.79	30.81
May 18	12 mid			31.16	30.88	30.88
	8 am			31.17	30.82	30.80
	12 n.			31.18	30.83	30.84
May 19	4 pm			31.18	30.86	30.86
	12 mid			31.18	30.86	30.87
	8 am			31.15	30.90	30.89
May 20	12 n.			31.21	30.88	30.86
	4 pm			31.21	30.87	30.86
	12 mid			31.20	30.87	30.88
May 21	8 am			31.20	30.90	30.92
	12 n.			31.19	30.91	30.90
	4 pm			31.20	30.91	30.91
May 22	12 mid			31.16	30.90	30.90
	8 am			31.17	30.90	30.95
	12 n.			31.16	30.90	30.91
May 23	4 pm			31.17	30.90	30.91
	12 mid			31.14	30.90	30.89
	8 am			31.12	30.86	30.87
May 24	12 n.			31.11	30.86	30.88
	4 pm			31.10	30.89	30.87
	12 mid			31.10	30.88	30.86
May 25	8 am			31.10	30.83	30.84
	12 n.			31.07	30.89	30.88
	4 pm			31.05	30.88	30.84
May 26	12 mid			31.04	30.85	30.79
	8 am			31.27	30.97	30.97
	12 n.			31.16	30.71	30.70
May 27	4 pm			31.11	30.69	30.67
	12 mid			31.11	30.69	30.67
	8 am			31.09	30.68	30.64
May 28	12 n.			31.09	30.62	30.56
	4 pm			31.09	30.62	30.62
	12 mid			31.09	30.62	30.56

Note: All elevations to City Datum: Add 727.57 for G.S.C. Datum, 1929 adjustment

TABLE 8

DAILY PRECIPITATION

WINNIPEG AND EMERSON

October 1949

DATE	WINNIPEG			EMERSON		
	Daily	Total April 1	Normal April 1	Daily	Total April 1	Normal April 1
Oct. 1						
2	.09	10.68	14.40	T	10.62	12.10
3		10.68	14.46		10.62	12.16
4		10.68	14.52		10.62	12.22
5	T	10.68	14.58		10.62	12.28
6	T	10.68	14.63		10.62	12.33
7		10.68	14.69		10.62	12.39
8						
9	.45					
10	2.93	14.06	14.85	2.86	13.48	12.54
11	T	14.06	14.91		13.48	12.59
12		14.06	14.96		13.48	12.64
13	T	14.06	15.01		13.48	12.69
14		14.06	15.06		13.48	12.74
15						
16		14.06	15.15		13.48	12.84
17	.05	14.11	15.20	.16	13.64	12.89
18	1.13	15.24	15.25	.60	14.24	12.94
19	.01	15.25	15.29	T	14.24	12.99
20	.53	15.78	15.33		14.24	13.04
21	.01	15.79	15.38	T	14.24	13.09
22	.02					
23	T	15.81	15.46		14.24	13.18
24	.10	15.91	15.50	T	14.24	13.22
25	T	15.91	15.54		14.24	13.27
26		15.91	15.58		14.24	13.32
27		15.91	15.62		14.24	13.36
28	.13	16.04	15.66		14.24	13.40
29	.20					
30	T	16.24	15.73	.16	14.40	13.49
31	.02	16.26	15.76		14.40	13.53

TABLE 9
PRECIPITATION

RED RIVER BASIN

NORTH DAKOTA

1950

Precipitation after snow survey (13-22 March 1950) to 12 May 1950
at selected stations in Red River basin of North Dakota

Date	Cava- lier	Devils Lake	Fargo	Forman	Grand Forks C.A.A.	Hills- boro	Maddock	Minot	Park River	Pem- bina	Sharon	Valley City
March												
15												
16				T							.12	T
17				.04			.07	T				
18												
19								T				
20					.06	T	.05		T	.02		
21	.10	T	.07	.11	.04	.15	.06		.03	.01	.05	.05
22												
23		.09	.02	T		T	.24	T			.04	.17
24		T	.01	.12		.22	.17	.01				.09
25		T	.05	.27	.01	T		.03				T
26	.22	.24	1.07	.21	.24	1.03	.21	.69	.28	.19	.60	.80
27	1.13	.12	.20	.08	.16	.17		1.07	.61	.12	1.30	.36
28	T		.01	.04	T			.05	.03			
29								T				
30		T						T				
31	.15	.07	.09		.18	.42		.05	.35	.03	.08	
April 1-30	2.19	1.87	1.79	.73	1.73	1.77	1.47	3.36	1.30	1.08	1.60	1.07
May												
1		.03	.05		.08			.03	T	.03		
2		T	.15		T			T				
3		.67	.70		.52			.55	.36	.40		
4		.04	T		T			.25				
5		.27	.14		.44			.23	1.31	1.41		
6		1.18	.88		1.00			.48	.92	1.59		
7		.01	.17		.04			.08		T		
8			T					T				
9		.20	1.17		.32			.53	.25	.26		
10		.06			.04			T	.13	.36		
11												
12			T		T					T		
Totals		4.85	6.57		4.86			7.41	5.57	5.50		

Notes: Homme Dam substituted for Park River 1-12 May
Records for May are not yet available in this office for stations which have
no total figures.

TABLE 10
 PRECIPITATION
 RED RIVER BASIN
 MINNESOTA

1950

Precipitation after snow survey (13-22 March 1950) to 12 May 1950
 at selected stations in Red River Basin of Minnesota

Date	Ada	Argyle	Campbell	Crookston	Detroit Lakes	Fergus Falls	Fosston	Hallock	Red Lake Falls	Red L. Indian Agency	Roseau	Wheaton
March												
15										.02		
16											.17	
17										.27	T	
18												
19												
20												
21		.07	.27	.12		.13	.16		.13		.07	T
22				T	.05					.13		
23			1.07		.03							
24						.12			.01			.25
25			.28									
26	.91			.56	.08	.61	.08	.04	.10		T	.45
27		1.45	.47	.45	1.26	.25	.06	.79	.35	.76	.26	.35
28		.09	.93		.29			T		.65	T	.41
29												
30	.20					.25						
31				.47		.21	.18		.35		T	
April												
1-30	1.96	2.25	1.94	2.30	1.79	1.70	1.49	1.41	1.61	2.29	0.96	1.67
May												
1				.02	T							
2			.18		.04							
3			.68	.75	.32							
4				.19	T							
5			.18	.20	.23							
6			.66	1.07	.36							
7												
8			T									
9			1.09	.62	.63							
10			T	.06	.03							
11												
12												
Totals			7.75	6.81	5.11							

Notes: Twin Valley substituted for missing record at Ada for April
 Records for May are not yet available in this office for stations which have no total figures

TABLE 11

PRECIPITATION

RED RIVER BASIN

MANITOBA

1950

Period	Boissevain		Ninette		Graysville		Morden		Altona		Morris		Sprague		Emerson		Winnipeg	
	Act.	Nor.	Act.	Nor.	Act.	Nor.	Act.	Nor.	Act.	Nor.	Act.	Nor.	Act.	Nor.	Act.	Nor.	Act.	Nor.
Apr. 1-10	.04	.44	.68	.38	.40	.18	1.15	.31	.48	.32	.27	.52	.29	.80	.12	.67	.37	
11-17	T	.36	.01	.32	Nil	.17	Nil	.30	Nil	.26	.21	.14	.25	Nil	.12	Nil	.30	
18-24	T	.39	.22	.38	.20	.19	.06	.33	.04	.32	Nil	.06	.33	T	.13	.11	.33	
25-May 1	1.32	.39	1.24	.43	1.10	.29	1.02	.34	.84	.36	Nil	.42	.37	.40	.12	.93	.34	
2-8	2.27	.35	1.58	.42	2.12	.39	2.92	.37	2.28	.38	.35	1.06	.42	1.90	.30	2.31	.41	
9-15	1.08	.35	.66	.44	.70	.47	.56	.43	.44	.44	.35	.68	.46	.46	.48	1.18	.43	
16-22	.92	.41	1.22	.48	1.50	.56	1.40	.45	.47	.47	.42	1.44	.52	.62	.53	.66	.50	
23-29	Nil	.47	T	.51	Nil	.63	.01	.48	.06	.50	.45	Nil	.56	T	.60	.03	.58	
30-June 5	Nil	.53	Nil	.61	.04	.71	.16	.58	.48	.56	.62	.56	.63	.48	.66	.50	.65	
Totals	5.63	3.69	5.61	3.97	6.06	3.59	7.28	3.59	4.62	3.61	3.32	4.88	3.83	4.66	3.06	6.39	3.91	

TABLE 12

DAILY PRECIPITATION

WINNIPEG AND EMERSON

From April 1 to June 9, 1950

DATE	WINNIPEG			EMERSON			DATE	WINNIPEG			EMERSON		
	Daily	Total Apr.1	Normal Apr.1	Daily	Total Apr.1	Normal Apr.1		Daily	Total Apr.1	Normal Apr.1	Daily	Total Apr.1	Normal Apr.1
April													
1							7		4.02	1.75		3.10	.79
2	.37	.37	.08	.40	.40	.02	8	.47	4.49	1.81	.12	3.22	.85
3		.37	.12		.40	.04	9	.50	4.99	1.86	.34	3.56	.92
4		.37	.16		.40	.05	10		4.99	1.92		3.56	.99
5		.37	.21		.40	.07	11	.07	5.06	1.99		3.56	1.06
6							12	.04	5.10	2.05		3.56	1.13
7							13						
8							14	.10	5.20	2.18		3.56	1.27
9							15		5.20	2.25		3.56	1.33
10	.30	.67	.42	.40	.80	.13	16	.07	5.27	2.32	.12	3.68	1.40
11		.67	.46		.80	.15	17		5.27	2.39		3.68	1.48
12		.67	.50		.80	.17	18	.37	5.64	2.46	.30	3.98	1.56
13		.67	.54		.80	.19	19	.12	5.76	2.53	.20	4.18	1.64
14		.67	.58		.80	.21	20						
15							21	.10	5.86	2.68		4.18	1.80
16		.67	.67		.80	.24	22		5.86	2.76		4.18	1.88
17		.67	.71		.80	.26	23						
18	.11	.78	.76		.80	.28	24	.03	5.89	2.91		4.18	2.05
19		.78	.81		.80	.30	25		5.89	2.99		4.18	2.14
20		.78	.86		.80	.32	26						
21		.78	.90		.80	.33	27						
22							28		5.89	3.26		4.18	2.40
23		.78	1.00		.80	.37	29	.35	6.24	3.35	.36	4.54	2.50
24	.18	.96	1.05	.30	1.10	.38	30	.06	6.30	3.44		4.54	2.60
25	.29	1.25	1.10		1.10	.40	31	.03	6.33	3.53		4.54	2.70
26	.04	1.29	1.15		1.10	.41							
27		1.29	1.20		1.10	.43	June						
28		1.29	1.24		1.10	.45	1	.01	6.34	3.62		4.54	2.79
29							2	.05	6.39	3.72		4.54	2.88
30	.42	1.71	1.34	.10	1.20	.49	3						
May							4						
1		1.71	1.40		1.20	.52	5		6.39	4.01		4.54	3.15
2	.21	1.92	1.46		1.20	.55	6		6.39	4.11		4.66	3.24
3		1.92	1.52		1.20	.59	7	.08	6.47	4.21		4.66	3.34
4	.74	2.66	1.58	.86	2.06	.64	8	.03	6.50	4.31		4.66	3.43
5	1.36	4.02	1.63	1.04	3.10	.69	9	.16	6.66	4.42		4.66	3.53
6													

TABLE 13

MISCELLANEOUS DISCHARGE MEASUREMENTS

RED RIVER BASIN IN MANITOBA

1950.

Stream	Location	Date	Sectional Area Sq. Ft.	Velocity Ft./sec.	Discharge c.f.s.	Gauge Reading Feet
Red River	Redwood Bridge	May 8	16,770	5.27	88,400	753.47
		May 10	17,500	5.51	96,500	754.67
		May 12	18,000	5.59	100,800	755.50
		May 18	18,200	5.71	103,900	755.77
		May 25	17,200	5.56	95,900	754.55
		May 29	16,300	5.20	84,600	752.27
		June 6	13,600	4.51	61,400	747.26
		June 9	12,590	4.17	52,500	744.97
		June 13	11,100	3.67	40,800	742.17
June 21	8,930	2.79	24,900	737.61		
Red River	Elm Park Bridge	Apr. 24	13,600	3.69	50,900	750.50
		May 1	14,600	4.36	63,500	752.74
		May 4	15,600	4.52	70,500	752.78
		June 30	6,610	1.82	12,100	736.47
Red River	Ste. Agathe about 100 ft. below Ferry	June 9	11,820	3.54	41,800	761.53
		June 28	4,430	2.60	11,530	744.16
Red River	St. Andrews Locks	May 19	2,220	3.31	7,360	
Saw River	C.P.R. Bridge La Salle	May 8	4,040	1.20	4,830	766.46
		May 11	4,380	1.16	5,080	767.65

TABLE 14

RED RIVER

Gauge Readings - 1950

Wahpeton - Winnipeg

DATE	WAHPETON	FARGO	GRAND FORKS	EMERSON	LETELLIER	ST. JEAN	MORRIS	STE. AGATHE	ST. NORBERT	* WINNIPEG
Apr. 14	6.07	884.07	814.16	768.47						736.67
15		882.90	814.58	769.19						736.67
16	6.40	882.88	815.75	770.03						736.87
17	7.01	883.99	817.35	770.99			759.8			737.87
18	6.65	883.84	819.74	772.69			764.7			738.47
19	6.41	883.25	821.22	774.64	772.2	768.5	767.4		749.1	740.97
20	6.07	881.68	822.10	776.44	773.8	769.3	768.3	760.2	749.2	743.07
21	6.00	879.59	822.50	778.84	775.7	770.2	768.5	760.0	751.3	746.17
22	5.34	878.11	822.50	782.49	778.2	770.9	769.2	760.7	752.7	747.37
23	4.79	877.18	822.46	785.29	781.1	772.6	770.3	761.8	753.7	748.07
24	4.85	876.43	823.15	787.04	782.2	774.6	771.9	762.31	754.7	748.97
25	4.73	875.30	823.43	787.99	783.3	775.8	773.0	764.0	755.7	748.97
26	5.18	875.59	822.97	788.54	783.9	776.8	773.8	764.6	755.7	748.77
27	4.70	875.39	822.07	788.94		777.7	774.6	765.2	755.7	748.87
28	4.70	875.39	820.70	789.32		778.2	774.9	766.1	756.4	749.27
29	5.10	875.24	819.08	789.50		779.0	775.8	767.1	757.4	749.77
30	5.14	875.11	817.50	789.59		779.4	776.6	767.7	757.7	750.27
May 1	4.59	875.31	816.30	789.58		779.8	777.2	768.6	758.5	750.87
2		875.44	815.40	789.44		779.8	777.9	769.3	759.4	751.27
3	5.71	876.14	815.30	789.29		780.0	778.4	770.1	759.7	751.67
4	7.08	876.59	815.90	789.13		780.1	778.8	770.5	759.7	752.07
5	7.16	877.32	817.55	789.11		780.25	779.2	770.9	761.2	752.47
6	7.75	881.17	819.86	789.01		780.55	779.7	771.65	762.2	753.87
7	9.39	882.93	822.15	789.29			780.34	772.19	763.0	754.67
8	9.44	883.82	824.06	789.57			780.84	772.4	764.0	755.27
9	10.37	886.49	824.86	789.79		781.05	781.21	772.75	764.6	755.87
10	11.86	888.01	825.13	789.94			781.46		765.1	756.57
11	11.04	888.63	825.24	790.29			781.58		765.4	756.97
12	9.28	888.98	825.29	790.59			781.6		765.6	757.37
13	7.81	889.04	825.25	790.81			781.66			757.62
14	6.91	888.52	825.00	790.82			781.74			757.77
15		887.19	824.65	790.69			781.7		765.6	757.67
16	6.53	885.22	824.20	790.74			781.62			757.67
17	6.35	883.22	823.67	790.67			781.6			757.77
18	6.40	881.23	823.10	790.54			781.27			757.82
19	6.44	879.59	822.40	790.40			781.42			757.87
20	6.70	880.27	821.66	790.19			781.32			757.77
21		880.27	820.93	789.94			781.15			757.77
22	7.03	880.27	820.46	789.69			781.0			757.62
23	6.75	880.59	820.12	789.39			780.96			757.42
24	6.62	880.78	819.52	788.99			780.79			756.97
25	6.46	881.07	818.65	788.69			780.58			756.52
26	6.38	879.52	817.70	788.48			780.25			755.97
27	6.47	879.08	816.70	788.19			779.9			755.42
28	6.39	878.48	815.63	787.84			779.57			754.72
29		878.37	814.60	787.54			779.3			753.97
30		878.09	813.50	787.24			779.01			753.42
31	6.28	877.84	812.35	786.84			778.51			752.77
June 1	6.38	877.59	811.16	786.49			778.09	770.2		752.17
2	6.78	877.46	810.07	786.07			777.38	769.2		751.57
3	7.18	877.39	808.91	785.62			776.8			750.92
4	7.26	877.59	807.67	785.16			775.85			750.27
5	7.36	877.98	806.76	784.56			774.9	766.35		749.47
6	7.36	878.18	805.85	783.94		775.20	773.7	765.2	757.4	748.77
7	7.42	878.34	805.04	783.14			772.3	764.1	756.2	747.87
8	7.36	878.33	804.37	782.31			771.2	762.7	754.2	747.17
9	7.34	878.41	803.64	781.29			772.0	769.8	753.2	746.37
10		878.26	802.97	780.14			770.7	768.5	752.1	745.57
11	7.38	878.22	802.20	778.89			769.4	767.1	751.0	744.77
12	7.40	878.00	801.60	777.52			768.3	765.8	750.1	743.97
13	7.48	878.24	801.60	776.14					749.1	743.27
14	7.48	878.43	800.23	774.64			763.3	755.8	748.1	742.57
15	6.36	878.35	799.73	773.09			762.1	754.6	747.2	741.87
16	6.24	877.52	799.50	771.59			760.7	753.4	746.2	741.17
17	6.22	876.96	799.24	770.09			759.4		745.2	740.57

Note: All readings taken at 8:00 a.m.

Gauge Datum:

Wahpeton: - station datum

* - Readings at James Avenue Pumping Station.

Fargo, Grand Forks: U.S.C. & G.S. 1929 Adj.
Emerson to Winnipeg: G.S. org. 1929 Adj.
(established 1950)

TABLE 15

ASSINIBOINE RIVER
Gauge Readings
1950

Date	Brandon	Portage	Headingley	Winnipeg James Ave.	Date	Brandon	Portage	Headingley	Winnipeg James Ave.
April 14	1165.15	853.03	762.36	736.67	May 17	1166.51	850.68	765.52	757.77
15	1165.38	853.43	762.30	736.67	18	1166.51	850.53	765.00	757.82
16	1165.38	854.03	762.47	736.87	19	1166.62	850.48	764.72	757.87
17	1165.78	854.48	763.06	737.87	20	1167.25	850.43	764.60	757.77
18	1165.47	854.48	764.20	738.47	21	1167.34	850.48	764.46	757.77
19	1165.60	854.13	764.80	740.97	22	1167.45	850.43	764.38	757.62
20	1165.88	853.43	764.67	743.07	23	1167.06	850.73	764.30	757.42
21	1166.18	850.33	765.62	746.17	24	1166.95	850.88	764.30	756.97
22	1167.00	849.08	764.60	747.37	25	1167.10	850.88	764.36	756.52
23	1168.60	849.54	765.18	748.07	26	1167.15	850.68	764.36	755.97
24	1167.90	849.33	766.05	748.97	27	1166.92	850.63	764.25	755.42
25	1167.65	849.63	763.90	748.97	28	1166.56	850.53	764.06	754.72
26	1167.45	850.33	763.36	748.77	29	1166.34	850.48	763.95	753.97
27	1167.33	850.33	763.52	748.87	30	1166.24	850.43	763.92	753.42
28	1167.15	850.03	763.10	749.27	31	1166.00	850.33	763.88	752.77
29	1167.13	849.83	763.95	749.77					
30	1167.12	849.83	763.69	750.27	June 1	1165.76	850.13	763.76	752.17
May 1	1167.05	849.63	763.62	750.87	2	1165.60	850.03	763.58	751.57
2	1167.00	849.63	763.60	751.27	3	1165.35	849.93	763.44	750.92
3	1167.09	849.63	763.60	751.67	4	1165.20	849.63	763.32	750.27
4	1167.17	849.63	763.55	752.07	5	1164.92	849.53	763.18	749.18
5	1167.22	849.88	763.65	752.47	6	1164.91	849.43	763.04	748.77
6	1167.25	850.23	765.25	753.87	7	1164.77	849.33	762.90	747.87
7	1167.09	850.43	765.00	754.67	8	1164.74	849.23	762.82	747.17
8	1167.17	850.63	764.94	755.27	9	1165.15	849.13	762.72	746.37
9	1166.97	850.63	765.35	755.87	10	1165.11	849.13	762.60	745.57
10	1166.76	851.03	765.82	756.57	11	1165.20	849.23	762.52	744.77
11	1166.74	851.03	765.65	756.97	12	1165.32	849.33	762.55	743.97
12	1166.64	851.23	765.75	757.37	13	1165.60	849.23	762.63	743.27
13	1166.66	851.28	765.82	757.62	14	1165.53	849.23	762.66	742.57
14		852.03	765.62	757.77	15	1165.40	849.33	762.58	741.87
15	1166.63	851.53	765.72	757.67	16	1166.10	849.53	762.64	741.17
16	1166.57	851.03	765.82	757.67	17	1165.92	849.53	762.74	740.57

Note: All Readings Taken At 8.00 a.m.

TABLE 17

RED RIVER AT WINNIPEG, MAN.

Location: Redwood Bridge.Drainage Area: 111,000 square miles.Gauge: Chain or staff.Discharge Record: Stage-discharge relationship defined by current meter measurements made in 1922 and 1950.Datum: Geodetic Survey of Canada, 1929 adjustment.Remarks: Stage-discharge relationship affected by closing the gates of St. Andrews Dam and Locks.

Gauge height in feet, and discharge in second-feet.

DAY	APRIL		MAY		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
1			749.03	69,120	750.47	75,750
2			749.51	71,340	749.92	73,200
3			749.90	73,100	749.34	70,560
4			750.37	75,280		68,000
5			750.81	77,350		65,000
6			752.22	84,100	747.33	61,720
7	732.15		752.94	87,600	746.47	58,180
8	732.74		753.50	90,400	745.74	55,260
9	733.38		754.09	93,350	745.01	52,240
10	734.25		754.65	96,350	744.29	49,360
11	735.05		755.07	98,720		
12	735.76		755.47	101,120	742.69	42,960
13	735.87		755.67	102,420	742.17	40,880
14	735.94		755.81	103,260	741.45	38,250
15	735.75		755.67	102,420	740.67	35,380
16	736.05		755.71	102,660	740.22	33,760
17	736.94		755.77	103,020	739.60	31,600
18	737.18		755.77	103,020		
19	739.47		755.84	103,440	738.46	27,680
20	741.55	38,600	755.77	103,020	737.92	25,780
21	744.15	48,800	755.72	102,720		
22	745.57	54,580	755.65	102,300		
23	746.58	58,700	755.42	100,820		
24	747.34	61,760		98,500		
25	747.27	61,480	754.59	96,050		
26	747.17	61,080	753.79	91,850		
27	747.32	61,680	753.47	90,250		
28	747.82	63,800	752.72	86,500		
29	748.22	65,500	752.30	84,500		
30	748.72	67,700	751.69	81,560		
31			751.12	78,880		

TABLE 18

RED RIVER AT EMERSON, MAN.Location: Canadian National Railway BridgeDrainage Area: 40,200 square miles.Gauge: Chain or staff.Discharge Record: Stage-discharge relationship defined by current meter measurements.Datum: Geodetic Survey of Canada, 1929 adjustment.Remarks: International Gauging Station

Gauge height in feet, and discharge in second-feet at mid-day.

DAY	APRIL		May		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
1	751.24	1,560	789.59	72,900	786.42	42,900
2	751.84	1,840	789.43	70,600	785.99	40,500
3	753.49	2,760	789.25	68,300	785.54	38,600
4	755.42	4,060	789.11	66,500	785.09	37,200
5	757.42	5,470	789.11	66,500	784.49	35,900
6	759.24	6,820	788.99	65,100	783.84	34,600
7	760.79	8,050	789.34	69,400	783.12	33,400
8	762.09	9,110	789.60	73,000	782.20	32,000
9	763.39	10,200	789.84	76,600	781.12	30,500
10	764.64	11,400	790.01	79,300	779.94	28,900
11	765.74	12,500	790.41	85,900		
12	766.81	13,600	790.64	90,200		
13	767.79	14,700	790.84	94,400		
14	768.61	15,800	790.84	94,400		
15	769.34	16,800	790.69	91,200		
16	770.12	17,900	790.74	92,200		
17	771.07	19,000	790.65	90,400		
18	772.94	21,500	790.51	87,700		
19	774.89	23,900	790.34	84,600		
20	776.59	26,500	790.14	81,300		
21	779.24	30,300	789.84	76,600		
22	782.99	36,100	789.61	73,200		
23	785.54	41,600	789.32	69,200		
24	787.19	48,100	788.89	64,000		
25	788.09	55,900	788.64	61,300		
26	788.61	61,000	788.44	59,300		
27	788.99	65,100	788.14	56,400		
28	789.35	69,680	787.81	53,400		
29	789.52	71,900	787.49	50,500		
30	789.61	73,200	787.19	48,100		
31			786.77	45,000		

TABLE 19

ROSEAU RIVER NEAR DOMINION CITY, MAN.

Location: Langside Traffic Bridge, 8 miles northeast of
Dominion City.

Drainage Area: 1900 square miles

Gauge: Chain

Discharge Record: Stage-discharge relationship defined by
current meter measurements.

Datum: Geodetic Survey of Canada, 1923 adjustment.

Gauge height in feet, and discharge in second-feet.

DAY	APRIL		MAY		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
1		23	792.45	2780	792.80	2950
2		23	793.26	3210	792.63	2860
3		23	794.16	3930	792.39	2750
4		24	794.91	4800	792.25	2690
5		25	796.12	6680	792.04	2600
6		26	796.82	8110	791.89	2540
7		27	796.66	7760	791.75	2480
8		28	796.51	7440	791.56	2410
9		29	796.35	7120	791.44	2370
10		30	796.26	6940	791.28	2310
11		30	796.09	6620		
12		30	795.86	6210		
13		35	795.63	5830		
14		35	795.53	5680		
15		40	795.18	5170		
16		40	794.98	4890		
17	781.84	70	794.83	4700		
18	785.57	200	794.86	4740		
19	784.29	300	794.94	4840		
20	785.26	500	795.20	5200		
21	787.62	800	795.35	5410		
22	789.75	1500	795.25	5270		
23	790.12	1850	795.01	4930		
24	791.69	2200	794.73	4570		
25	792.94	3020	794.38	4160		
26	791.71	2460	793.97	3740		
27	791.02	2230	793.61	3440		
28	791.20	2290	793.34	3250		
29	791.38	2340	793.15	3140		
30	791.66	2440	793.03	3070		
31			792.93	3020		

TABLE 20

RAT RIVER NEAR OTTERBURNE, MAN.

Location: Traffic bridge at Joubert's Farm, 4 miles south-east of Otterburne.

Drainage Area: 704 square miles.

Gauge: Staff

Discharge Record: Stage-discharge relationship defined by current meter measurements.

Datum: Assumed

Gauge height in feet, and discharge in second-feet.

DAY	APRIL		MAY		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
1		10	101.87	2230	99.10	555
2	90.79	10	102.15	2400	98.66	530
3	90.81	10	102.56	2660	98.16	505
4	90.94	11	102.78	2810	98.12	485
5	90.95	11	104.81	4030	98.10	460
6	90.92	12	107.29	5850	97.78	440
7	90.82	12	106.79	5340	96.16	420
8	90.93	13	105.87	4380	96.37	410
9	91.06	14	105.71	4180	95.80	410
10	91.13	14	105.54	3980	95.36	400
11	91.31	15	105.46	3920		
12		16	104.72	3300		
13	91.35	18	104.66	3260		
14	91.40	20	103.72	2570		
15	91.41	22	102.81	1980		
16	91.63	25	102.77	1900		
17	92.66	35	102.30	1610		
18	96.34	200	101.80	1340		
19	97.40	300	101.78	1280		
20	97.41	300	101.79	1240		
21	97.63	350	101.77	1200		
22	98.82	600	101.80	1160		
23	100.05	1150	101.67	1080		
24	100.47	1530	101.42	978		
25	100.80	1680	101.28	916		
26	100.69	1630	100.80	802		
27	100.70	1630	100.67	763		
28	101.08	1810	100.30	690		
29	101.30	1920	100.11	646		
30	101.71	2140	99.80	601		
31			99.43	575		

TABLE 21

SALE RIVER AT LA SALLE, MAN.

Location: Canadian Pacific Railway Bridge.Drainage Area: 860 square miles.Gauge: Staff.Discharge Record: None.Datum: Geodetic Survey of Canada, 1929
adjustment.Remarks: Readings taken by Drainage Board,
Department of Public Works, Man.

Gauge heights in feet.

DATE	Gauge Height	DATE	Gauge Height
May 8	766.43	May 20	772.01
9	766.91	21	772.01
10	767.41	22	771.71
11	767.61	23	771.36
12	767.71	24	770.46
13	767.71	25	769.21
14	767.84	26	768.41
15	768.31	27	767.71
16	769.71	28	766.51
17	770.61	29	765.41
18	771.31	30	764.41
19	772.01	31	763.51

TABLE 22

SALE RIVER AT SANFORD, MAN.

Location: Concrete highway bridge on No. 3
Highway east of Sanford.

Drainage Area: 680 square miles.

Gauge: Staff.

Discharge Record: None.

Datum: Geodetic Survey of Canada, 1929
adjustment.

Remarks: Readings taken by Drainage Board,
Department of Public Works, Man.

Gauge heights in feet.

DATE	Gauge Height	DATE	Gauge Height
May 11	772.72	May 20	773.57
12	772.62	21	773.47
13	772.32	22	773.22
14	771.97	23	772.72
15	771.67	24	771.82
16	771.72	25	770.27
17	772.27	26	269.02
18	772.87	27	768.00
19	773.67		

TABLE 23

SEINE RIVER NEAR PRAIRIE GROVE, MAN.

Location: At traffic bridge, $\frac{1}{4}$ mile south of Mile Post 9
on Highway No. 12 in S.E. $\frac{1}{4}$, Sec. 26, Tp. 9, Rge. 4-E.

Drainage Area: 495 square miles

Gauge: Staff.

Discharge Record: Stage-discharge relationship defined by
current meter measurements.

Datum: Assumed

Gauge height in feet, and discharge in second-feet.

DAY	APRIL		MAY		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
1	95.65	9	99.89	804	95.65	306
2	95.80	10	99.77	786	95.65	306
3	96.18	11	99.70	775	95.67	308
4	97.32	13	100.21	851	95.83	324
5	97.71	15	101.56	1100	95.37	279
6	97.99	16	103.93	2160	94.88	233
7	97.88	16	104.34	2860	94.58	207
8	97.91	16	104.28	2720	94.42	194
9	98.38	18	104.25	2660	94.24	178
10	98.41	18	104.13	2440	93.92	152
11	98.52	18	104.07	2340		
12	97.75	19	103.84	2050		
13	97.28	19	103.50	1820		
14	97.15	19	102.75	1500		
15	97.44	60	101.60	1190		
16	98.42	200	100.90	1050		
17	101.43	400	100.09	914		
18	103.97	800	99.36	794		
19	104.20	1000	99.08	752		
20	103.87	1370	98.63	684		
21	103.65	1900	99.28	782		
22	103.37	1710	99.32	788		
23	102.56	1360	99.32	788		
24	101.66	1120	99.21	771		
25	100.93	971	99.01	741		
26	100.19	849	98.51	666		
27	99.65	768	97.92	580		
28	99.81	791	97.66	544		
29	99.72	778	96.68	420		
30	99.57	756	96.16	361		
31			95.89	331		

TABLE 24

ASSINIBOINE RIVER AT HEADINGLEY, MAN.

Location: Canadian Pacific Railway Bridge, $\frac{1}{2}$ mile south of Headingley Station.

Drainage Area: 62,510 square miles.

Gauge: Staff

Discharge Record: Stage-discharge relationship defined by current meter measurements.

Datum: Topographical Survey.

Gauge height in feet, and discharge in second feet.

DAY	APRIL		MAY		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
1	759.26	306	763.62	6630	763.71	6750
2	759.68	476	763.60	6600	763.54	6520
3	761.05	1300	763.60	6600	763.44	6330
4	761.25	1360	763.58	6570	763.28	6150
5	761.40	1460	763.90	7030	763.13	5940
6	761.75	1720	765.25	9010	763.00	5760
7	762.15	2050	764.95	8610	762.88	5590
8	762.22	2100	765.03	8730	762.79	5480
9	762.12	1990	765.50	9460	762.69	5350
10	761.98	1840	765.77	9890	762.45	5190
11	762.18	2000	765.64	9680		
12	762.40	2190	765.78	9910		
13	762.52	2340	765.82	9810		
14	762.33	2200	765.62	9810		
15	762.30	2200	765.77	9840		
16	762.74	2670	765.72	9920		
17	763.40	3400	765.38	9270		
18	764.43	4670	764.91	8550		
19	765.00	5480	764.68	8200		
20	764.87	5590	764.60	7930		
21	766.04	7040	764.43	7480		
22	764.60	6520	764.35	7060		
23	765.65	8500	764.26	6880		
24	765.44	8990	764.30	6960		
25	763.70	6740	764.36	7180		
26	763.37	6280	764.33	7180		
27	763.67	6700	764.25	7180		
28	764.03	7230	764.06	7030		
29	763.88	7000	763.95	7090		
30	763.67	6700	763.92	7050		
31			763.88	6960		

TABLE 25

ASSINIBOINE RIVER AT BRANDON, MAN.

Location: First Street Traffic Bridge.Drainage Area: 35,550 square miles.Gauge: ChainDischarge Record: Stage-discharge relationship defined by current meter measurements.Datum: Geodetic Survey of Canada, 1923 adjustment.

Gauge height in feet, and discharge in second-feet.

DAY	APRIL		MAY		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
1	1164.40	910	1167.05	3730	1165.70	2670
2	1164.58	990	1167.07	3740	1165.50	2530
3	1164.52	953	1167.16	3820	1165.31	2400
4	1164.50	935	1167.19	3850	1165.18	2310
5	1164.55	955	1167.19	3850	1164.99	2170
6	1164.75	1050	1167.25	3910	1164.85	2080
7	1165.12	1260	1167.08	3750	1164.71	1990
8	1164.95	1150	1166.99	3670	1164.76	2020
9	1165.00	1170	1166.96	3650	1165.16	2290
10	1164.90	1100	1166.77	3500	1165.11	2260
11	1165.08	1200	1166.72	3460		
12	1165.04	1160	1165.59	3350		
13	1164.95	1090	1166.60	3360		
14	1165.08	1160	1166.66	3410		
15	1165.22	1430	1166.69	3430		
16	1165.18	1730	1166.57	3340		
17	1165.60	1970	1166.45	3240		
18	1165.26	2360	1166.43	3240		
19	1165.60	2600	1166.82	3540		
20	1165.85	2780	1167.26	3910		
21	1166.45	3240	1167.30	3950		
22	1166.89	3590	1167.31	3960		
23	1168.48	5010	1167.00	3710		
24	1167.78	4380	1165.06	3730		
25	1167.53	4160	1165.17	3830		
26	1167.43	4070	1167.03	3710		
27	1167.35	4000	1166.83	3540		
28	1167.17	3830	1166.54	3310		
29	1167.10	3770	1166.33	3140		
30	1167.12	3790	1166.22	3060		
31			1165.96	2850		

TABLE 26

SOURIS RIVER AT WAWANESA, MAN.

Location: Traffic Bridge $\frac{1}{4}$ of a mile north of Wawanesa.

Drainage Area: 24,150 square miles.

Gauge: Chain

Discharge Record: Stage-discharge relationship defined by current meter measurements.

Datum: Canadian National Railways White's Altitudes, 1915.

Remarks: At certain low stages the flow is affected by the P.F.R.A. Dam.

Gauge height in feet, and discharge in second-feet.

DAY	APRIL		MAY		JUNE	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
1	1157.58	815	1158.08	1820	1159.57	2870
2	1158.26	895	1158.19	1880	1159.56	2860
3	1157.20	595	1158.28	1940	1159.54	2840
4	1156.97	535	1158.36	1990	1159.46	2780
5	1157.41	800	1158.48	2080	1159.40	2730
6	1157.71	755	1158.64	2190	1159.32	2670
7	1157.30	700	1158.61	2170	1159.11	2520
8	1156.26	680	1158.59	2150	1159.59	2880
9	1155.72	667	1159.18	2570	1159.40	2730
10	1156.58	810	1159.70	2970		
11	1156.48	910	1160.72	3790		
12	1156.83	1140	1160.70	3770		
13	1157.08	1260	1159.91	3140		
14	1157.42	1430	1159.56	2860		
15	1157.96	1750	1159.40	2730		
16	1157.83	1670	1159.36	2700		
17	1157.41	1430	1159.38	2710		
18	1157.67	1570	1159.43	2750		
19	1157.43	1440	1159.56	2860		
20	1157.55	1500	1159.61	2900		
21	1157.57	1510	1159.70	2970		
22	1157.55	1500	1159.75	3010		
23	1157.56	1510	1159.75	3010		
24	1157.64	1550	1159.72	2990		
25	1157.72	1600	1159.72	2990		
26	1157.76	1630	1159.71	2980		
27	1157.75	1620	1159.70	2970		
28	1157.77	1630	1159.70	2970		
29	1157.80	1650	1159.69	2960		
30	1157.93	1730	1159.65	2930		
31			1159.58	2870		

APPENDICES

- No.
1. Extracts, relating to the flood of 1826, from "The Red River Settlement, Its Rise and Progress - Alexander Ross".
 2. Extracts, relating to the flood of 1826, from "The History of Manitoba - D. Gunn and C.R. Tuttle".
 3. Extracts, relating to the flood of 1826, from "Journal of Occurrences, Kept at Fort Garry, in Red River Settlement, from 1st June 1825, until 31st July 1826 - by Francis Heron".
 4. Extracts, relating to the flood of 1826, in a letter of Bishop Provencher to Bishop Panet, Month of July 15, 1826, from "Documents Relating to Northwest Mission. 1815-1827 - Grace Lee Nute".
 5. Extracts, relating to the flood of 1826, from "Monsieur Provencher et les Missions de la Riviere - Rouge par L'Abbe G. Dugas" published by C.O. Beauchemin & Sons, Montreal, 1889.
 6. Extracts, relating to the flood of 1826, from report by Governor George Simpson to Governor and Committee, London, - Norway House, June 14, 1826.
 7. Extracts, relating to the flood of 1852, from "The Red River Settlement, Its Rise and Progress - Alexander Ross".
 8. Extracts, relating to the flood of 1852, from "The History of Manitoba - D. Gunn and C.R. Tuttle".
 9. Extracts, relating to the flood of 1852, from "Notes of The Flood at Red River, 1852 - Bishop Anderson of Rupert's Land".
 10. Extracts, relating to the flood of 1852, from "Mr. Black's Private Journal, Upper Fort Garry, 1852".
 11. Extracts, relating to the flood of 1852, from diary of Dr. William Cowan, Surgeon to Enrolled Army Pensioners at Fort Garry.
 12. Extracts, relating to the flood of 1852, from a letter by Chief Factor Donald Ross dated July 2, 1852 at Red River Settlement to Sir George Simpson.
 13. Extracts, relating to the flood of 1852, from a letter by Chief Factor James Bird dated July 6, 1852 at Red River Settlement to Sir George Simpson.
 14. Extracts, relating to the flood of 1852, from a letter by Governor Eden Colville dated May 18, 1852 at Lower Fort Garry to Archibald Barclay, Secretary.
 15. Extracts, relating to the flood of 1852, from "Flood of 1852 by Abbey Leonide Priveau, Annual Chronicle, 1852. Pages 175-176-177.
 16. Extracts, relating to the flood of 1852, from the letters of Mgr. Provencher.
 17. Extracts, relating to the flood of 1861, from a letter dated at Fort Garry, May 1, 1861 by W. Mactavish, Acting Governor of Rupert's Land to Thomas Fraser, Secretary.
 18. Extracts, relating to the flood of 1861, from a letter dated at Fort Garry, May 16, 1861 by W. Mactavish, Acting Governor of Rupert's Land, to Thomas Fraser, Secretary.
 19. Extracts, relating to the flood of 1861, from Transactions of the Manitoba Historical Society Series III - Number 3, 1947. "Floods at Red River - S.P. Matheson".
 20. Extracts, relating to the flood of 1882 and comparison with other floods, from Manitoba Daily Free Press, May 6th, 1882.
 21. Extracts, relating to the flood of 1882, from The Manitoba Free Press, April 27, 1882.

APPENDIX I

Extracts, relating to the flood of 1826, from "The Red River Settlement, Its Rise and Progress - Alexander Ross".

"The winter had been unusually severe, having begun earlier and continued later than usual. The snow averaged three feet deep and in the woods from four to five feet. The cold was intense, being often 45° below zero; the ice measured five feet seven inches in thickness. Notwithstanding all this, the colonists felt no dread till the spring was far advanced, when the flow of water, from the melting of the accumulated snow, became really alarming. On the 2nd of May, the day before the ice started, the water rose nine feet perpendicular in the twenty-four hours.

..... "On the 4th, the water overflowed the banks of the river and now spread so fast that, almost before the people were aware of the danger, it had reached their dwellings. Terror was depicted on every countenance and so level was the country, so rapid the rise of the waters, that, on the 5th, all the settlers abandoned their houses and sought refuge on higher ground.

"At this crisis, every description of property became of secondary consideration and was involved in one common wreck, or abandoned in despair. The people had to fly from their homes for the dear life, some of them saving only the clothes they had on their backs. The shrieks of the children, the lowing of cattle and the howling of dogs, added terror to the scene.".....

..... "By this time, the country presented the appearance of a vast lake, and the people in the boats had no resource but to break through the roofs of their dwellings and thus save what they could. The ice now drifted in a straight course from point to point, carrying destruction before it, and the trees were bent like willows by the force of the current.

"While the frightened inhabitants were collected in groups on any dry spot that remained visible above the waste of waters, their houses, barns, carriages, furniture, fencing and every description of property might be seen floating along over the wide extended plain, to be engulfed in Lake Winnipeg. Hardly a house or building of any kind was left standing in the colony.".....

..... "The water continued rising till the 21st, and extended far over the plains. Where cattle used to graze, boats were now flying under full sail.".....

..... "It subsided, of course, very gradually. It was on the 15th of June that the settlers, for the first time, drew near the sites of their former habitations."

APPENDIX 2

Extracts, relating to the flood of 1826, from "The History of Manitoba - D. Gunn* and C.R. Tuttle".

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"In recording the transactions of 1826, the most disastrous since the commencement of the colony, we must premise by stating that the preceding months of September and October had been uncommonly rainy and cold. About the 20th October, the wind began to blow fiercely from the north, accompanied by a heavy fall of snow, which lasted forty-eight hours and literally choked the water in the river, and when the wind fell, such was the intensity of the frost that not only the rivers but even the great lakes assumed their winter covering. Heavy falls of snow succeeded each other at short intervals during the first part of the winter, and in January, the snow in the wood, where undisturbed by the winds, was five feet deep.".....

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"We have stated above how suddenly and unexpectedly the winter set in and the great depth of snow that fell in the early part of it. The hunters had arrived at their hunting grounds and found beffalo, but from various causes were unable to make any provisions for a future day before the storms of the winter covered the plains with snow three or four feet deep. Their horses had become useless in hunting and on account of the great labor they had to perform in obtaining their scanty food from so great a depth of hard packed snow, were in a few weeks not only unfit for any kind of labor but unable to procure their own food. While thus destitute of food for man and for beasts, between the 15th and 20th December, a great snow storm came on, such as has rarely been seen even on those wide and treeless plains. This storm, which blew from the north, continued to rage during three days and four nights, drove the buffalo before it beyond the reach of the hunters and killed a great many of their horses.".....

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"The colonists had scarcely recovered from the anxieties and exertions of the previous winter when they were overtaken by another calamity as unexpected as it was destructive. The spring was unusually cold until the last week in April, when the wind began to blow from the south, the snow began to thaw, and on the 2nd of May the accumulated water overflowed the banks, literally and rapidly changing the valley of the Red River into a huge lake. At Fort Garry it rose nine feet perpendicular in twenty-four hours. Many of the settlers had built their shanties on the low points along the river. The water rose so suddenly that, in some cases, its rushing into the houses roused the inmates from their beds, when, in their terror, they fled, under the shades of night, to the upper bank, venturing a second time into the flood to relieve their cattle from their dangerous position. But there were cases, not a few, where the people were cut off from the second bank by deep water, and in these cases, the inmates had to climb to the roofs of houses and pass the night in these very unpleasant and dangerous situations, until the light of day enabled their neighbors to see their perilous condition and come to their rescue with boat or dug-out and land them on dry ground.

* Mr. Gunn was a correspondent for the Smithsonian Institute and was an eye-witness of the flood of 1826.

"But here they found no abiding place, so level was the country, so rapid the rise of the water, that on the 5th all the land was submerged for some miles on each side of the river. The terrified people fled, some went to the pine hills on the east, some to the rocky hills on the west, others went down along the river and found dry land; and those who had been located near Upper Fort Garry with the gentle DeMeurons, whom his Lordship of Selkirk brought into the colony to restore order and keep the peace, camped on the high lands on the north of the Assiniboine. At this crisis every boat and dug-out was called into operation and performed excellent service: first, in carrying the people who had to flee for life to places of safety; next, in returning to save all that could be found of the abandoned property; for many of the fugitives had taken nothing with them except the clothes on their backs. Furniture, grain and utensils of every kind had been left in the houses, many of which were beginning to float; a few had been crushed by trees broken down by the masses of solid ice floated down by the ever increasing flood. In many instances the houses could only be entered by breaking through the roofs, and save what they could. Notwithstanding every effort, property of every description was seen for days drifting over the plains or down the river, to be finally engulfed in Lake Winnipeg.".....

..... "It is pleasing to be able to state, notwithstanding the sudden and unexpected overflowing of the water, that so few lives had been lost. Two French half-breed lads, while paddling a canoe before the stream, were forced by the current against an uprooted tree that projected into the river, upset and drowned. A third man was drowned while collecting the wreck of his buildings.

"After what we have already stated it would be superfluous to say much on the causes of the above disastrous occurrence. However, we will briefly say that autumnal rains had filled to overflowing the lakes forming the sources of the Red River and the swamps along its course. Then an extraordinary depth of snow fell during the winter months. A very late spring, and, as a natural consequence, a quick melting of the snow. In these we have the causes. We may here observe that the water was observed to be rising a few days before the ice began to break and continued rising until the 21st of May. It was then sixteen feet above the usual high-water mark at the opening of the river. By the middle of June the waters had so receded as to be contained within the banks of the river, and the settlers began to return to the vicinity of the sites of their former habitations.".....

APPENDIX 3

Extracts, relating to the flood of 1826, from "Journal of Occurrences, Kept at Fort Garry, in Red River Settlement, from 1st June 1825, until 31st July, 1826 - by Francis Heron".

1826

- May 3rd Wednesday. The ice in the Rivers 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. Rainy weather. Wind E.
- May 4th Thursday. The water in the Rivers 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. Wind S.E.
- May 5th Friday. About 2 P.M. the ice in the Red River at length broke up, with an awful rush; carrying away cattle, houses, trees and everything else that came in its way. The river overflowed its banks everywhere, and carried the ice with great velocity to a greater distance from its course than had ever been before seen by the oldest inhabitants. The houses of the Settlers were one instant seen standing, and the next not a vestige was to be discovered, to denote their situations. Forty-seven dwelling houses were thus carried off by the first rush, in the short space of half an hour, and many others afterwards from which the wretched inhabitants, barely escaped with their lives. The waters at the same time rushed into the forts, but the banks being fortunately high, the ice only rubbed against the corner of our front bastion. The forts were also guarded by the trees on the Assiniboine Point. Apprehending an inundation we had previously taken the precaution to raise all the perishable goods and property in the stores, some distance from the ground. This necessary task occupied all hands during this morning and the whole of yesterday. On the floods entering the forts, the families, and part of the people of both establishments were moved out to an elevated situation above the forts, on the Assiniboine, and the rest of the people were placed to take care of the property in the forts. Wind S.W. blowing a strong breeze. Weather mild.
- May 6th Saturday. The waters continued to increase during the last night and this day. The ice during the same time ran past without intermission in immense masses, mingled with the wrecks of houses, fences, trees, etc. Some of the people of the settlement employed during the day removing their most valuable effects from their dwellings to high situations on the banks of the Assiniboine, while others placed themselves and property on scaffolds formed amongst the trees; and well was it for them they did so, for before they had fully succeeded, their houses and part of their furniture, were swept off before their eyes by the icy deluge. The havoc was terrible. Boats and canoes were now used in the forts, in passing from one house to another. The clerks and men employed raising all the property higher in the stores than it had been before; the inundation turning out to be greater than at first apprehended. About sixty families with 200 head of cattle enclosed on half an acre of ground, by the floods. Boats sent to give relief. Warm weather, with thunder lightning and rain.

- May 7th Sunday. 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.
- May 8th Monday. The rivers have become almost clear of ice, but the waters increase apace. All the Company's men and boats continue day and night in snatching from watery graves, such of the settlers as were unable to escape from their houses, from the roofs of which, several of them were taken up by our people, with such of their property, as they had saved. Thus repeatedly have the Company been the means of saving the lives of this ill fated people this ill fated year. Cold weather with sleet and rain. Wind N.E.
- May 9th Tuesday. The waters still rose, and the whole country has assumed the appearance of a large lake. The boats of the fort continue day and night, in use, saving the settlers, with their remaining cattle and effects from destruction. The wrecks of houses are constantly floating down the stream; and the tales of woe from all quarters are really heart-rending. All claim the aid of the fort, the court of which is constantly filled with a flotilla of canoes, imploring the first helping hand. Warm weather. Wind N.W.
- May 10th Wednesday. The scene of desolation and distress in the settlement, was if possible greater this day than yesterday, or before, as the continued rising of the floods, not only increases the alarm, but also the destruction of property. Our boats employed as yesterday. Our people encamped without the fort were from the rapid rising of the waters, obliged to pitch further up the Assiniboine River to higher ground. Tempest with darkness, thunder, lightning and rain.
- May 11th Thursday. The floods continued to rise considerably throughout the last twenty-four hours, and with the anxiety of the settlers and ourselves for the safety of our lives and property. The remains of houses and fences are constantly floating down the stream. Our boats have been solely employed by the inhabitants in removing their effects up the Assiniboine. All is bustle and confusion. Tempestuous wind, with thunder, lightning and rain throughout the night.
- May 12th Friday. Matters the same as yesterday.
- May 13th Saturday. Our people encamped on the banks of the Assiniboine River have been obliged to pitch their camp some miles higher up that stream; their original encampments being overflowed by the rapid swelling of the waters. The forts now stand like a castle of romance in the midst of an ocean of deep contending currents, the water extending for at least a mile behind them, and they are thereby only approachable by boats and canoes. Mr. McKinzie with the few hands he keeps with him in the forts, are obliged to live in the highest stories of the highest houses. The pickets and the chimneys of the houses are falling daily, as well as the plastering of the

walls, and even the houses themselves begin to totter on their foundations. It is really distressing to see such fine complete establishments, thus become, in so short a period, in the condition of a wreck. The settlers were obliged to move still higher up the Assiniboine, for safety, and most of our boats were employed by them as usual in transporting their families, cattle and property to a more secure station than their last retreat. The wrecks of houses still float down the stream without intermission. Tempest, with thunder, lightning and rain.

- May 14th Sunday. Our people were again forced to remove their camp still higher up the Assiniboine, to the vicinity of Sturgeon Creek. The waters rise so rapidly that the property was considered to be no longer safe in the forts, consequently, our people and most of our boats, with the help of some of the settlers, commenced removing the Company's property, with all dispatch, up the Assiniboine to our encampment there.
- May 15th Monday. Weather cloudy, with thunder lightning and rain, but more moderate than yesterday. Wind S.E. and blowing hard.
- May 16th Tuesday. The whole face of the country, both below and above our encampment, is covered with water, and in this windy weather, looks like an immense lake in a storm. Strong S.W. wind. Cloudy weather, with a few light showers of rain.
- May 17th Wednesday. The waters rise at the rate of two feet in twenty-four hours, but at our encampment we have still an elevation of six feet, the highest situation except one, within many miles. All the Canadian, French Half-breed, Swiss, and Demeuron inhabitants, are encamped around us, and we are only fifteen persons in number to defend that property, which was not considered safe in the forts, from their depredations, and which there were so many plots on foot to seize, while there. Fine warm windy weather. Wind S.W.
- May 18th Thursday. The waters continue to rise at the rate of ten inches in the space of twenty-four hours. The people and almost all the cattle are safe with us, and everywhere else, throughout the settlement. Our camp assumes a regular appearance. We have the waters in front, and the land about Sturgeon Creek in the rear. However, some of the people being yet in terror from the rapid rise of the floods, have moved some miles from us. Fine weather. Wind S.W.
- May 19th Friday. The water rising at the rate of four inches in twenty-four hours. Two Canadians arrived with Sturgeon from the Rapids, which they sell at 5/-each. Some freemen from beyond Pembina also arrived and report the waters to be as high there as here; High winds during the day, with a dreadful storm of rain, thunder and lightning at night.
- May 20th Saturday. Some freemen arrived from the upper part of this (the Assiniboine) river, and report that the waters in the 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. Strong North West wind, with thunder,

lightning and rain. Almost all the buildings throughout the settlement carried off by the floods and high winds. Many of them containing property.

May 21st Sunday. The people engaged in prayer at the tents of the Clergy. Cloudy weather. Wind west blowing a strong gale. The camp got on fire, but which was soon got under, there being plenty of help, and a good supply of water.

May 22nd Monday. The inundation seems to have reached, at length, its extreme height, it being imperceptible, whither the water rose or fell during the last thirty-six hours, and this happy circumstance seems to revive a gleam of hope in the minds of the forlorn community around us, who are attached to the soil, that their case may not yet be altogether desperate. A Demeuron was last night drowned, in a creek close to our encampment, when in quest of his cattle. Search was made for his remains, but without success. Messrs. McDermot and Nolin arrived at our camp from Pembina in a boat. They both brought furs to sell, but the former most. They state the waters to be falling there, the effects of which we expect soon to experience at this place.

May 23rd Tuesday. The happy discovery was made this morning, and hailed with joy by the anxious multitude, that the water had fallen two inches during the last night. This long wished for circumstance seems to bring relief to the minds of all. Sultry weather in the morning, in the evening thunder, lightning, and rain. Wind variable.

May 24th Wednesday. Wind S.W. blowing a strong gale.

May 25th Thursday. The water fell three inches last night at our encampment.

May 26th Friday. Fine warm weather. Wind S.E.

May 27th Saturday. The waters fall at the rate of 10 inches in twenty-four hours. Warm windy weather. Wind west.

May 31st Wednesday. The floods fall at the rate of one foot in twenty-four hours, but makes, at a general view, little appearance of diminution, owing to the great extent of country inundated. The settlers seeing at length the improbability there is of their cultivated lands drying sufficiently soon to enable them to secure seed for the ensuing year, have consequently commenced breaking up new ground, where such is to be found dry, in which they plant small quantities of wheat, to prevent its becoming once more extinct in the settlement. A man and three children were drowned this morning in the rapids above our encampment, by the oversetting of their canoe. Search was immediately, and generally made for their bodies, but without success. Indeed the current runs with such velocity, that what once falls into it, it is in vain to attempt to recover. About noon we experienced a heavy storm of thunder, lightning and rain; after which the weather became more than usually pleasant.

June 6th Tuesday. All hands continued fitting out our boats. The water falls at the rate of one foot in twenty-four hours, at our encampment, though it

is said not to exceed six inches about the Forks, where it is more expanded. Rainy weather, with a strong S.E. wind.

- June 12th Monday. Fine warm weather. Wind west.
- June 13th Tuesday. The water continues falling at the usual rate.
- June 14th Wednesday. Hearing that the fort is getting dry a contract of small expense was entered into with some settlers (having no men of our own to do this work) to transport the property thither. Warm weather. Wind N.E.
- June 15th Thursday. Fine warm weather. Wind west.
- June 16th Friday. Rainy weather. Wind south east.
- June 21st Wednesday. Windy weather with showers of rain.
- June 22nd Thursday. The settlers still continue putting seed in the ground in proportion, as the waters withdraw from their cultivated lands, but of which a very small part is yet dry. Wind N.W. blowing a strong gale. Weather cloudy.
- June 24th Saturday. Continued our voyage up the River towards the fort, but made slow progress, owing to the great force of the current. Wind S.E. blowing a strong breeze. Weather cloudy.
- June 25th Sunday. This morning we arrived at the fort, which we found a complete pile of ruins. We pitched alongside, there being no houses yet habitable for our reception.
- June 26th Monday. Fine warm weather. Wind west.
- June 27th Tuesday. Cloudy weather. Wind N.E.
- June 28th Wednesday. Windy weather with showers of rain.
- July 1st Saturday. Clear warm weather. Wind S.W.
- July 2nd Sunday. The settlers continued as busily employed putting down their seed barley and potatoes this day, as during any other of the week. Wind and weather as yesterday.
- July 3rd Monday. Most of the farms are now clear of water, and as far as possible have been planted with potatoes and barley, which constitute the principle crops this season. The quantity of land under crop is far short of that of last year.
- July 4th Tuesday. The waters continue to fall regularly at the rate of one foot in twenty-four hours, and are now getting within the banks of the Rivers in most parts. Vegetation is uncommonly rapid. Crops appear above ground the third day after being planted, which is no doubt owing to the moisture of the ground and heat of the weather. Clouds of mosquitoes as usual. Warm weather. Wind south.

July 5th

Wednesday. The waters are now nearly within the banks of the River in every part, and are just at the height they were last year, at the highest, and even then they were uncommonly high. The people of the settlement employed enclosing their farms, and building new houses, with as much energy as if no misfortunes had ever befallen them.

(H.B.C. Archives B.235/a/7, fos. 32d-46.)

APPENDIX 4

Extracts, relating to the flood of 1826, in a letter of Bishop Provencher to Bishop Panet, Month of July, 15, 1826, from "Documents Relating to Northwest Mission. 1815 - 1827 - Grace Lee Nute".

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"Our Red River is not in very good condition this year. Famine made itself felt this winter because the hunt on the prairie was a complete failure. The winter was very long and very severe; the ice did not break up until May 5; it was, indeed, at that season as strong as in January. It demolished a good half of the houses. The great abundance of snow caused a flood the like of which has never been seen in the region. All the banks of our river overflowed, and we were obliged to take refuge with our animals in the high places. I believe that the water rose thirty to forty feet above the low-water mark. Almost all the rest of the houses were carried away. It rose five feet in ours and in our chapel, and caused a great deal of damage. We were two months without saying Mass, except on Sundays, and one month out of our house, to which we did not return until about June 15."....."Our colony has lost about two hundred and fifty souls in Swiss Meurons and others; they are fleeing the country; being frightened away by the accidents of this year.".....

APPENDIX 5

Extracts, relating to the flood of 1826, from "Monseigneur Provencher et les Missions de la Riviere-Rouge par L'Abbe G. Dugas" published by C.O. Beauchemin & Sons, Montreal, 1889.

Chapter 8 - Flood of 1826*

In the Spring of 1825, the Red River rose somewhat higher than usual. A few low spots were flooded, but nevertheless the settlers suffered no damage.

Since the arrival of white settlers in this country, no one knew of any flood. The Indians told of a flood, a long time ago, which had covered the prairies, but no one could fix the approximate time; this present generation had not been a witness to such a flood.

The 15th of October, 1825, a heavier than usual snowfall began to fall. The preceding summer, due to a heavy rainfall, all the waters of the rivers and lakes had remained high. That winter was one of the coldest on record. In the past 25 years, none remembered such a cold, hard winter. The Spring was long, during the month of April, a cold North wind blew continuously. The snow melted suddenly in the beginning of May. The ice which usually broke-up about the 20th of April, broke-up that year the 5th of May. It had all the thickness of winter ice. The water was already above its banks, as the ice started to move. Carried away by the heavy current, the ice razed (raised) everything in its path. The water rose gradually from the end of April until the 20th of May. The place where Mgr. Provencher took refuge with his settlers was surrounded by water on all sides, they were in reality on an island. Two or three days before the 20th of May, the settlers watching the rising waters were seized with a great fear, and believed that they were destined to drown on their island of refuge. Mgr. Provencher himself, seeing that there was no human help to be expected, to escape being drowned, told his people to implore the help of heaven. He ordered two days of fast and fervent prayers to ask God to save them from this catastrophe, which was menacing them. The 20th of May, the water stopped rising, but for one week it remained stationary.

At last about the end of the month, the water started to go down gradually and on the 20th of June, the river was back in its bed. The water had risen 40 feet above its ordinary summer level.

* Translated from the French

APPENDIX 6

Extracts, relating to the flood of 1826, from report by Governor George Simpson to Governor and Committee, London - Norway House, June 11, 1826.

"Up to my arrival at Red River on the 1st of June every thing connected with the Honble. Coys. affairs afforded me great satisfaction, but here I am deeply concerned to say, a calamity of the most unforeseen nature presented itself, one which I conceive to be a death blow to the Colony, the immediate distress occasioned thereby is beyond description and the consequence threatening the lives of its wretched inhabitants. This evil to which all the others that this truly unfortunate Colony has been from time to time visited put together, bears no comparison, was occasioned by the overflowing of the Red and Assiniboine rivers on the breaking up of the ice to such an extent as to give the whole country, as far as the eye could carry, the appearance of a lake with the exception of a few elevated spots at the distance of several miles from each other, whither the settlers retreated to save their lives and such of their property as could be transported thither. To give an idea of the state of the waters, I was enabled to enter the Red River with my canoe above Nettly Creek instead of the usual passage from Lake Winnipeg, and the current in the bed of the River was so strong that we could not stem it, and paddled through the still water over the plains to a spot below the rapids where I found Chief Factor Mackenzie with the people of the Company's establishment and a large body of settlers encamped; from thence to the "Pines" two or three miles behind Messrs. Bird and Thomas's lots was a complete sea or lake, and from thence to a hillock at the entrance of Sturgeon Creek on the Assiniboine River there was not a dry spot, and over which my canoe passed, the water covering the roofs of the greater part of the houses in the Scotch settlement; on those three spots of rising ground the whole population of the Colony were encamped, and the greatest portion reduced to the utmost distress by hunger; in short such a scene of misery has been rarely witnessed and almost baffles description. It is however most gratifying to be enabled to say that only one life was lost, that of a poor Neuron who was drowned in endeavouring to save his little property, and this providential salvation of life was mainly owing to the praiseworthy and indefatigable exertions of Chief Factor Mackenzie, who kept all the Company's boats plying about the Settlement for the purpose of removing the people and their most valuable effects to places of security. It was most fortunate that the rise of water was gradual, otherwise very few indeed could have escaped being carried away by the overwhelming current.....Up to the date of my departure from the Settlement (11th instant) the plains were still covered with water, but it was gradually falling off, and in very few places will it be possible to sow or plant before the first of July.....When I visited Fort Garry there was 11½ feet of water in the fort, the picketing and bastions carried away, and the buildings tottering, but the greater part of the Company's property was saved; there will still, however, be a considerable loss incurred by this unprecedented and unforeseen visitation of providence. Mr. Chief Factor Mackenzie passes the summer inland and will do every thing that lays in his power to alleviate the distresses of the unfortunate people by whom he is surrounded. They, on the whole, are orderly and well disposed, and they seem to appreciate the lively interest taken in their cases and the great exertions used to afford them relief. I must now take leave of this painful subject, but shall report such further intelligence as may reach me in course of the Fall, mean time your Honors may rest assured that no effort will be wanting on the part of the Council or myself to afford every assistance and support to such as stand in need of it."

APPENDIX 7

Extracts, relating to the flood of 1852, from "The Red River Settlement, Its Rise and Progress - Alexander Ross".

"On the 7th of May the water had risen eight feet above the high-water mark of ordinary years, overflowed the banks of the river, and began to spread devastation and ruin in the settlement; boats and canoes in great request for the saving of lives and property; all hurry, bustle and confusion; some groups on spots higher than the rest, anxiously waiting a boat, a canoe, or some friendly hand to save them from a watery grave. From 150 yards wide, the usual breadth of the river, it had spread to three miles on each side and rose for several days at the rate of nearly an inch per hour."

.....
"On the breaking up of the river, the channel got choked up with ice, which caused the water to rise seven feet in an hour or two. This occurred at night after the people had gone to bed, and it came on them so suddenly that, before they were aware of it, themselves and their beds were afloat, cattle and sheep were drowned, and two men, who had gone to rest on a small rick of hay, found themselves in the morning drifting with the current, some three miles from where they had laid down the night before. Others again, in the absence of canoes or other assistance, had to resort to the house-tops; some took to the water and hung to the branches of the trees and bushes, till daylight brought them relief."

.....
"On the 12th, half the colony was under water, and had made a clean sweep of all fencing and loose property on both sides of the river, for a distance of 22 miles in length. In all this extent, so low and flat is the country throughout, that not a single house was excepted - all was submerged - not an inhabitant but had fled,"

.....
"On the 22nd, the water was at its height, and the coincidence is remarkable, inasmuch as on the same day of the month the water was at its height, during the former flood, twenty-six years ago: but it was then 18 inches higher than it has been this year; still, the people being fewer, the damage at that time was less. During eight days before the change, dwelling houses and barns were floating in all directions, like sloops under sail, with dogs, cats and poultry in them. Out-houses, carts, carioles, boxes, cupboards, tables, chairs, feather beds, and every variety of household furniture drifting along added to the universal wreck."

.....
"At its height the water had spread out on each side of the river six miles, for a distance of fourteen miles in length - not a house was excepted. Loaded boats might have been seen sailing over the plains, far beyond the habitations of the people. The spectacle was as novel as it was melancholy. Three thousand five hundred souls abandoned their all and took to the open plains.

.....
"The falling of the water allowed many of the people to approach their cheerless homes about the 12th of June."

APPENDIX 8

Extracts, relating to the flood of 1852, from "The History of Manitoba - D. Gunn and C.R. Tuttle".

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.... "The year 1852 witnessed a renewal of the terrible scenes of 1826, another flood covering and destroying a great part of the Red River Settlement. On the seventh of May, says Mr. Ross, in an appendix to his "Red River Settlement", the water had risen eight feet above the high-water mark of other years. The overflow soon spread ruin throughout the settlement, boats and canoes were in the most urgent demand with which to save life and property. The river had extended its breadth to about six miles and was rising at the rate of about one inch per hour. The settlers were now filled with the greatest consternation.

"On the 12th of May, seven days after the flood had commenced, about half the colony was inundated, and the great damage had been done to almost every description of property for a distance of over twenty miles up and down the river.

"On the 22nd, the water reached its greatest height, being within eighteen inches as high as in the flood of 1826, previously described by Mr. Gunn.

"The flood of 1852 found more property within its reach on account of the settlement being larger. As in the earlier flood but one life was lost; a few horses, cattle and some pigs were neglected and consequently drowned, in other respects the destructions were almost unlimited.

"The flood was caused in this way:- On the breaking up of the river, the ice, according to Mr. Ross' account, choked in the channel, which caused the water to rise seven feet in the course of a few hours. This occurred in the night, and before the people were aware of it, they were floating in their beds. Hence the confusion was great, and much more loss sustained than would have resulted had the first stages of the disaster occurred in the day time. The cause of the flood, as stated above, is disputed; some say there was no ice jam at all.

.... "The cold as well as the water pressed so hard, that one man was reduced to the necessity of cutting up his plough for firewood to save his children from freezing. The spectacle was as novel as it was melancholy. Three thousand five hundred souls abandoned their all, and took to the open plains. The loss of property, besides that of the crop for the year, was estimated at 25,000 pounds sterling. The people were huddled together in gipsy groups on every height or hillock that presented itself.

"The Colonial Governor, the Bishop of Rupert's Land, as also the Rev. John Black, were untiring in their efforts to aid and comfort and cheer the heartless, homeless people; but it was not until the 12th of June that they could approach their desolate homes and commence the work of rebuilding or repairing, as the case required."

APPENDIX 9

Extracts, relating to the flood of 1852, from "Notes of The Flood at The Red River, 1852 - Bishop Anderson of Rupert's Land".

Its effects were very different in different places; they varied almost with every reach of the river, and according to the level of the bank at each spot. It was perhaps the most disastrous among the Canadians around and above the "Upper Fort"; it was very severe in the upper and middle Church districts; it affected a good deal the lower part of the Assiniboine; while the upper part of the district of St. James on that river and those of St. Andrew's and the Indian Settlement, were almost untouched.

April 25th The ice having partially broken up, rendered it unsafe to cross the river. A few however, came over in the morning; more to the afternoon service. Large masses of ice passed during the evening and the following day. The water had risen much, even before the ice gave way, and continued doing so during the week, there being no outlet for it as yet towards the lake. The rise was sometimes a foot or a foot and a half, in 24 hours.

The winter had been unusually fine until the end of February, but through the whole of March a great deal of snow had fallen, which seemed sufficiently to account for the present rise.

May 3rd These expectations were encouraged by the very slight rise during the night, but from 10 a.m. till 2 p.m. the water gained so fast as to lead to very painful forebodings. Some houses opposite to us are already abandoned, their inmates tenting on the little knolls behind. We hear of one settler taking a bateau right through his house. From the Fort we hear that more than fifty deserted houses may be seen.

May 4th Rode up to the Fort the sight very distressing. The bridges are all giving away.

May 5th Towards night heavy rain commenced, the first since the breaking up of the ice.

May 7th Horses of the Company pass down; sent for security to the Stone Fort. They were seen fording and swimming the creeks, now swollen to rivers. In every direction there are processions of cattle, horses and carts going to the Little Mountain, the creaking sound of the wheels is melancholy to hear. Or stable drifts down the river.

May 8th During the forenoon a little snow and sleet fell. Water still rising.

May 9th (Sunday) We had heard over night that the waters were stationary at Pembina; but the great rise in the night dispelled such a pleasing idea. Many had hoped to defer the removal of their cattle till after the day of rest, but were forced to go off at once. I prepared for service but with a heavy heart. The pathway to the Church was open, but only just so; the waters had entered one corner of the churchyard, and had the service been three hours later, we could not have gone over dry shod. The gathering of the congregation was very different from usual. Some came over their cornfields in the large boat.

May 9th (contd) "Et ducunt remos illic, ubi nuper ararant." Others were ferried across the creek where my bridge was many feet under water.

The strength of the south wind is bringing down a prodigious volume of water.

The most melancholy sight of the day had been when those tented on my grounds moved off, and passed over the swollen water to the north side of the church. All walked right through the stream, men and women up to their waist; the cattle were swum over, and the carts with great difficulty got through.

The Red River opened for itself fresh channels into the Assiniboine above the junction, so that from Pembina to our settlement was a broad lake, and it came down upon us - as an Indian, I believe, first expressed it - like a race horse.

May 10th Another beautiful morning, but the rise in the night greater than any previous one. The water was now in the granary and store, and I was some time standing in the water.

They were distressed at finding us so surrounded with the waters. Their accounts were most painful. The barn of Emilien, the largest farmer among the Canadiens, had floated away; they reported, also, the loss of many other houses, carried down by the current.

A poor Frenchman called on me, begging for a little relief; his house had been swept away, and besides this, he was left without a bateau; he was houseless and spoke of his seven children with tears in his eyes, but he added - "C'est le bon Dieu qui m'a afflige" - a lesson of patience to us all.

We ascended the high raft of wood, to take a prospect around. How desolate! not a creature visible to the eye, save one neighbor, with his wife, on top of their raft. Boats, too, were seen in unusual places, still carrying cattle over.

May 11th The rise in the night rather less; the platform was now floating; my garden, the last dry spot, was now under water, and the churchyard, the seedplot for eternity, was also covered.

May 12th It was a melancholy sight to look down from the gallery, and as I viewed the churchyard laying under water, I thought what could be done in case of death. There had been two funerals the day before at St. Andrews; what could I do if death occurred in the upper settlement? The rise of the night had been very great, and the wind was strong from the south-east. This caused a violent current against the house, which we could hardly stem on our return from the church;

May 13th After a most tempestuous night, a bright morning; the wind falling, but still considerable. The rise much as before; not one dry spot below; no resting place for the sole of the foot. We had prayers in the kitchen, standing in water three inches deep. What devastation this one night must have made? If we felt somewhat alarmed, what must it have been for those exposed to the severity of the weather?

The nearest resemblance to our condition might be found in a prolonged shipwreck, in which the waters are fast gaining on the vessel, and one knows not what to rescue and save, or whether the ship itself will hold out to the end.

May 14th Rose at half-past four, the weather still stormy. The men, however, said "Keche nootin, mahjah kwinskitin" - It blows hard, but it is fair. We started soon after five. My sister was brought in a wooden bateau from the foot of the stairs through the hall and kitchen, and thus got into the birch-rind canoe.

May 14th (contd) We went right over the fields - nearly the line of our usual land-road - to avoid the strong current and long winds of the river. After a hard paddle, we reached our refuge at Mr. Taylor's, where many came out to welcome us. After dinner I rode up to the encampment on the little mountain, where I saw Captain Hill and the pensioners. Found Mr. Black and Dr. Cowan there also, who confirmed the good tidings of a diminished rise.

May 15th The cold of the previous day had almost prepared us to expect the snow and sleet which fell this morning and continued for some hours - a most wintry aspect for the middle of May. Nearly thirty had slept under the roof, females and children being taken in from the tents around; on one occasion as many as thirty-five.

An evident decrease in the rise of the water, - a great mercy; for, had it continued at the same rate, a very few days must have driven us from our present refuge, and tents were being prepared in the expectation that we would yet have to pitch to. Mr. Taylor arrived in the evening and reported one boat-load of our property taken down to the Rapids; the boat to return on Monday for more should the rise continue.

May 16th (Sunday) A fine, cold morning. After breakfast, proceeded on horseback to the Little Mountain, and found that Captain Hill had made the necessary preparations, and selected a spot sheltered, as much as possible, from the north wind. Before me was a table, covered with a scarlet cariole cloth, by which I stood for service. The congregation formed in a semi-circle around, consisting of pensioners, their families, and other settlers, about 100 in all.

May 17th I started early in the canoe to visit my own house. In passing the Fort, called to see the Mayor and Mr. Black. At the Fort gate the current was terrific, and we entered with difficulty. Instead of the usual bustle of May - the most active month of the year - all was desolate; boats were within the quadrangle, and one taking in cargo from the upper windows of the store. Breakfasted with Major Caldwell, after which the rapidity of the current soon carried me to my own house.

On leaving the church tower, the boat went through the churchyard gate, and for some distance kept its course over the plains; but, on getting into the current of the river, the tide was so strong against us that we made but little head; and after trying for some time to stem it, to little purpose, I urged Mr. Hunter to return, and hailed my canoe, into which I jumped and got up in safety, through God's blessing. The waves were so high as almost to threaten to swallow us up.

May 18th A boat came to take some provisions and seed for our use above; but little, comparatively, could be done while the waves were so high, and the house so deep in water and difficult to pass through. The heavy porch of oak had floated off, and the boat was now moored close by the front door.

After a hard pull, we arrived in safety, but all were sadly afflicted at the loss of our valued and trusted cook. The rest of the day was spent in realizing the delight of being on dry land, and enjoying the pleasures which the unwearied kindness of our friends could afford.

May 19th (Indian Reserve near Selkirk) - All was energy around; we seemed to have passed to another atmosphere. Ploughing was going on on both sides of the river. In a walk before breakfast, saw the seed being committed to the ground; while, on the other side of the road, the wheat was already up. Seven ploughs were at work in one field, and five or six in another, those whose land was dry feeling the necessity of

Notes of the Flood at the Red River, 1852 4

May 19th (contd) cultivating on a larger scale. The children were engaged in clearing and preparing the little garden around the parsonage.

Submerged District - Mr. Chapman's account of the losses in his own district was appalling. The houses of two brothers had been entirely swept away, with their barns and wheat; while along a considerable space on the other side of the river there was not one house left standing.

May 21st The river still stationary. The height, on the whole, is certainly not so great as in the former flood, perhaps by about eighteen inches; but as the channel of the river is deeper and broader, and the creeks very much enlarged, there may be an equal volume of water. Delighted to find that the water had sunk an inch in my own house. I started to pass the night there. We had a most beautiful sail. The river was like that of a vast lake studded with houses, of many of which the projecting gable was the only part visible. The calmness of the evening gave an increasing hope; there was a young crescent moon, and the water was falling slightly in the house.

May 22nd A beautiful morning. There was still a decrease in the water; a flag was hoisted at Oak Lodge, a signal to give the good news, according to agreement, to those on the hill.

May 23rd (Sunday) Noticed the calmness and activity of the day. There was a better congregation, owing to the beauty of the day, between 250 and 300. The day was intensely hot.

May 24th Strange sights met our eyes as we proceeded. Some of the bridges we saw four miles below their former locality, and on the opposite side of the river. The railing round some of the graves of the Upper Church had also been carried down as far. A barn had been tied to a strong tree, to secure it, but it eventually floated off. The houses, many of them standing up to the eaves in water, showed less the destructive effects of the water upon them than some weeks after when the waters had retired.

Here (at Park's Creek, half way between the Middle Church and the Rapids) the current, from being confined within narrow limits, became more impetuous, and we had been strongly advised to proceed by land, but not being timid on the water, and having confidence in the skill of our three men, we preferred going on to the Rapids.

The rapidity of the current almost made one giddy to look at it, it was running at the rate of eight or ten miles an hour.

May 25th The breadth of the whole expanse was supposed to be, in some places, twelve miles, - this instead of our usual narrow river.

May 26th Went down to our house in the morning; gratified to find only twenty inches of water, instead of forty, in our rooms.

May 27th There was a little refreshing rain and a fine evening, when I took a gallop up to the Little Mountain. Had tea with Mr. and Mrs. Logan, and from them obtained what I had much desired, a copy of the "Missionary Register" for December, 1826, with Mr. Jones' account of the former flood.

May 28th The morning being more promising, the boat came, and we went up to survey the river above Sturgeon Creek, but a shower came on and prevented us from fully accomplishing our plan, and we returned home well drenched.

Notes of the Flood at the Red River, 1852 5

May 29th A lovely morning after the storm. The first sound that greeted me on awaking was the pleasing word "Pahstazoo" - It is dry. I went over to the church, entering still by the window, and found that the pulpit and reading desk had now regained their proper position.

May 30th (Whit Sunday) A morning of very heavy rain. It was doubtful for some time whether I could start for service, but the rain gradually lessened, and I determined to make the attempt.

May 31st The closing day of another month, in the language of the country, the flower month; tomorrow, the commencement of the heart-berry or strawberry month.

June 1st Rode up to the mountain to bid farewell. Beaver Creek boats passed down today.

June 2nd Rode up to Sturgeon Creek to see those there before leaving; a pretty spot, and large encampment. Many were out; all busy preparing for the departure of the boats.

June 3rd Started from St. James early with my family; left our kind friends with regret; we had a quick run down; the land is fast reappearing. The chief fear now is the slip of the bank; many houses are supported and propped up, lest the earth should launch forward and carry them away. Reached the parsonage at St. Andrews about five.

June 5th This morning we were surprised by Major Caldwell's arrival; his first visit down during the flood. The day was somewhat stormy.

June 7th Soon after we had dined, I started off by canoe for my own house to see Mr. Pridham once more before leaving for England. The chief feature which I noticed as novel was the pyramids of clay in front of the houses, as the people were shovelling out the mud left within from their chimneys having given way and fallen in. We were late in reaching the upper settlement, but on getting near the house we were so overjoyed at the sight of the stubble fields, which appeared dry to the eye, that we determined to try the land and make a short cut across. We soon repented our rashness, finding each step that we sunk deep in the treacherous mud.

APPENDIX 10

Extracts, relating to the flood of 1852, from "Mr. Black's* Private Journal, Upper Fort Garry, 1852".

1852

- April 1st During the whole of last month the weather has been very stormy with a great deal of snow and today there is a little appearance of spring, and indeed less, as regards temperature and the quantity of snow on the ground, than there was a month ago. The snow is now very deep and if we have a sudden thaw there will be a great deal of water on the ground.
- April 15th Weather rather chilly; thaw goes on very gradually freezing at night. Some fears of a flood not without some ground.
- April 25th Ice breaking up and drifting.
- April 28th Water rising rapidly; Lavalier's point covered today....
- May 1st Water in the river rising at about the rate of a foot every 24 hours - within about six feet of the level of the Fort.
- May 3rd The water still rises - about 4 inches last night - a good many people were obliged to quit their houses on the 1st and a good many more will have to abandon them today.
- May 6th The water still rises at about the rate of eight inches in the 24 hours, almost all the Pensioners are out of their houses.
- May 7th Finding the water still rising and being apprehensive of the plains being deluged from behind which would cut off all retreat except by water conveyance have today sent off to the Lower Fort all our horses, including the English horse and bull.
- May 8th Water still rising at the rate of between 8 and 9 inches in the 24 hours. Very near Fort now.
- May 9th The water still rising at the rate of 9 inches in the 24 hours. The water entered the Fort at the corner of the east bastion today. A great many people leaving their houses and flying to the hills.
- May 10th Water rose 5 3/4 inches in 12 hours. A great many houses and barns drifting down the river.
- May 11th From 3 P.M. yesterday to 7 A.M. today, the rise has been 6 inches or 3/8ths of an inch per hour. The water just at the front gate and afterwards creeping in. Luckily the weather is fine and warm. Sent out a boat to Pembina today for the relief of Mr. Setter who had but one boat and may be reduced to extremity as regards the Company's property and servants. At 12 noon the rate of advance of the water still on the increase.

* Chief Trader John Black

- May 12th Water still rising at about the same rate. Barns, houses and other property floating down.
- May 13th Water knee deep all over the Fort. Sent off a boat to the Lower Fort with hams, pemican and C. Passengers Mrs. Caldwell & family Mrs. Pelly & C. Loaded the boat in the Fort yard. The only dry spot within 4 or 5 miles all round is the little knoll in front. From 7 o'clock P.M. yesterday till 1 P.M. today the rise has been 10 inches in that thirty hours.
- May 14th Rate of rise decreasing - 2 inches being the rise during the last 12 hours; about half the former rate. Water beginning to appear on the house floor.
- May 15th From 7 A.M. yesterday to the same hour today the rise has been $6\frac{1}{2}$ inches - Snowing and blowing from the north, very cold. At 10 P.M. no increase, the water has been stationery since morning.
- May 16th From last night till noon today the rise has only been about $\frac{5}{8}$ ths (sic) of an inch.
- May 17th Since yesterday morning till this the rise has been about 10 inches, that being now the depth on the house floor. On the store floor it is 13 inches deep. The Pembina boat returned. Heard from Mr. Setter there that the water has been 6 feet 2 ins. deep around the house but that up to the 14th it had fallen 1 foot, 4 ins. a very favorable symptom for us here....
- May 18th Rise of water since yesterday about 2 inches. Still blowing hard from the North; very cold....
- May 19th Since yesterday the water has been stationary. Heard today of the fate of David Lowe the Bishop's servant who left his home in a batteau and has not since been heard of, we conclude he has been drowned.
- May 20th Water stationary.
- May 21st Since yesterday there seems to have been a fall of $\frac{1}{8}$ th of an inch.
May 22nd Fall from extreme height today 2 inches. Went to the Lower Fort today and returned in the evening; all the houses above Parks Creek abandoned. Water fearfully rapid, and no land to be seen.
- May 23rd Water fallen two inches since yesterday. Beautiful weather.
- May 24th Water down two inches more.
- May 25th Water again down two inches.
- May 26th Water still falling gradually - off the house floor today after being there 11 days. Sounded the channel of the river today; Red River 47 feet and Assiniboine 42.
- May 27th Water off the store floor today.

May 28th Water still falling
May 29thThe water continues to fall.
May 31st Water still falling and more rapidly.

(H.B.C. Archives B. 235/a/15, fos. 4d. -7)

APPENDIX II

Extracts, relating to the flood of 1852, from diary of Dr. William Cowan, Surgeon to enrolled Army Pensioners at Fort Garry.

April - 1852

<u>Day</u>	<u>Time</u>	<u>Wind</u>	<u>Temp.</u>	<u>Remarks</u>
21	6 AM	N.	30	Clear and cold. Few birds.
	Noon	N.	38	
	10 PM	N.	30	
22	6 AM	S.E.	28	Clear. Saw first two ducks. Cloudlets. Saw six geese. River rising very fast. Clouds from West.
	Noon	E.	49	
	10 PM	E by S	37	
23	6 AM	S.E.	32	Bright. River rose 14" last night. Ice still fast. Sky overcast. Circle around sun with prismatic colors.
	Noon	S.E.	44	
	10 PM	E.	34	
24	6 AM	N.E.	34	No rain. Sky dark. River up 2". Ice unmoved. Ice moved in both rivers.
	Noon	E.	51	
	10 PM	N.E.	32	
25	6 AM	E.	32	Clear. River up 3" last night. Ice moved for about an hour. Ice moved for about an hour.
	Noon	N.	44	
	10 PM	N.	32	
26	6 AM	N x W	30	Ice moving and stopping. Ploughing commenced. River rising.
	Noon	N.W.	48	
	10 PM	N.W.	35	
27	6 AM	N.	32	Both rivers pretty clear of ice. Cold. River rising hourly.
	Noon	E x N	40	
	10 PM	N.E.	33	
28	6 AM	S.E.	38	River rose 1 ft. during night. Ice commenced to move at 10 o'clock. River rising very fast. River rising about 1 1/2" per hour.
	Noon	S x E	58	
	10 PM	E x S	44	
29	6 AM	S.E.	42	River risen 9" since 7 PM. (28th). River rising 1" per hour. Raining. River rising same rate.
	Noon	S.E.	57	
	10 PM	S.E.	47	
30	6 AM	S.E.	41	Rain ceased. Overcast. River up 5". River up 6" since 6 AM. Overcast. Overcast. River rising 1" per hour.
	Noon	E.	54	
	10 PM	S x E	43	

M A Y - 1 8 5 2

<u>Day</u>	<u>Time</u>	<u>Wind</u>	<u>Temp.</u>	<u>Remarks</u>
1	6 AM	S.W.	40	Rain during night. Sky overcast. River up 5".
	Noon	E x N	55	River rising rapidly.
	10 PM	E x S	45	River up 1 ft. in 24 hours. Sky overcast.
2	6 AM	E x S	42	River up 7". A good number out of their houses.
	Noon	S.E.	62	Clear & blowing fresh. River rising rapidly.
	10 PM	S.E.	52	River rising rapidly. Inside the fort fencing.
3	6 AM	S x E	48	Clear. River up 3" last night.
	Noon	S.	63	River up 2½" since 6 AM. Dr. Bunn making rafts.
	10 PM	S x E	40	River up 2". Fields between the Fort and Red River almost all flooded. Talk of embanking the water out of the Fort.
4	6 AM	S.	48	Sky clear. River up 3½" since 9 PM (3rd). Pensioners leaving the Point houses and coming into Fort.
	Noon	S.	62	Cloudlets. River up 1-1/8" since 6 AM
	10 PM	S.E.	58	River up 7-7/8" since 9 PM (3rd).
5	6 AM	S.	55	River rising same as night before. Boats from Pembina report very high water. Higher than in Spring of 1850.
	Noon	S.	69	River up 2½" since 5 AM.
	10 PM	S x E	62	River has risen 4½" since 5 AM. Raining and overcast.
6	6 AM	S.	59	River up 3-3/4" during night. Rain ceased.
	Noon	S.	69	Blowing fresh. River rising rapidly. Many of settlers proper out with their cattle toward Mountain.
	10 PM	S.	55	River up 4½" today. River about 3 feet from level of Fort.
7	6 AM	W.	52	Cloudy. River rise in night 3-3/4".
	Noon	-	-	River rising same rate
	10 PM	N.W.	36	Cloudy. Blowing fresh.
8	6 AM	N.W.	40	River rose 4½" in night.
	Noon	N.W.	44	Captain has just started with two good men, Pensioners and families to camp at Little Bluff.
	10 PM	N.W.	35	River has risen today rather more than average. Night cloudlets.

M A Y - 1 8 5 2

<u>Day</u>	<u>Time</u>	<u>Wind</u>	<u>Temp.</u>	<u>Remarks</u>
9	6 AM	S.W.	46	Cloudlets. River risen 5-3/4" since night. River rising more rapidly than it has done since it rose over the banks. Water not more than a foot from level of Fort.
	Noon	-	-	
	10 PM	W.	57	River has risen more than 5" last 12 hours. Creeks will soon be overflowing the plains. Has already passed through surface drains into Fort. Sturgeon Creek rose one inch last night.
10	6 AM	W.	52	River has risen 5 1/2" in last ten hours. McNab's boat stopped for us opposite middle gate on way to Sturgeon Creek. Girl sick. River has run over between Tait's and Fraser's below Mr. Pruden's. Saw a barn float down the river entire. River rising now at the rate of 12" in 22 hours.
	Noon	N.W.	67	
	10 PM	N.	39	
11	6 AM	E.	46	Cloudlets. River has risen 6" since 3 PM May 10th -- diminished rate of increase. Old bastion at the point tilted over. River has entered Fort gate. River has spread over ground in front of Mayor's house. Pensioners now all out. I have packed up for removal tomorrow AM. River almost rose to be in 1/2 my rooms tonight.
	Noon	E x N	61	
	10 PM	E x S	54	
12	6 AM	S.	52	Up to eaves of houses. Boats brought into Fort. Bastion still standing. Have everything ready for removal. Water coming into room under doorsill. Strong current setting through fort and going out at small gate. Water rising about 1/4" per hour. Thunder. Heavy rain.
	Noon	S x W	Thermo- meter removed.	
	10 PM	S.	--	
13	6 AM	W.	--	River has risen about 4" last night. Judging by the eye. Warm, clear. Bastion still standing. Thunder and rain last night. Blowing fresh. Water about in Fort up to the knee. Plains look a sea.
	Noon	N.W.	--	
14	--	N.	--	River has risen less than usual last night. About 1/4". A good many people (3 tents) still on small knoll North of Fort.

M A Y - 1 8 5 2

<u>Day</u>	<u>Time</u>	<u>Wind</u>	<u>Temp.</u>	<u>Remarks</u>
15	--	N.E.	--	Blowing strong all night. Cold sleet. River risen about 5 $\frac{1}{2}$ " last 24 hours. Visited pensioners yesterday in a canoe - two tents on little knoll - dry ground diminishing. Miserable morning.
	Noon	--	--	Gale continues. River rose very little today - almost imperceptible.
16	--	N x W	--	River rose about 1/4" last night - River rose this day ? inch. Calm tonight.
17	--	S x W	--	River rose about 1" during night. Water 13" on shop floor. Sent down by the boat going to Lower Fort Dr. Rae's (?) books. Boat arrived from Pembina.
18	--	N.	--	Blowing fresh. Cold. River rose about 1" yesterday, and 1/2" during the night. Cloudlets.
19	--	--	--	River has risen very little last night, very nearly at a stand today. Cloudlets. P.M. rise today almost imperceptible.
20	--	S.	--	Warm. Water appears still at a stand. Wind N.W.
21	--	N.	--	Subsidence of water perceptible. Nearly 1/4" last night. Cloudlets. Boats going up to high ground at Burke's to be repaired. Great many swallows about the Fort.
22	--	S.W.	--	Water subsided about 2" since AM (21st). Number of waves passing over Fort. Cloudlets.
23	--	S.W.	--	Fine. River fallen about 1" in 12 hours.
24	--	N.E.	--	Warm. River falling. Water has subsided very much today.
25	--	S.E.	--	Warm, clear, water still falling rapidly about 1" on floor.

M A Y - 1 8 5 2

<u>Day</u>	<u>Time</u>	<u>Wind</u>	<u>Temp.</u>	<u>Remarks</u>
26	--	N.E.	--	Calm. Water has left the floor of house. Helped Mr. Black to wash it out. Great deposit of mud. Today Magnus sounded both rivers. R.R. 47 feet, Assiniboine 42 feet. Adding 1½ feet for fall now 48½ and 43½.
27	--	N.E.	--	Fresh. Cloudy. Spot of dry land inside fencing. Water falling about one inch in 12 hours. Platform in front of house awash. My rooms cleared out. About 6" still on floor of my room. Water off shop floor.
28	--	S.E.	--	Light breeze. Sky overcast. Water still falling about same rate. Plains appearing green again.
	PM	--	--	Raining. Blowing fresh - N.E. Cold.
29	--	--	--	Water fallen considerably. My room cleaned out.
30	--	--	--	No remarks.
31	--	S.E.	--	Warm

J U N E - 1 8 5 2

1	--	--	--	No remarks.
2	--	--	--	Removed to my own room last night.
4	--	--	--	People returning to houses.
5	--	--	--	Water said to have fallen a foot last night.
6	--	--	--	Wind North. Thermometer 60. Thermometer now in my room. Blowing fresh. Rain.

APPENDIX 12

Extracts, relating to the flood of 1852, from a letter by Chief Factor Donald Ross dated July 2, 1852, at Red River Settlement to Sir George Simpson.

".....Nothing could be more quiet and prosperous than the state of the settlement till the unfortunate flood of this spring overwhelmed everything in wreck and ruin. The flood is now gone and all those whose houses remained have returned to them.

(H.B.C. Archives D.5/34, Fos. 21d.)

APPENDIX 13

Extracts, relating to the flood of 1852, from a letter by Chief Factor James Bird dated July 6, 1852 at Red River Settlement to Sir George Simpson.

".....We have only lately returned from the hill whither the flood drove us with much discomfort and where I had some difficulty in withstanding the urgent persuasions of Mrs. Bird to leave the country altogether and spend the rest of our days in Old England. This prospect is now given up and we are preparing to pass another year here as comfortably as we can, depending for food principally like many others, on the hoard of former years. My land like that of all above Parks Creek was not dry soon enough to admit of our sowing wheat, some by the bye have been vigilant enough to sow a good deal, which promises well in the high lands the hill, but we exerted ourselves to get down barley which as tho' things must be untoward the Grubs are totally destroying.

(H.B.C. Archives d.5/34, fos. 49-49d.)

APPENDIX 14

Extracts, relating to the flood of 1852, from a letter by Governor Eden Colville dated May 18, 1852 at Lower Fort Garry to Archibald Barclay, Secretary.

".....I have much regret in informing you that the Settlement has been visited by a very serious calamity from the waters having risen to a height nearly equal to that attained in the disastrous year 1826. As far as I can learn, the water on that occasion only exceeded the present elevation by two feet. More than three fourths of the population have been compelled to leave their houses, and betake themselves to the nearest ridges with their cattle and sheep. In the greater part of the settlement, there will not be a stick of fencing left, and many houses, barns and stables have been swept away. At the Upper Fort, which is on the highest ground in that vicinity the water yesterday stood ten inches on the floor of the main house, and about fourteen inches in the sale shop. Fortunately the rise has been gradual, varying from 5 to 11 inches a day, which gave us ample time to remove all the property to the upper floors, and I do not anticipate any loss whatever on the goods, produce, or returns in store; but I imagine that the buildings will incur some damage, and all the fences round the fort will be carried away. I have great hopes that the water has attained its height, or nearly so; as from 6 a.m. on 15th to 6 a.m. on 17th inst. the rise was only $3\frac{1}{2}$ inches, say $1\frac{1}{4}$ inches per day, while the day before it had risen about ten inches. I sincerely trust, therefore, that I shall not be called upon to report any serious loss of the Company's property, though it is clear that the Settlement has sustained a blow, that it will not recover for years; nor can I look forward to next winter without serious apprehension. The whole of the farms from the upper lots in the Main River to within eight miles of this establishment are at this moment covered with water to the depth of several feet, and in this neighborhood the low points, which are the best adapted to raising wheat, are also flooded, nor is there any prospect of the waters abating sufficiently soon to allow of wheat being sown. In this section every field will be sown with wheat, and I trust that we may be blessed by an abundant harvest. In the remainder of the settlement we can only hope that the waters will subside, so as to allow the settlers to sow barley and plant potatoes. We have also a good reserve of wheat on hand, say 16000 bushels, and I think the Scotch settlers will be able to secure nearly equal to a year's consumption for themselves, while the more improvident Canadians and half breeds will have in a great measure to trust to the produce of the gun and the net. On the whole, though we cannot fail to have much destitution in the course of the winter, I think, with an average season, and productive fisheries in the fall we shall not have an actual famine.

20 May. By late advice from Pembina we learn with much satisfaction that the water had fallen sixteen inches, and at this place it has been now stationary for 24 hours, so that I think we may soon expect the subsidence of the waters. I regret to have one fatal casualty to report - one David Low, servant to the Bishop of Rupert's Land, who was drowned by the upsetting of his canoe. We had some difficulty in persuading the Pensioners to leave the Fort in sufficient time, but they are all encamped on a ridge about 8 miles from the Upper Fort in company with Captain Hill, and by the last accounts were all doing well.

APPENDIX 15

Extracts, relating to the flood of 1852, from "Flood of 1852 by Abbey Leonide Primeau, Annual Chronicle, 1852. Pages 175-176-177.

In reading the chronicles of the Grey Nuns of St. Boniface, one cannot overlook the tale of the flood of 1852, of which we have taken the following extracts on the occasion of the centenary of their arrival in St. Boniface.

In the month of April, the ice broke, and caused considerable damage as the water kept rising. The banks overflowed into the prairies, and it was almost a total flood.....

The water continued to rise until the 20th of May, covering the ground with five feet of water. We had more than $1\frac{1}{2}$ feet of water on the first floor; we were like a vessel at sea. When the wind stirred up this mass of water, the waves broke so violently on the walls of our stationary ark that it was tottering. During the night of the 16th and 17th of May, the wind raged so strongly that we expected to be wrecked, our haven shook so hard. Monseignor and his priests lived in the Archbishop's house, surrounded by water.

On the afternoon of the 12th, we had to evacuate the first floor as water was beginning to penetrate everywhere. Our dear Mother Valade had the floor pierced so that it would not be lifted from the beams.

On the 19th of May, the water started to go down. It was a ray of hope. The water kept going down slowly. We watched it go down with a great satisfaction. At last, on the 1st of June, the water was off the first floor, and we took possession of our kitchen and dining hall. We then started the huge cleaning job of our chapel. It did not take us long to be able to return our divine Host to his little domain.

The 4th of June, the R.P. Bermond was able to celebrate the holy sacrifice. Finally, the 6th of June, the earth was free of its liquid garment.

* * * * *

APPENDIX 16

Extracts, relating to the flood of 1852, from the letters of Mgr. Provencher.

Flood of 1852

The family of Lagimoniere knew another great flood, the one of 1852. This is how Mgr. Provencher tells of this flood:-

"Dear Lord, our sins have angered Heaven. A flood as terrible as the one of 1826 has come and ruined our already poor country.

The wake of this disaster has carried away homes, granaries, stables, bridges, fences, with a great loss of household goods. There were 5 feet of water around my house. Another two or three inches and it was on my floor. I did not leave. I was as one on a vessel on the ocean. Day and night, I could hear the waves, whipped by a strong wind, beat against the walls of my house. The water kept rising until the 20th of May.

The people and livestock have taken refuge far out in the prairies. There was no loss of life. Only by the end of June were we able to sow some barley and potatoes. All will ripen if God gives us a favorable season.

The water had risen, we were told, about one foot to 18 inches below the crest of 1826. It has caused a great deal more damage because the population is now much larger. Some grain was lost. My home and the church served as public shelters, as all other houses were in danger of being carried away by the water. What a sad perspective for next year."

* * * * *

APPENDIX 17

Extracts, relating to the flood of 1861, from a letter dated at Fort Garry, May 1, 1861 by W. Mactavish, Acting Governor of Rupert's Land to Thomas Fraser, Secretary.

".....I regret to have to inform you that the Settlement has again been visited with a flood, which, though so far, it has not been so destructive as that of 1852, will very much injure the prosperity of the place, in the beginning of last month the thaw set in very suddenly, and from the great quantity of snow which fell last winter the whole country was soon literally under water, about three weeks ago, the Red River commenced rising here, and has continued to do so steadily till within the last few days when the rate of rise moderated a little, it is still however from 5 to 6 inches in the 24 hours. At present all the settlers above this on the Red River, have been driven from their houses by the water, many of them having from 5 to 6 feet of water on their lower floors. Great numbers of the settlers as far down as the Middle Church have also been obliged to abandon their houses and retire to the high ground behind with their cattle. The water is now disagreeably close to the front and side walls of this Establishment, and the whole point below is so deeply under water that our fencing is in many places very nearly covered. As yet I have not learned that any of the settlers houses have been carried off, but a very great deal of their fencing has been swept away. It is to be feared that in the inundated portion of the Settlement there will be no wheat sown this season, this will cause a great deal of suffering particularly among the Canadian portion of the population, who generally have no stock of grain on hand."

(H.B.C. Archives A.11/96, fo. 559d.)

APPENDIX 18

Extracts, relating to the flood of 1861, from a letter dated at Fort Garry, May 16, 1861 by W. Mactavish, Acting Governor of Rupert's Land, to Thomas Fraser, Secretary.

".....I am happy to be able to inform you that the water has fallen here considerably no part of this Establishment with the exception of the cellars has been under water, though it was very near being so. The damage done to the Settlement has not been by any means so great as that occasioned by the flood of 1852, partly from the water this season not having been so high by from 3 to 4 feet as it was at the last flood, but also from the Settlers, having been warned by the experience of 1852, taking decided measures to save their property from the commencement of the rise of the River. Many, however, 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."

(H.B.C. Archives A.11/96, fo. 569d.)

APPENDIX 19

Extracts, relating to the flood of 1861, from Transactions of the Manitoba Historical Society Series III - Number 3, 1947. "Floods at Red River - S.P. Matheson."

"For the records of the two floods which I have described, I have had to depend upon the notes which I have gathered from those who were here when they occurred. In 1861, however, there was an inundation of which I was an eye-witness, though I was only a small boy. It was only of a partial extent and did not cover nearly as large an area as the two previous ones. The fact is, these succeeding floods seem to have grown less, both in extent and in their destruction, as time went on, which is an encouraging feature bearing upon the possibility of any recurrent ones. That of 1861 appears to have made so small an impression on the public that I have searched in vain for any reference to it in the histories covering that period. Only the low lying lands were affected, and as far as I can recollect, not many houses were flooded. In portions of Kildonan and Middlechurch considerable inconvenience to the inhabitants was caused, with the result that homes were abandoned and a good many people migrated as they did in '26 and '52 to the higher lands."

APPENDIX 20

Extracts, relating to the flood of 1882 and comparison with other floods, from Manitoba Daily Free Press, May 6th, 1882.

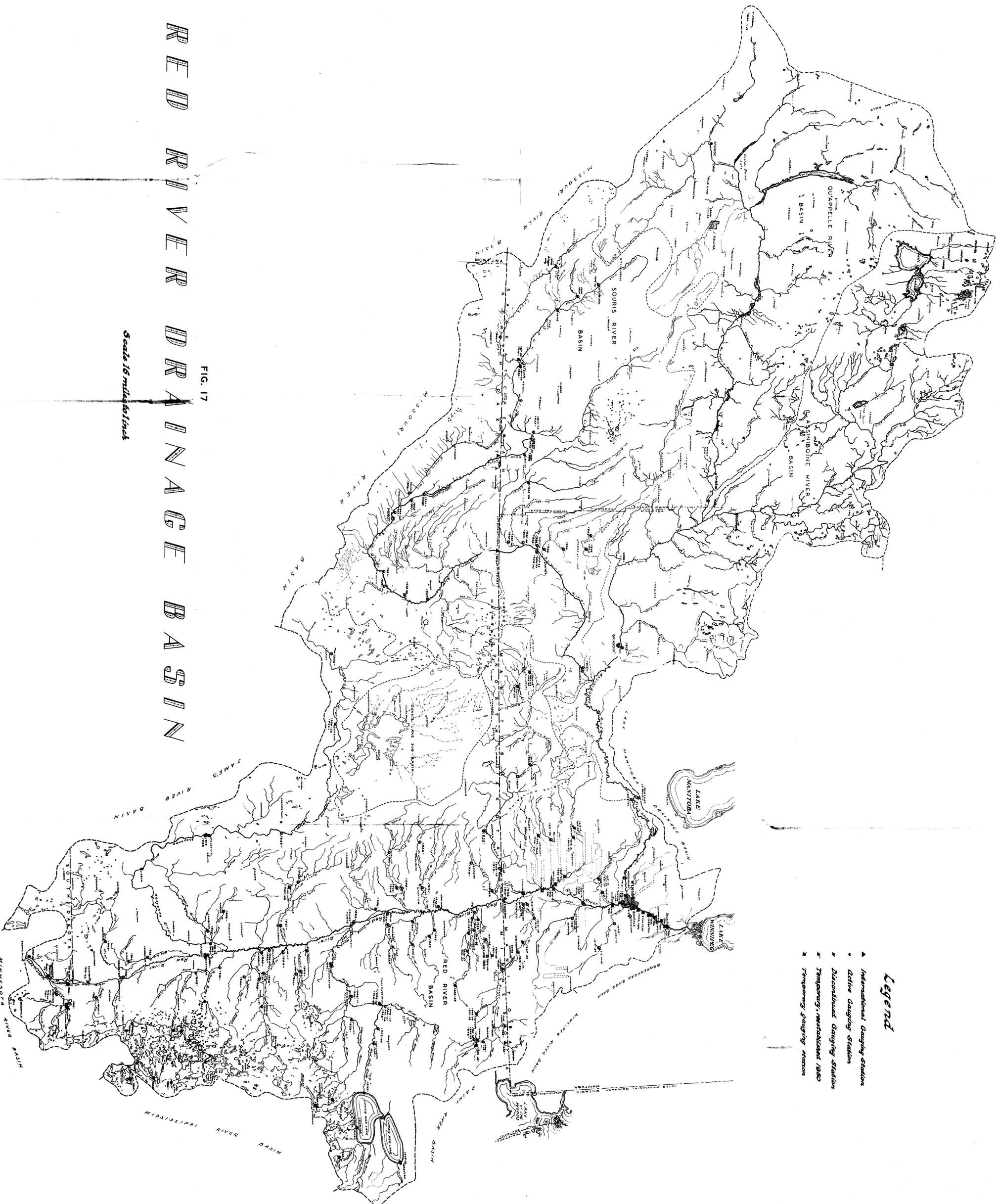
The Red River at the foot of Broadway was, at noon Wednesday, 6 feet, 6 inches, lower than the flood of 1861; 8 feet, 9 inches, lower than the flood of 1852, and 10 feet, 9 inches, lower than the flood of 1826. In this connection we might mention the following extracts from an old diary which were made some time ago by Mr. A. McArthur. In 1826 the flood began early in May. May 4th, water came into the Upper Church (St. John's). The people removed to Snake Indian Hills (Stoney Mountain), where they remained until June 12th. Only three houses were left standing in the settlement. In 1852 the ice broke on the 28th April. The winter had been fine until the end of February, and there had been much snow during March. May 2nd water rising; people alarmed; snow and sleet. May 9th, water at the corner of the Churchyard St. John's. May 12th, house still dry; water entering hall. May 19th, water at a standstill. Highest point reached, 40 inches in the Bishop's house. May 21st, water receding. May 26th, water down to 20 inches in the Bishop's house. June 1st, flood abated in the Upper Church; weather very hot. The church was closed altogether five weeks. The people went out to Little Stoney Mountain and St. James (Silver Heights), the latter locality being dry, as well as the former.

APPENDIX 21

Extracts, relating to the flood of 1882, from The Manitoba Free Press, April 27, 1882.

A reconnaissance party on April 27, 1882, left Emerson by boat to determine the reason for high water at Emerson - thought to be ice jams.

"The party report very high water all along the river. The banks of the river from Emerson to Morris are very low and all the houses are flooded. At St. Jean Baptiste, as far as the eye can reach, nothing was to be seen but one broad expanse of water. North of Morris the banks are higher and the dwellers along the shore did not seem to be suffering from the floods at all. When they left Emerson there was scarcely a place of business in town that was not flooded, and the principal mode of transport was by means of boats, the water having reached as far up as First Street.



RED RIVER DRAINAGE BASIN

FIG. 17

Scale 16 miles/kilometers

Legend

- ▲ International Gauging Station
- Active Gauging Station
- ◻ Discontinued Gauging Station
- * Temporary, established 1963
- ✕ Temporary gauging station