Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

- [x] Coloured covers / Couverture de couleur
- [ ] Covers damaged / Couverture endommagée
- [ ] Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- [ ] Cover title missing / Le titre de couverture manque
- [x] Coloured maps / Cartes géographiques en couleur
- [x] Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- [ ] Bound with other material / Relié avec d'autres documents
- [ ] Only edition available / Seule édition disponible
- [ ] Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- [ ] Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

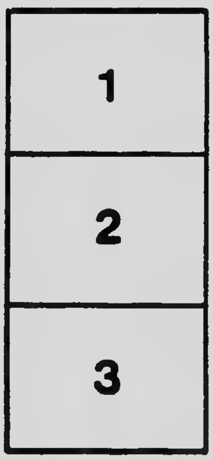
- [ ] Coloured pages / Pages de couleur
- [ ] Pages damaged / Pages endommagées
- [ ] Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- [ ] Pages detached / Pages détachées
- [x] Showthrough / Transparence
- [ ] Quality of print varies / Qualité inégale de l'impression
- [ ] Includes supplementary material / Comprend du matériel supplémentaire
- [ ] Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- [ ] Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

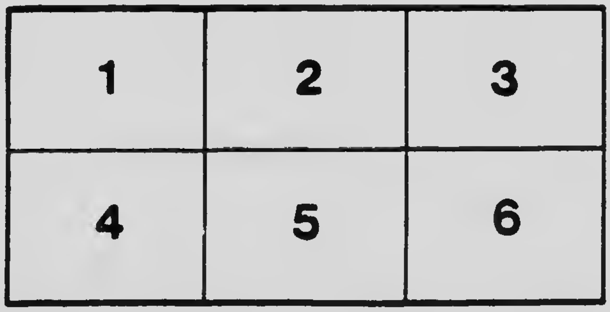
- [x] Additional comments / Commentaires supplémentaires: Page 136 is incorrectly numbered page 36.

This item is filmed at the reduction ratio checked below /
Ce document est filmé au taux de réduction indiqué ci-dessous.

10x		12x		14x		16x		18x		20x		22x		24x		26x		28x		30x		32x
															✓							

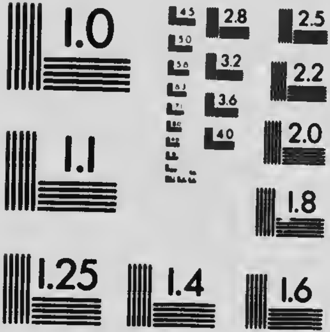

1
2
3


1
2
3


1
2
3
4
5
6

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



Pigeon River, Shining Falls.

DEPARTMENT OF THE INTERIOR—CANADA

Hon. W. J. ROCHE, Minister. W. W. CORY, Deputy Minister.

DOMINION WATER POWER BRANCH,

J. B. CHALLIES, C.E., Superintendent.

PROGRESS REPORT

OF THE

MANITOBA HYDROGRAPHIC SURVEY

FOR

THE CALENDAR YEARS 1912 - 13 - 14

BY

M. C. HENDRY, B.A.Sc.

OTTAWA

PRINTED BY J. de L. TACHÉ, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY

1916

25F—1916]—1½

To Field Marshal, His Royal Highness Prince Arthur William Patrick Albert, Duke of Connaught and of Strathearn, K.G., K.T., K.P., etc., etc., etc., Governor General and Commander in Chief of the Dominion of Canada.

MAY IT PLEASE YOUR ROYAL HIGHNESS:

The undersigned has the honour to lay before Your Royal Highness the Manitoba Hydrographic Survey Report for the calendar years 1912-13-14.

Respectfully submitted,

W. J. ROCHE,
Minister of the Interior.

OTTAWA, May 31, 1915.

DEPARTMENT OF THE INTERIOR,

OTTAWA, May 31, 1915.

The Honourable W. J. ROCHE, M.D.,
Minister of the Interior.

SIR,—I have the honour to submit the Manitoba Hydrographic Survey Report for the calendar years 1912-13-14, and to recommend that it be published as Water Resources Paper No. 4, of the Dominion Water Power Branch.

I have the honour to be, sir,

Your obedient servant,

W. W. CORY,
Deputy Minister of the Interior.

DEPARTMENT OF THE INTERIOR,

DOMINION WATER POWER BRANCH,

OTTAWA, MAY 31, 1915.

W. W. CORY, ESQ., C.M.G.,
Deputy Minister of the Interior.

SIR,—I have the honour to submit the attached report on the Manitoba Hydrographic Survey for the calendar years 1912-13-14 by M. C. Hendry, B.A.Sc., Chief Engineer.

In view of its important bearing on the industrial development of Manitoba, I would recommend that it be published as Water Resources Paper No. 4, of the Dominion Water Power Branch.

Respectfully submitted,

J. B. CHALLIES,
Superintendent.

WINNIPEG, May 31, 1915.

J. B. CHALLIES, ESQ.,
Superintendent, Dominion Water Power Branch,
Department of the Interior,
Ottawa, Ont.

SIR,—I have the honour to submit herewith the manuscript of the Progress Report of Stream Measurement, Manitoba Hydrographic Survey.

This report covers the hydrographic work carried on by this Survey since its organization in 1912 up to the end of 1914. I would request that it be published as one of the Water Resources Papers of the Dominion Water Power Branch.

In submitting this report, I wish to acknowledge the loyal and efficient assistance of all members of my staff in collecting and arranging the data herein compiled.

I have the honour to be, sir,

Your obedient servant,

M. C. HENDRY,
Chief Engineer.

TABLE OF CONTENTS.

PART I

	Page.
Introduction	3
Organization and Scope	4
Districts	5
Definitions and Terms	12
Convenient Equivalents	11
Methods of Determining Discharge	14
Slope Method	15
Weir Method	16
Velocity Method	17
Chemical Method	17
Methods of Determining Mean Velocity	18
Float Method	18
Current Meter Method	19
Determination of Mean Velocity by Current Meter	20
Vertical Velocity Method	20
Three Point Method	20
Two Point Method	20
One Point Method	20
Integration Method	22
Winter Measurements	22
Metering Stations	24
Bridge Stations	24
Cable Stations	24
Cable Carrier Stations	25
Wading Stations	25
Boat Stations	25
Preparation of Data	25
Stout Method	26
Bolster Method	26
Explanation of Data	27
Acknowledgments	27
Summary and Recommendations	28

PART II.

HYDROGRAPHIC DATA.

Lake of the Woods Tributaries and Outlets	31
Rainy River	31
Kettle Falls	33
Fort Frances	38
Emo	41
Beaudette	45
Lake of the Woods Outlets	46
Eastern Outlet	46
Western Outlet	59
Mill "A" Headrace	65
Mill "C" Headrace	70
Keewatin Lumber and Mfg. Co's Headrace	73
C. P. R. Culvert, Mink Bay	76
War Eagle Outlet	77
North Tunnel Island	78
Combined Discharge of Outlets	88
Winnipeg River and Tributaries	91
Winnipeg River	91
Minaki	93
Throat Rapids	250
Dalles	250
Whitedog Falls	94
Slave Falls	101
Otter Falls	109
Pinawa Channel	116
Grand du Bonnet Falls	129

	Page.
English River	250
Whiteshell River	251
Whitemouth River	130
Red River and Tributaries	135
Red River	135
Emerson	136
Below Emerson	141
Elm Park Bridge	142
Redwood Bridge	143
Pembina River	144
Roseau River	146
Rat River	155
Seine River	252
Assiniboine River and Tributaries	161
Assiniboine River	161
Millwood	161
Brandon	166
Headingly	170
St. James	174
Shell River	178
Birdtail Creek	181
Little Saskatchewan River	185
Souris River	192
Cypress River	196
Pipestone Creek	197
Tributaries of Lake Winnipegosis	198
Red Deer River	198
Erwood	198
Hudson Bay Junction	199
Swan River	202
Mossy River	207
Fork River	213
Valley River	214
Ochre River	219
Tributaries of Lake Winnipeg from the West	225
Saskatchewan River	225
Pas	225
Head of Grand Rapids	231
Fairford River	235
Tributaries of Lake Winnipeg from the East	237
(1) Brokenhead River	237
(2) Manigotagan River	242
(3) Berens River	246
Nelson River	247
Miscellaneous Meterings	249

PART III.

Gazetteer of Lakes and Rivers 257

LIST OF ILLUSTRATIONS.

	Page.
Pigeon River, Shining Falls	Frontispiece.
Keewatin, M.H.S. Evaporation Station. Meteorological Instrument Shelter	6
Keewatin, M.H.S. Evaporation Station	7
Automatic Gauge House, Kenora—Interior View..	7
Lake of the Woods, Western Outlet—North Tunnel Island Metering Station	9
Winnipeg River, Little Du Bonnet Falls	13
Winnipeg River, Whitedog Falls. Meter Section on North Channel	13
Winnipeg River, Second McArthur Falls..	21
Winnipeg River, Slave Falls. Metering Section	21
Winnipeg River, Slave Falls. Cable Car Station	32
Roseau River, Dominion City. M.H.S. Gauge	32
Brokenhead River, Sinnot. Bridge, showing Gauge.	49
Whitemouth River at Whitemouth. Gauge at Bridge	59
Whitemouth River at Whitemouth. M.H.S. Bench Mark	6[illegible]
Assiniboine River, Brandon. M.H.S. Bench Mark......	69
Assiniboine River, Brandon. Gauge at Bridge.	81
Assiniboine River, Headingly. Meter Section at Bridge	92
Souris River, Wawanesa. Meter Section at Bridge	92
Fairford River, Fairford. Meter Section at Bridge, 1912	101
Berens River, First Rapids above Eleventh Falls.	115
Berens R[illegible]er, Eleventh Falls	115
Berens [illegible], Twenty-Ninth Falls.	126
Pigeon R[illegible], Sturgeon Falls.	129
Bloodvein River, Fourth Rapids.....	150
Manigotagan River, Meter Section. Outlet Moose Lake	162
Nelson River, Manitou Rapids. Meter Section, Summer Conditions..	183
Nelson River, Manitou Rapids. Meter Section, Winter Conditions	183

MAPS AND PLATES.

		To face page.
	Index Map........	16
Plate	1.—Winnipeg River Basin....	32
"	2.—Winnipeg River, Location of Metering and Gauging Stations	48
"	3.—Red River Basin	144
"	4.—Assiniboine River Basin....	160
"	5.—Drainage area tributary to Lake Winnipegosis	208
"	6.—Saskatchewan River in Manitoba..	224
"	7.—Saskatchewan River Drainage area....	224
"	8.—Rivers tributary to Lake Winnipeg from the East	240

PROGRESS REPORT

OF

THE MANITOBA HYDROGRAPHIC SURVEY FOR 1912-13-14.

PART I

PART I.

PROGRESS REPORT OF THE MANITOBA HYDROGRAPHIC SURVEY FOR THE CALENDAR YEARS 1912-13-14.

INTRODUCTION.

The inception of the work of the Manitoba Hydrographic Survey was a natural consequence of the hydraulic power investigations commenced in Manitoba by the Dominion Water Power Branch in 1911. The institution of these investigations rendered imperative hydrographic studies of the rivers in the province, as prior to 1911 the collection of such data along systematic lines had nowhere been undertaken. Under ideal conditions the gathering of hydrographic data should precede the study of rivers from a power or other standpoint. Under the above circumstances it was necessary that the investigations of the streams for discharge and power should be carried on simultaneously.

The gathering of hydrographic data is of prime importance, not only from a hydraulic power standpoint, but also in connection with other uses of the surface water supply. These various uses may be enumerated as follows:—

1. Domestic, municipal and manufacturing purposes.
2. Irrigation.
3. Water-power.
4. Drainage.
5. Sewage Disposal.
6. Navigation.
7. Flood Prevention.

In the province of Manitoba, information regarding stream flow or surface water supply is or may be required for any one of these uses. Throughout the province, numerous towns and villages are depending upon the rivers for their domestic water supply; this demand will rapidly grow as the population increases, and further information in regard to the amount of water available will be required. In the southwestern part of the province, where the average annual rainfall varies between 14 and 17 inches, and where agriculture is the chief pursuit, the use of water for irrigation purposes is to be expected. Many of the rivers throughout the province present power possibilities, and studies have been made to determine their probable economic value. The true value of these potential water-powers cannot be determined without a thorough knowledge of the water available in the streams, especially under conditions of low discharge. In the northern and southwestern portions of the province the reclamation of large tracts of lands by drainage may profitably be undertaken. As settlement becomes more dense the necessity for the reclamation of these lands will become more pressing; it is essential, therefore, that accurate information concerning the regimen of flow of streams forming the natural outlets for such drainage be obtained.

The use of the streams of the province in connection with sewage disposal will, at no distant date, command attention since the rapid growth of the towns and villages will soon render necessary the formulation of a policy relative to the disposal of their waste in such a manner as will obviate any possible danger to the community as a whole. In order that this question may be handled intelligently, a thorough knowledge of the run-off conditions of the streams is of extreme importance.

Several of the main rivers in the province might be utilized for navigation purposes; in fact, before the advent of the railway in Manitoba, the Red river formed the only means of communication with the outside world. Improvement for navigation purposes is being urged in many quarters, and for this purpose a study of the hydrology of these streams is necessary.

Owing to the fluctuation of stream flow, not only from day to day but from month to month and from year to year, and the effect that such variation may have upon any one of the uses to which the streams may be adapted, it is imperative that the gathering of stream flow data be made to extend over a considerable term of years, so that a true idea of the stream regimen may ultimately be formed.

ORGANIZATION AND SCOPE.

When the Manitoba Hydrographic Survey was organized early in 1912, it was decided that the work should be carried on in as comprehensive a manner as possible, and that as funds became available and the opportunity offered, the work should be extended to embrace the whole of the province of Manitoba. At its inception, however, the district in which stream flow data were particularly required was that tributary to the Winnipeg river as surveys were being carried on to determine the power possibilities of that river. Mr. Douglas L. McLean, under whose direction these power investigations were being carried out, was placed at the head of the survey. Office quarters were secured in Winnipeg, and office equipment, supplies, and the necessary outfit for field work assembled. Several engineers who had been employed on the Winnipeg River work were detailed to the Hydrographic Survey, and the work of stream flow investigation was instituted. Since the organization of the survey the work has been extended from time to time until it now covers all the principal rivers of the province.

Mr. McLean resigned from his position in October, 1913, in order to accept a position on the construction staff of the Greater Winnipeg Water Supply project, and the work was thenceforth energetically carried on until the following June by Mr. S. S. Scovil, Assistant Chief Engineer. Upon the writer taking charge of the work, Mr. Scovil was transferred to Ottawa, being placed in charge of the run-off and storage studies undertaken by the Lake of the Woods Technical Board, in connection with the Lake of the Woods Reference before the International Joint Commission.

In organizing this work, it was recognized that probably the best and most comprehensive methods for gathering hydrographic data were those employed by the Water Resources Division of the United States Geological Survey. Through the courtesy of the officers of that organization, studies were made of their field and office methods, both districts covered by their engineers and at the head office in Washington. The work was then mapped out and has since been carried on along lines closely following the practice of the United States engineers.

The different streams to be studied were investigated and suitable locations selected for the establishment of metering stations, the selection of the stations depending upon the physical features and the need of data in that particular locality. At these metering stations, gauges were also established and the services of some person living in the locality were secured to read the gauge daily. These daily observations are recorded in a book provided for the purpose and examined by the engineer on each of his trips to the station. The readings as entered in the book are transferred to cards by the gauge reader, and are forwarded weekly to the chief engineer. From a study of these readings and the meterings, the daily discharges are arrived at.

On the organization of the Manitoba Hydrographic Survey the work of the Winnipeg River Power Survey was merged with it. Since then all investigations, whether hydrographic, storage, power, or river improvement, have been carried on under the one central control. By this arrangement the work naturally falling within the scope of the survey has been carried on efficiently and systematically. Conservation investigations for power and storage are being dealt with in a comprehensive manner with a view to determining the best use of the available water supply.

In gathering the stream flow data it is believed that the results obtained are sufficiently accurate for all practical purposes; the aim being not so much to concentrate on a few streams and so obtain records of extreme accuracy, but rather to spread the effort over a wide territory and so serve as many purposes as possible without unduly sacrificing the accuracy of results. In this connection it is essential that the records, in order that they may properly cover all possible range in stage of the rivers investigated, should extend over a considerable term of years. On some streams this term should be from five to ten years, while in other cases it should extend over a much longer period, say from ten to twenty years. The length of term will depend largely on the character and relative importance of the stream and the possibility of estimating the discharge by comparison with records of other streams in the vicinity. To quote from an authority on this subject, "the object should be to gauge a certain number of streams at all seasons of the year so as to ascertain their total discharge and its seasonal distribution, also to gauge others at certain stages which have been determined to be critical points in their regimen." It may be stated here that the standpoint taken by the United States Geological Survey is, that owing to the constantly changing flow of the streams, data of reasonable accuracy showing the distribution of flow over several consecutive years, are of more importance than very accurate measurements covering short periods of time.

Care should be exercised in drawing conclusions from the data published herein, owing to the limited period over which most of the records extend, and the fact that these records are often unsupported by any earlier observations.

DISTRICTS.

During the first year that the hydrographic work was carried on, some twenty-six regular stations were established at which data were collected throughout the year; forty-one others were located at which miscellaneous readings were secured throughout the summer. From time to time during the past three years, these stations have been revised and others established. In the light of fuller information, it was found desirable to change the location of certain stations so as to increase the value of the data gathered. Owing to transportation difficulties met with in connection with the operation of others, changes have been made which without making for greater accuracy have rendered stations more accessible. In other cases, it has been deemed advisable to discontinue a station entirely owing either to overlapping or to the fact that the information could be obtained indirectly from some other station.

During the first year following organization, attention was concentrated as much as possible on that portion of the country tributary to the district covered by the water-power investigations, and practically all of the permanent stations then established are located in that drainage area. The miscellaneous stations established were spread throughout the province with a view to instituting the work and at the same time ascertaining the desirability of permanent stations in the several localities. Whenever their value has been established, stations have, as far as possible, been located, though owing to the pressure of other branches of the work it has not been possible to carry out this policy to as great an extent as is desired.

In dealing with the work of the survey, the territory covered, due principally to geographic conditions, falls naturally into several main divisions. From time to time the work in these several divisions may be extended, since up to the present time only the principal streams have been examined. The divisions may be enumerated as follows:—

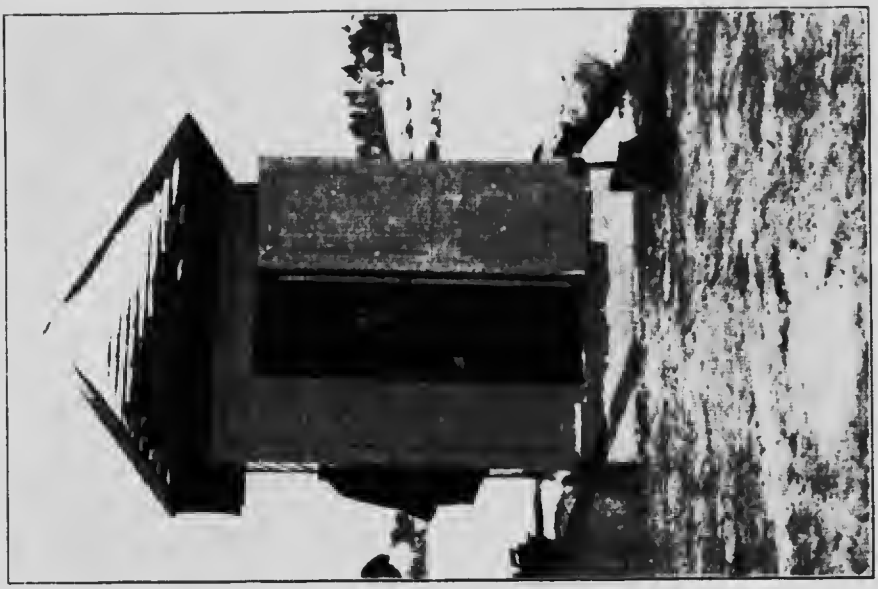
1.—Lake of the Woods tributaries and outlet.
2.—Winnipeg river and tributaries.
3.—Red river and tributaries.
4.—Assiniboine river and tributaries.
5.—The district to the west of lake Winnipegosis, including the Saskatchewan river and its tributaries.
6.—The east shore of lake Winnipeg.
7.—The Nelson river.

Keewatin, M. H. S. Evaporation Station. Meteorological Instrument Shelter.

Lake of the Woods Tributaries and Outlet.

The lake of the Woods district comprises all that territory lying above the outlets of the lake, and includes the lake of the Woods, Rainy river, Rainy lake and tributaries and Namakan lake and tributaries. This district forms the chief source of the Winnipeg river, and as it has a very important bearing on the power reach of the river below the outlet, a number of stations were established, the principal ones being at the outlets of the lake of the Woods. Meterings on the Rainy river at International Falls were made in conjunction with the United States Geological Survey, while stations were established and maintained by this Survey at the outlets of Namakan lake. Besides these, some ten or twelve stations were established on the smaller rivers tributary to the lakes.

Owing to the power studies being made on the Winnipeg river, and the need of information relative to regulation, a knowledge of the hydrology of these rivers and lakes was of prime importance. The work instituted in the first year of the survey has therefore been vigorously continued, but with one or two



Automatic Gauge House, Kenora. Interior view.

Keewatin. M. H. S. Evaporation station.

important changes. About the time that the work was instituted a reference was made to the International Joint Commission in connection with the regulation of the level of the lake of the Woods. As there are many interests involved in this regulation, and since it is not only an international but also an interprovincial question, several Provincial and Dominion Governmental Departments have been consulted and required to furnish data. These data are principally along hydrological lines so it was necessary to make some divisions of the work. Under the arrangement made, the Manitoba Hydrographic Survey confined its operations to the gathering of data in the vicinity of the outlets of the lake of the Woods. Above that point all the data are being collected by the other departments referred to. These data which are made available to the consulting engineers of the International Joint Commission are of considerable volume, and necessitate keeping an engineer and an assistant continuously on the ground. Owing to the fact that the waters of the lake of the Woods are discharged into the Winnipeg river, through a number of outlets some of which are controlled by power plants, it has been necessary to establish metering stations at a number of points, and gauges at various other locations. In addition to the work relative to these gauging and metering stations, data of a meteorological nature are also being gathered.

Winnipeg River and Tributaries.

The district referred to as the "Winnipeg river and tributaries" comprises all that territory lying below the lake of the Woods outlets and tributary to the Winnipeg river. The tributaries are not numerous and, with the sole exception of the English river, are of small magnitude. The English river joins the Winnipeg in the vicinity of the interprovincial boundary of Ontario and Manitoba, and drains a large territory directly north of the lake of the Woods district. Lying almost entirely in unsurveyed territory, its drainage area is rather indeterminate, but roughly speaking it forms about one-half of the total tributary drainage area lying above the junction of the two rivers. A station has been established on this river near the mouth, but, owing to the remoteness from settlement, it has been found impossible to secure the services of a gauge reader. On this account it has not been possible to arrive at the daily discharge directly, only scattered meterings being available, but from a consideration of the measurements taken on the Winnipeg river above and below the confluence, the discharge of the English river may be approximately deduced. The smaller tributaries of the Winnipeg have been metered and records of the discharge kept more or less systematically, depending upon their importance.

On the main river, records are available since 1907 and are included in this report. The records from 1907 to 1910 inclusive are based on tail-race gauge readings at Point du Bois, together with discharge measurements made at or in the vicinity of Otter falls by engineers of the city of Winnipeg and of the Winnipeg Electric Street Railway. In October, 1911, a metering station was established by this survey at Slave falls, the measurements being referred to the same gauge at Point du Bois. On the Pinawa channel there are three stations, one at the intake to the channel and the other two, respectively, above and below the power-house of the Winnipeg Electric Railway Company, the last two being established for the purpose of rating the power station.

The two districts just described lie almost entirely within the Laurentian formation; in fact, the Winnipeg river and the lake of the Woods may be said to form the southwestern boundary of that formation. This would account in a great measure for the small number of rivers tributary to the basin from the southwest.

The granites and gneisses of the Laurentian formation underlie the whole region, and the topographical features are typical of it, lakes and rivers abounding throughout the district. Rock outcroppings are very frequent and the soil covering is shallow, conditions which would tend to rapid run-off, were the lack of storage in the form of ground-water not made up for in a large degree by the numerous lakes. The forest covering of the district varies. In some parts it is sparse owing to the shallow soil, while in other parts dense growths of evergreens, such as spruce, pine, and balsam are to be found, with occasional clumps of birch. Much lumbering has been carried on in the district, and most of the larger stands of timber have been cut. In other parts the forest has been overrun with fire so that the standing timber is now to a large extent of second growth.

Lake of the Woods, Western Outlet. North Tunnel Island metering section.

At present the stations in the district at which run-off data are being gathered are confined almost entirely to the outlets of the lake of the Woods and the Winnipeg river.

Red River District.

What is known as the Red river district is that portion of the Red river valley lying between the international boundary and lake Winnipeg; it also includes the territory drained by its tributaries, with the exception of the Assiniboine. The nature of the area drained by the river within the province varies between the swampy and muskeg country bordering the Laurentian formation to the east and the open prairie found generally to the west of the river. Owing to the nature of the country lying to the east, drainage for land reclamation is to be expected; such reclamation will naturally have an effect upon the range in stage of the river; in fact, this effect has to some extent already occurred owing to drainage schemes in operation to the south of the international boundary in the state of Minnesota. The possibility of such an effect upon the river renders its study advisable. Drainage already in operation or to be anticipated, is not, however, the only reason necessitating the collection of hydrographic data. The importance of the river from a navigation standpoint has been put forward on numerous occasions; in fact, with the idea of its improvement for that purpose, a careful survey was carried out by this organization. Such improvement would but revive an early use of the river which before the advent of the railway formed the chief artery of communication and transport with the outside world. In order that all phases of the question may be looked into, metering stations have been established at Emerson, near the international boundary, and at Winnipeg, and gauges have been located at several other points. In addition, metering stations have been established on the several tributaries, viz., the Roseau, the Rat, and the Seine.

Assiniboine River District.

The Assiniboine river forms the chief tributary to the Red river within the confines of the province of Manitoba; it drains the country to the west of the Duck and Riding mountains and north of the international boundary. Some of its tributaries have their source within the province of Saskatchewan. The southern and western part of the drainage area may be termed prairie country, with scattered timber bluffs. The northern section of the area has a greater tree covering, the Riding mountain district at the source of one of the tributaries being well timbered and lying within a forest reserve. The tributaries from these two areas are characteristic of the country which they drain. One of the chief tributaries, the Souris, has the small winter flow generally noted for prairie streams. It rises within the province of Saskatchewan, makes a loop down into the state of Minnesota, and then recrosses the international boundary into the province of Manitoba. This stream flows through what may be termed the dry section of Manitoba, the district drained having the lowest annual rainfall of any portion of the province. The Little Saskatchewan, rising in the Riding mountains, is also a tributary of the Assiniboine and is worthy of mention owing to its power possibilities. There are at present three power developments on this river, viz., at Minnedosa, Rapid City, and Brandon.

As the Assiniboine, with its tributaries, drains parts of the province that are very well populated, it is important as a source of domestic water supply or a means of sewage disposal. In addition, the possible use of its waters for irrigation purposes in the southwestern part of the province may be anticipated, while its possible importance as a source of power renders a careful hydrographic study advisable. A number of metering stations have been established, both on the main river and on its more important tributaries; as opportunity offers it is intended to add to these in order that a thorough knowledge of the river may be obtained.

District West of Lake Winnipegosis.

In the district west of lake Winnipegosis there are a large number of streams of different sizes, some of which are not directly tributary to lake Winnipegosis, but add their waters to that lake through several of the smaller lakes tributary to it.

With two or three exceptions, all the rivers of importance in the district have their sources in the Riding, Duck, or Porcupine mountains, and are not of great length, although the flow is much more constant than in the southern part of the province. The northern part of the district adjacent and tributary to the Saskatchewan, while wooded to a greater or less extent, is low lying.

While some of these streams are not of immediate interest from a hydrological standpoint, nevertheless, as the district becomes populated they will become of increasing importance. In some cases the success of the drainage schemes which may be undertaken will depend largely upon their capacity and possibility of improvement. In addition to this, the towns which are now located or may spring up in the neighbourhood will have to look to them for their domestic water supply. In some cases these rivers are capable of development from a power standpoint. Perhaps the most important in this district in this respect is the Saskatchewan. This river has as its drainage basin practically all that portion of Alberta and about two-thirds of Saskatchewan lying south of the fifty-fourth parallel of latitude. There are two or three points at which this river might be developed for power purposes, while considerable areas lying contiguous to the river between its mouth and the western boundary of Manitoba might profitably be reclaimed by drainage.

A number of metering stations have been established in the district, and also a number of stations where gauge readings only are taken, so that a general knowledge of the hydrography of the district is being obtained; additional stations will be added as necessity arises.

Rivers Entering Lake Winnipeg on the East.

The district covered by the drainage on the east side of lake Winnipeg is for the most part typical of the Laurentian formation; in consequence, practically all of the rivers entering on that side of the lake are interrupted at numerous points in their course by falls and rapids. Throughout the district at various points are to be found stands of timber which may be utilized either for the manufacture of lumber or for pulp and paper purposes. With these facts in view, studies have been made of the power possibilities of the rivers. In order that the conclusions reached may be sound, the possible run-off of the rivers should be accurately determined. Owing to the difficulty in securing competent gauge readers, it has been found difficult to establish regular stations.

However, miscellaneous meterings have been made on these rivers at various times, including the low-flow period which occurs during the winter months, and upon these it has been possible to base the estimates of minimum flow.

On the Berens river it has been possible to secure the services of a gauge reader in the vicinity of Little Grand rapids; a metering station was accordingly established, and it is hoped that records of considerable value will be obtained.

Nelson River.

The Nelson river forms the sole outlet of practically all the drainage areas included in the foregoing six districts. It forms the outlet of lake Winnipeg into which empty the Winnipeg, Red, Saskatchewan, Berens, Pigeon, Bloodvein, and Dauphin rivers, the last named being the outlet of lake Winnipegosis and lake Manitoba. The fall of the Nelson between the outlet of lake Winnipeg and Hudson bay is, in round numbers, 700 feet. A great portion of this natural fall in the river is concentrated in the form of swifts, rapids, and falls. It is to be expected that, with such a vast drainage area tributary to the river, the discharge will be exceptional. It is also a natural inference that, in a drainage area which includes so many lakes forming natural regulation basins, the minimum flow will bear a fairly close relation to the mean flow. Certain of the natural storage basins encountered in this drainage area are of great proportions, among which are the following large lakes: lake Namakan, Rainy lake, and the lake of the Woods on the Winnipeg; Lac Seul on the English; lake Manitoba, Dauphin lake, lake Winnipegosis, and lake Winnipeg. Besides these there are many others of less extent; for instance, in the Winnipeg River basin there are, in addition to those named, 106 lakes which vary from about 3 to 140 square miles in area.

The value from a power-producing standpoint of a river like the Nelson, where numerous falls occur and where, as may reasonably be expected, the minimum flow will approach the mean annual flow, should be enormous, especially where the drainage areas is of such great proportions. With this in view and with the advent of the Hudson Bay railway and greatly improved transportation facilities, the development of some of these possible sites may reasonably be expected. It was considered of the utmost importance, therefore, that the systematic gathering of data relating to the discharge of the Nelson river should be undertaken without delay. Accordingly, during the summer of 1911, an engineer of this survey was detailed to make an investigation of the upper portion of the river and locate a metering station at some point easy of access where the services of a gauge reader could be secured. A station was carefully established in the vicinity of Manitou rapids and a number of meterings were secured during the summer and early fall. It is intended that as soon as winter conditions become settled another engineer will be sent in to the station to carry on the hydrographic work throughout the winter. In addition, information is being gathered relative to streams tributary to the Nelson in the vicinity of Manitou rapids.

DEFINITIONS AND TERMS.

The volume of water flowing in a stream called 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 which represent a rate of flow, as "second-feet," "miner's inches," and "run-off in second-feet per square mile"; and (2) those which represent the actual quantity of water, as "run-off depth in inches" and "acre-feet."

The units used in this report are "second-feet," "second-feet per square mile," "run-off in inches," and "acre-feet" or "mile-feet." The first two belong to the first group and the last three to the second. They may be defined as follows:

(a) "Second-feet" is an abbreviation for cubic feet per second (c.f.s.) and is the quantity of water flowing per second in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of factors given in the following table of equivalents.

(b) "Second-feet 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 both as regards time and area.

(c) "Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed over the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

(d) "Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity of water required to cover an acre to the depth of 1 foot. It is the common unit of measurement of quantity, and is generally used in connection with storage.

(e) "Mile-foot" is equivalent to 27,878,400 cubic feet, and is the quantity of water required to cover one square mile to a depth of 1 foot, and is equal to 640 acre-feet. While not a common unit of measurement of quantity it is sometimes made use of in connection with large storage projects to express the quantity of water stored.

Winnipeg River. Little Du Bonnet Falls

Winnipeg River, Whitedog Falls. Meter section on North Channel.

CONVENIENT EQUIVALENTS.

1 second-foot equals 35·71 British Columbia miner's inches, or one British Columbia miner's inch equals 1·68 cubic foot per minute.
1 second-foot equals 6·23 British imperial gallons per second; equals 538,272 gallons for one day.
1 second-foot equals 7·48 United States gallons per second; equals 646,317 gallons for one day.
1 second-foot for one year covers 1 square mile 1·131 foot or 13·572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet; equals 724 acre-feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one 28-day month covers 1 square mile 1·041 inch deep.
1 second-foot for one 29-day month covers 1 square mile 1·079 inch deep.
1 second-foot for one 30-day month covers 1 square mile 1·116 inch deep.
1 second-foot for one 31-day month covers 1 square mile 1·153 inch deep.
1 second-foot for one day equals 1·983 acre-foot.
1 second-foot for one 28-day month equals 55·54 acre-feet.
1 second-foot for one 29-day month equals 57·52 acre-feet.
1 second-foot for one 30-day month equals 59·50 acre-feet.
1 second-foot for one 31-day month equals 61·49 acre-feet.
100 British imperial gallons per minute equals 0·268 second-foot.
100 United States gallons per minute equals 0·223 second-foot.
1,000,000 British imperial gallons per day equals 1·86 second-foot.
1,000,000 United States gallons per day equals 1·55 second-foot.
1,000,900 British imperial gallons equals 3·68 acre-feet.
1,000,000 United States gallons equals 3·07 acre-feet.
1,000,000 cubic feet equals 22·95 acre-feet.
1 acre-foot equals 43,560 cubic feet.
1 acre-foot equals 271,472 British imperial gallons.
1 acre-foot equals 325,850 United States gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0·0737 second-foot per year.
1 acre equals 43,560 square feet.
1 cubic foot equals 6·23 British imperial gallons.
1 cubic foot equals 7·48 United States gallons.
1 cubic foot of water weighs 62·5 pounds.
1 foot per second equals 0·682 mile per hour.
1 horse-power equals 550-foot pounds per second.
1 horse-power equals 746 watts or ·746 kilowatts.
1 horse-power equals 1 second-foot of water falling 8·80 feet.

To calculate water-power quickly:

Second-feet × fall in feet ÷ 11 = net horse-power on water wheel, realizing 80 per cent of theoretical power.

METHODS OF DETERMINING DISCHARGE.

Three separate methods are commonly followed in the determination of discharge of streams, and these methods involve the use of certain formulæ based on physical data more or less easily ascertaine The three methods referred to are:—

1. The slope method.
2. The weir method.
3. The mean velocity method.

The Slope Method.

In the slope method of determining the discharge, the fact that the slope of the bed of the stream, and consequently the surface slope bears some definite relation to the discharge is made use of. A number of empirical fomulæ have been deduced from time to time in an effort to express this relationship, and among these in most common use are the Chezy, the Kutter, and the Bazin formulæ.

What is known as the Chezy formula was deduced by a French engineer of that name about the year 1775, and takes the form of:—

$V = C\sqrt{rs}$ in which V is the velocity, C a coefficient depending upon the slope, the roughness of the channel and the wetted perimeter; r is the hydraulic radius, being the cross-sectional area divided by the wetted perimeter, and s the slope, being the head or fall in the section divided by the length of the section. This formula: $V = C\sqrt{rs}$ may be considered the fundamental slope formula. Various modifications of it have been deduced from time to time depending upon values of C obtained from formulæ based upon experiments and observations. The Kutter and Bazin formulæ belong to this class, and the former is perhaps the better known, taking the form of: $V = C\sqrt{rs}$ where C is obtained from the equation:

$$C = \frac{41 \cdot 6 + \frac{\cdot 00281}{S} + \frac{1 \cdot 811}{n}}{1 + \left(41 \cdot 6 + \frac{\cdot 00281}{S}\right)\frac{n}{\sqrt{r}}}$$

Where r and S have the same significance as in the Chezy formula, the factor "n" is known as the coefficient of roughness.

The Bazin formula, often considered to be one of the best for the determination of flow in open channels, takes the form: $V = C\sqrt{rs}$ where

$$C = \frac{157 \cdot 6}{1 + \frac{c}{\sqrt{r}}}$$

the coefficient "c" depending upon the roughness of the channel; values being determined for different classes of material by experiment.

Humphreys and Abbott made determinations of C from which they also derived a formula. As the first-named formula depended on experiments carried on in small channels of various natures, and the latter upon observations made on the Mississippi river, the governing conditions were of a widely different nature; it is therefore to be expected that neither of the formulæ could be considered as generally applicable. The diversity of the results obtained from the use of these two formulæ was the subject of investigation by Kutter and Ganguillet and undoubtedly influenced the final determination of Kutter's formula.

Tables have been prepared giving values for the coefficient "n" in Kutter's formula and "c" in the Bazin formula, and are to be found in practically every handbook. It is, however, very difficult to choose the correct value for these coefficients, and it is therefore advisable that whenever possible the value of "n" and "c" in the two formulæ be computed from a measured discharge.

In the Manitoba work, the results of which are herewith published, it is seldom necessary to make use of the slope method of determining the discharge; in fact, about the only application of the method is in the determination of flood discharges, or, in conjunction with meterings on rivers where the gauge height does not always bear a constant relation to the discharge. For the Kutter formula it is, however, possible in each of these cases, to arrive at a value for the factor "n" since from a determination of the hydraulic radius at the time of metering, the slope and the mean velocity, the value "c" may be found from the equation: $V = C\sqrt{rs}$; then having found the value of "C" this may be equated to Kutter's formula and the value of "n" derived, or may be found in the tables prepared for this purpose in any engineering handbook. A value for the coefficient "c" in the Bazin formula may be found in the same way.

Weir Method.

The weir method of determining discharge may be made use of in connection with widely varying discharges. Very often estimates of flow both under conditions of flood and of extremely low water may be arrived at by this method. Where funds are available, and the value of the records warrants the expense of installation, a permanent weir undoubtedly provides the best method of determining discharge. When the stream flow to be measured is of a comparatively small volume (a few second-feet), and the discharge is to be determined from time to time, a temporary weir may be utilized in conjunction with a gauge in the natural river channel.

This temporary weir would consist of a standard sharp-crested weir fastened for convenience to a wooden plank, the method of using it being as follows: A point in the stream below the gauge is selected and, after reading the gauge height, a temporary dam of earth and sods is thrown across the stream, in which dam the weir is placed; care being taken to place the crest absolutely level. Sods and earth are tamped about the weir to prevent leakage. The site of this small temporary dam should be so selected that the depth of water above will be at least twice the head on the weir, while the pond created should have a total width of several times the length of the crest. On the downstream side care must be taken to permit free access of air below the napp when the weir is discharging.

When the weir is installed, readings with the level are taken upon the crest, a gauge is placed 8 or 10 feet upstream from the dam and is set to the same datum as the weir crest. Readings of the water level on this gauge will then indicate the head on the crest of the weir.

In computing discharges by this method, a modification of the Francis formula may be made use of, these modifications being in the nature of corrections for end contraction and elimination of velocity of approach, the formula taking the form of: $Q = 3{\cdot}33\,(L - {\cdot}2H)\,H^{\frac{3}{2}}$, in which:

Q = discharge in second-feet.
L = length of crest in feet.
H = head in feet.

As mentioned before, where the value of the records warrants it and accurate continuous discharges are required, a permanent weir may be built; this, however, is seldom necessary as dams, if suitably situated and constructed, may be utilized. The main features governing the use of such structures as a means of determining the discharge are those relating to the characteristics of the dam itself, and also the consideration of the possible diversion of varying quantities of water around or through the dam. The physical requirements, in order that good records may be obtained, are as follows:—

1.—Crest all at the same elevation or divided into sections of the same elevation.
2.—Sufficient height to eliminate backwater effect from below.
3.—Absence of leaks.
4.—Crest of such type that the coefficient of discharge may be readily arrived at.
5.—Absence of flash boards or careful records of the use of same.

ie of
from
y be
id in
for

con-
both
this
rants
best
ed is
to be
ction

ened
lows:
gauge
n, in
utely
site
bove
have
side
weir

crest,
same
then

rancis
orrec-
rmula

curate
vever,
ay be
means
of the
arying
ments,

same

eadily

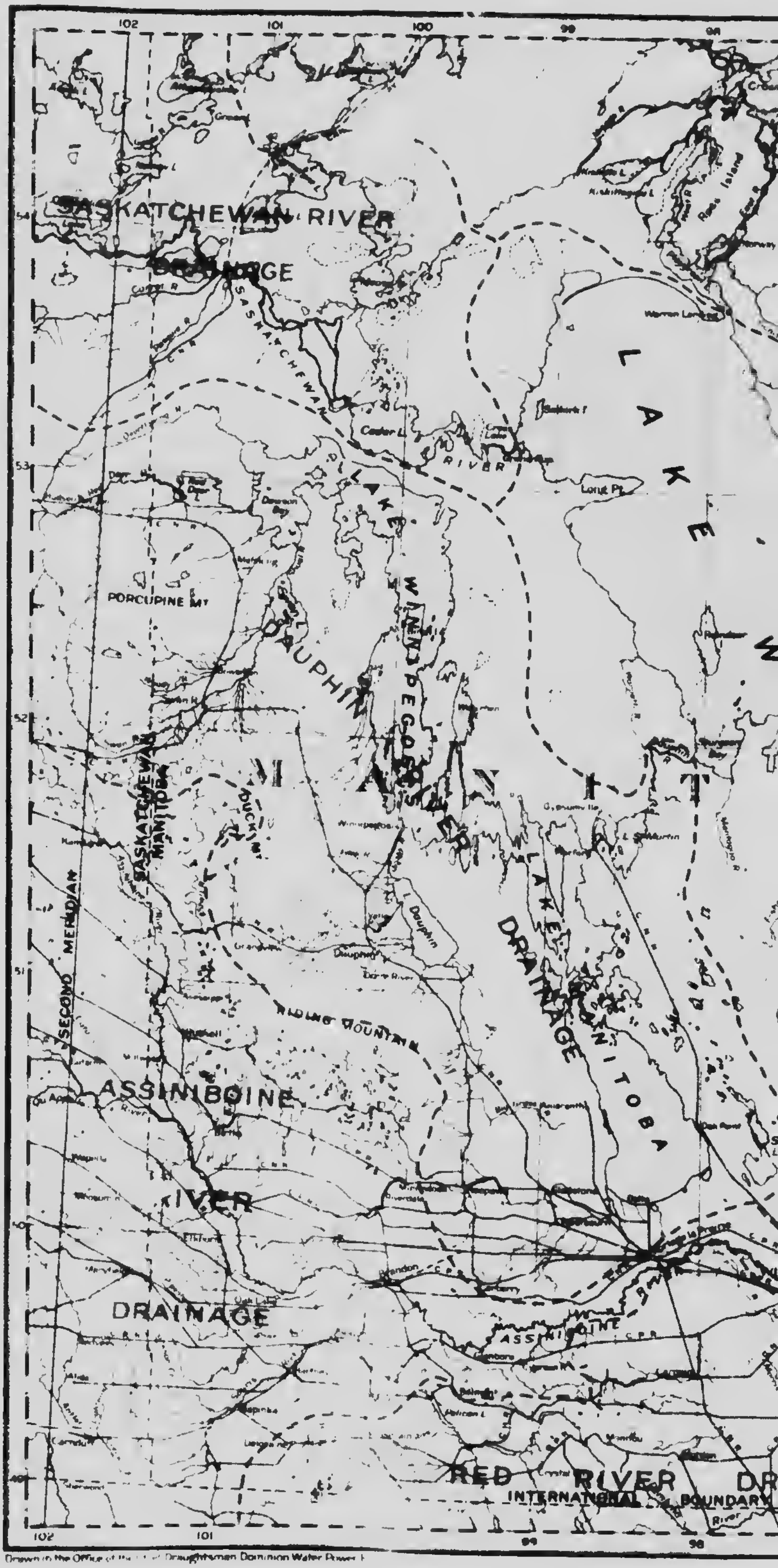
ise of
ay be
f con-
iarge,
nnec-
, etc.,
verted

pro-
, and
ection
of the
neter,

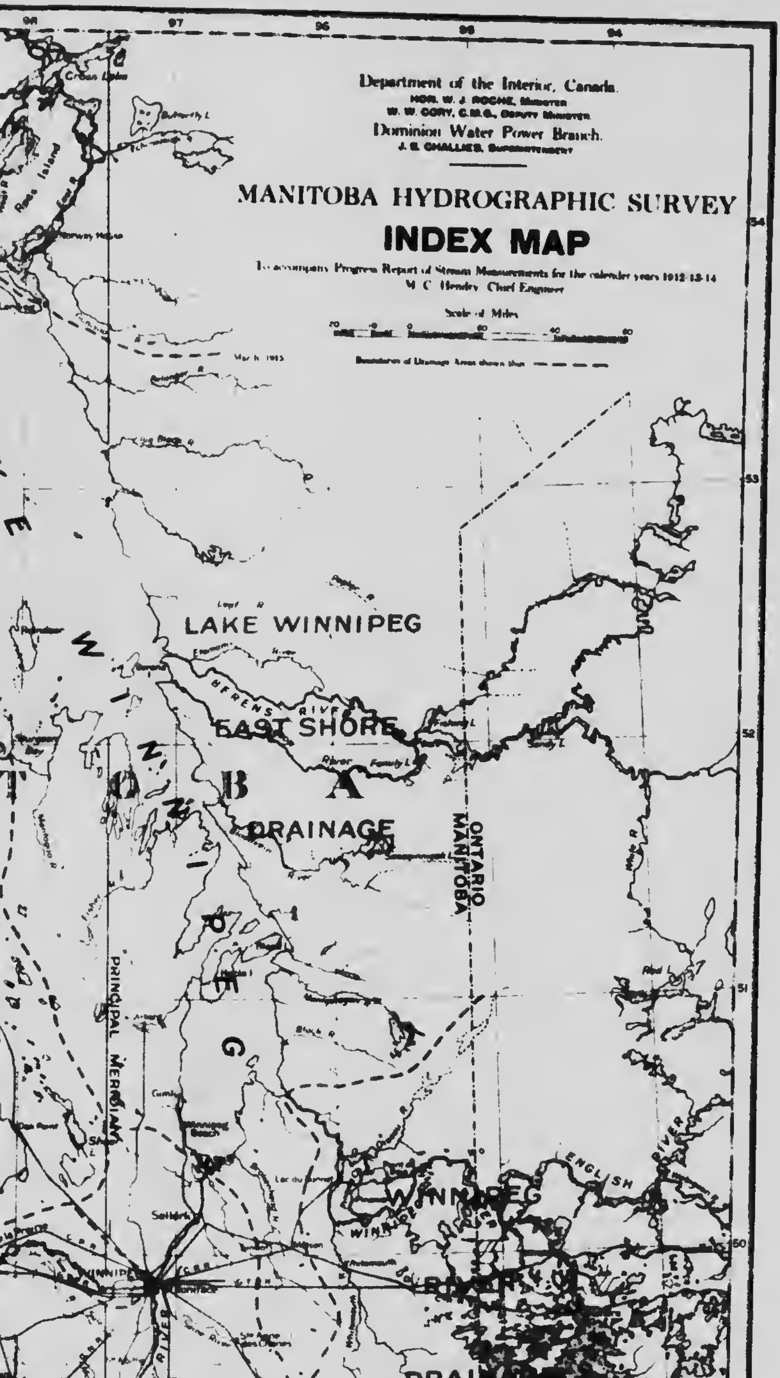
: (a)
these
locity
order
g the
n the
both
ghout
from
ht to
g the
ies of
vel or
stage
untry
ll, so
xtent
ge of

deter-
ench-
ently
same
Very
er, or
Where
ation
cross-
, and
; this
tream

and
. In
ocity
o the



Drawn in the Office of the ... Draughtsman Dominion Water Power


Department of the Interior, Canada.
HON. W. J. ROCHE, MINISTER
W. W. CORY, C.M.G., DEPUTY MINISTER
Dominion Water Power Branch.
J. B. CHALLIES, SUPERINTENDENT
MANITOBA HYDROGRAPHIC SURVEY
INDEX MAP
Scale of Miles
LAKE WINNIPEG
BERENS RIVER
EAST SHORE
DRAINAGE
ONTARIO
MANITOBA
PRINCIPAL MERIDIAN
ENGLISH RIVER
WINNIPEG
RIVER
DRAINAGE
RED RIVER
DRAINAGE
BOUNDARY
Selkirk
Ross Island

factor
meteri
the e
equate
the ta
the co

T
nectio
under
metho
the ex
metho
of a c
determ
with a
T
for co
A poin
height
which
level.
of this
will be
a tota
care n
is disc
W
a gaug
datum
indica
In
formu
tions
taking

A
contin
is sele
utilize
of det
dam i
quant
in ord

There are many things that may be said both for and against the use of dams as a means of determining discharge, which, generally speaking, may be summarized as follows: The use of a weir or dam has every advantage of continuity of records through the period of ice formation and flood discharge, while, on the other hand, it has the disadvantages of the uncertainty in connection with the proper coefficient to be used and the effect of debris, logs, etc., gathering on the crest, and the possibly varying amounts of water diverted for other uses.

Velocity Method.

The quantity of water flowing past a given point is derived from the product of two factors: (*a*) the mean velocity of the water past the point, and (*b*) the area of the cross-section of the river at that point. The area of the section depends upon the contour of the bed of the stream and the fluctuation of the water surface, the mean velocity being a function of the wetted perimeter, the roughness of the stream bed, and the slope of the water surface.

There are two principal methods of determining the mean velocity: (*a*) by current-meter, and (*b*) by float measurement. The requirements of these two methods are essentially the same, the method being to observe the velocity of the stream at a number of points throughout the cross-section. In order that good results may be obtained, care should be exercised in selecting the metering section. The section selected should be situated at a point in the stream where the banks are nearly parallel for a considerable distance both above and below the section. Also, the cross-section of the stream throughout this distance should be as nearly uniform as possible, the bottom free from projections, holes, large boulders, etc., and the banks of sufficient height to obviate the possibility of overflow under flood conditions. In selecting the site, due regard should be paid to its relation or proximity to tributaries of the stream, or to lakes, in order that sudden changes in the surface level or stage may be eliminated, the object being to secure a location where the stage or gauge height will truly indicate the discharge. In this northern country the stations are preferably located adjacent to the crest of a rapid or fall, so that backwater effects from tributaries lower down may be to a large extent eliminated, and open-water conditions may obtain under a greater range of temperature.

The equipment of a metering station usually consists of a gauge for determining the fluctuation of the water surface referred to a permanent benchmark, in order that any change in datum may be checked, and a permanently referenced initial point of measurement of the cross-section so that the same points at which the velocities are determined may always be found. Very often these points are located by stretching a tagged line across the river, or where a bridge is made use of, the points are marked upon the structure. Where the stream is swift or deep and no bridge is available, a cable or boat station may be established. The velocity at different points throughout the cross-section of the river is ascertained by either of the two methods mentioned, and the mean velocity over the whole section is then determined. Applying this mean velocity to the cross-sectional area gives the discharge of the stream at that point.

Chemical Method.

The most recent method of determining discharge in a stream, and possibly the most accurate, is what is known as the chemical method. In many cases, especially in turbulent mountain streams, determination of velocity and discharge by the float or current-meter method is impossible, owing to the difficulty in securing a station where the stream bed is uniform and the velocity sufficiently low. On the other hand, an application of the weir method would very often involve considerable expense on account of the necessity of rugged construction. In such cases the chemical method is particularly applicable.

Another purpose to which this method can be favourably applied is the rating of power stations. Owing to the advance in the art of water-wheel design and construction, the high degree of efficiency obtained and the premium placed upon such efficiency by purchasers, it is necessary that very careful determination be made. For wheels of large capacity the volume of water involved is great, and hence there is a possibility of errors of considerable magnitude creeping in, if the ordinary methods of determining discharge are used. With a view to eliminating these errors and securing the degree of accuracy required, there has recently been evolved what is known as the "chemical method" of measuring discharge. This method may be outlined as follows: Knowing approximately the volume of water to be measured, a definite quantity of chemical solution of known strength is added at a given rate to the stream or intake above the point of measurement. Owing to the turbulent nature of the stream or the churning action of the turbine wheels, this solution is thoroughly mixed throughout the whole volume of the water to be measured. In the case of a stream, samples of the water are taken some distance below the point of application of the solution, and in the case of power plants, in the tail-race. A chemical analysis of this water will reveal the amount of added chemical held in solution. Knowing the volume of the sample and the amount of solution added per unit of time, the determination of the volume of water flowing per unit of time involves only a simple calculation, for it may be readily seen that if:

Q = discharge of turbine or river.
q = " of salt solution.
N^o = concentration of salt solution.
N_1 = " of water before addition of salt solution.
N_2 = " of water in tail-race or river at sampling station.

Then: $$Q = \frac{N^o \times q}{N_2 - N_1}$$

This method of measurement has been quite recently brought forward, and the opinion is ventured that its use, especially in the case of power plant rating, will be generally adopted.

METHODS OF DETERMINING MEAN VELOCITY.

It has been mentioned before that the mean velocity in a channel may be determined by the use of either floats or a current meter. Each of these methods may be employed in several different ways depending upon the local conditions.

FLOAT METHOD.

Where floats are used for the determination of mean velocity they are mainly of three types, known as:—

1. Surface.
2. Sub-surface.
3. Tube or rod floats.

When surface floats are used to determine the velocity, the results obtained indicate the velocity of the stream at the surface only, and in order that this may be reduced to mean velocity it is necessary to apply some factor. A very good type of surface float consists of a tightly corked bottle, in the top of which is placed a small flag, sufficient weight being placed in the bottom, either sand or gravel, to cause it to float low down in order to avoid wind interference. Where measurements are being taken with a view to determining flood discharge, floating debris or cakes of ice may often be made use of to determine the surface velocity.

Subsurface and tube or rod floats are intended to give the mean velocity directly, the subsurface float being designed to float at any depth, a marker or flag on the surface being attached to the float to indicate the velocity. By placing the float at the proper depth the mean velocity is obtained by applying a slight correction to the observed velocity to offset the effect of the line connecting the float and flag. A tube float gives perhaps the best results, especially when the channel conditions are good; it consists of a tube or rod about 2½ inches in diameter and weighted at the lower end, the weight being large enough to cause the rod to float at the exact depth required. Although designed to measure the mean velocity directly, a factor less than unity must be applied to the observed velocity owing to the impossibility of floating the rod or tube low enough to register the effect of the slow moving water in contact with the bottom of the channel.

In measuring velocity by means of floats, a stretch of river from 100 to 200 feet in length is selected where the banks are parallel and the cross-section over the reach is as uniform as possible. The floats are placed at different points across the stream in order that they may indicate the velocity of the different stream lines; the time to traverse the measured reach is then taken and this, divided into the length of the reach in feet, gives the mean velocity in feet per second. From the number of obervations made across the section the mean velocity for the stream is obtained. Applying this mean velocity to the mean cross-sectional area of the stream determined from sections taken at various points throughout the run, the mean discharge is obtained.

Current-meter Methods.

The determination of velocity by current-meter is known as the indirect method. There are numerous current-meters of various types, but the two types in general use are represented by the Price and Haskell meters, the essential difference between the two being that in the former meter the rotating wheel is made up of a series of cups, while with the latter it takes the form of a screw propeller. The Price meter is the one used by this survey.

The principle upon which current-meters operate is as follows: The water impinging on the cups of the wheel or vanes of the screw causes them to rotate. By means of a contact and connections to a telephone receiver the operator is enabled to count the number of revolutions of the wheel or vanes. The number of revolutions in a given time bears a direct relation to the velocity of the stream at that point. This relation between the velocity of the moving water and the revolution of the wheel is determined for each meter by experiment. To rate the meter it is drawn through the water for a given distance at different speeds, the number of revolutions for each speed and the time being noted; from this data a rating table is prepared which gives the velocity in feet per second for any given number of revolutions in a given time.

In making measurements by means of the current-meter, the general method followed is: (1) After selecting a section on the stream where the banks are nearly parallel and straight for some distance above and below the section, and the channel well defined, a number of stations known as measuring points are laid off along a line perpendicular to the direction of flow, these points being usually fixed at regular intervals, the number varying with the size or width of the stream. (2) At each of these points soundings are taken and the cross-sectional area of the stream developed. The cross-section of the stream is theoretically divided into strips by vertical lines passing through the measuring points, and at each of these latter points the velocity is observed at various depths with a current-meter. By multiplying the area of each strip by the mean of the velocities at the two adjacent measuring points, the discharge of the strip is determined. The sum of the discharges of all these subdivisions gives the total discharge of the stream, and this, divided by the total cross-sectional area, gives the mean velocity of the stream at the metering section.

Determination of Mean Velocity by Current-meter.

There are several methods of determining the mean velocity for each one of the strips or sections into which the cross-section is divided, these being as follows:

1. By vertical velocity curves.
2. " the three-point method.
3. " the two-point method.
4. " the single-point method
5. " the integration method.

Vertical Velocity Curve Method.

In the vertical velocity curve method, a series of determinations of the velocity are made in each vertical at regular intervals; these intervals may be as close as half a foot apart, though generally each interval is equal to 0·1 the depth at that point. The meter is lowered so that the current is recorded at each one of the intervals, and from these records a vertical velocity curve is plotted with depths as ordinates and velocities as abscissæ. This curve shows graphically the magnitude and variation in the velocity at each point in the stream from surface to bottom. From the curve so plotted the mean velocity is obtained by dividing the area between the curve and its vertical axis, by the depth.

Three-point Method.

In the three-point method, the meter is held about half a foot below the surface, the same distance above the bottom and at mid-depth, the mean velocity being determined by dividing the sum of the top and bottom and four times the mid-depth velocity by six. Very often this method is modified by holding the meter at 0·2, 0·6, and 0·8 of the depth, but generally both this and the vertical velocity curve method are discarded in favour of what is known as the two-point method.

Two-point Method.

In the two-point method the velocities are observed at 0·2 and 0·8 of the depth, for it has been found from experiment that the mean velocity corresponds very closely to the mean of the observed velocities at these two points. It has also been found that not only does this method give results which closely approximate to the true mean, but the method may be applied with equal success when observing velocities for discharge under ice cover.

One-point Method.

Numerous experiments have been carried out with a view to determining the vertical velocity curve, and from this it has been found that the mean velocity nearly always occurs between 0·5 and 0·7 of the depth; on this account

Winnipeg River. Second McArthur Falls.

Winnipeg River, Slave Falls. Metering section.

when observing for mean velocity by the one-point method the practice generally followed is to observe the velocities at 0·6 of the depth, as under widely varying conditions it has been found the results obtained from this method very closely approximate to the true mean velocity. Or again, under flood conditions or when the depth of the stream is great, it is sometimes found impossible to place the meter at the desired position in the vertical. When such is the case or when, owing to floating debris or ice, damage to or loss of the meter might occur if it could not be quickly withdrawn, the velocity is measured about one foot below the surface and a suitable coefficient applied so as to obtain the true mean velocity. This coefficient varies between 0·85 and 0·95; where the velocities are high the coefficient approaches unity depending upon conditions of channel, slope and stage.

Integration Method.

To determine the mean velocity by the integration method, the meter is moved through the water at a slow uniform speed from top to bottom and return, the number of revolutions and the time taken for the operation being observed. This method, however, is not used in connection with Price meters, as it has been found that the vertical motion of the meter has an influence upon the speed of the wheel so that true results are not obtained.

WINTER MEASUREMENTS.

Determination of discharge under winter conditions is perhaps one of the most difficult features of stream measurement. The laws governing the flow of water in open channels have been fairly well determined, but under winter conditions the problem presented involves the consideration of a number of governing features of more or less indeterminate character. The relation of discharge to gauge height in winter is frequently totally different from the relationship existing in summer and, further, whereas the latter relationship is usually well defined, the former has to be modified according to the features peculiar to that season. Primarily, the estimates of daily discharge depend upon meterings taken at frequent intervals, as in the summer, and upon observed gauge heights. The winter meterings are taken in somewhat similar manner. The most desirable is the vertical curve method. An examination of velocities determined in this way points to the fact that the mean velocity in the vertical nearly corresponds to the mean of the velocities as determined at 0·2 and 0·8 of the depths as measured from the under surface of the ice, so that this method is generally followed. It should be made clear in referring to winter conditions that the presence of ice is involved either as an ice cover or otherwise.

To determine the discharge where an ice sheet is present, holes are cut in the ice at intervals of from 5 to 10 feet, large enough to allow the free introduction of the meter and the measurements are then taken in the same manner as under open-water conditions, except that the depths are computed from the under side of the ice sheet. In addition, the gauge height of the surface of the water to which the soundings are also referred and the thickness of the ice sheet at the various points across the section are noted. The horizontal distance between these points should preferably be the same as under open-water conditions although owing to the amount of labour involved in opening up the holes this is not always possible. The meter is either suspended by a cable in the ordinary manner or fastened to the suspension rods; the latter method is generally used where the water is shallow. For depths over 5 feet the cable is found to be most convenient. In metering under ice conditions, care must be taken to prevent the meter from freezing. In order to obviate this as much as possible the meter should be kept immersed and the transfer from one hole to another made as quickly as possible, since a small amount of water congealing on the rotor or near the bearing may very materially change the meter's rating. Should the meter become frozen, it may be thawed out by immersing in the water or carefully warming and wiping before a small fire. Where the rivers to be metered are large, and considerable time is necessary for the operation, it is often found advantageous to construct a small shelter of poles and canvas in order to protect the meter and the operator. As far as possible, winter measurements should be taken on the same section as those under summer conditions. If this is not found possible, or conditions prevent accurate measurements at the old station, a new station may be selected, but if such is done, care should be taken to refer the auxiliary gauge installed to the datum of the summer station, and sufficient soundings should be taken at the new station to develop the cross-sectional area.

The location for winter stations where ice cover is involved should be well below any stretch of open water where the formation of frazil or anchor ice might occur, and clog the section. It is preferable to locate the section above a rapid or fall if possible; even though the formation of an ice sheet occurs, the presence of such fall or rapid below the section will tend to eliminate any backwater effect due to the clogging of the channel below the station, and hence the gauge readings will indicate more closely the actual discharge from time to time.

The gauge at the station should be read daily and the thickness of the ice and the depth of the under surface of the ice below the water surface also noted. A record of the daily temperature is necessary. The gauge readers of this survey have been provided with a thermometer, a device in the form of a modified scaler's rule for reading the thickness of the ice, and where necessary, with an ice chisel. On the forms provided, the gauge reading, thickness of ice, depth of ice below water surface, and temperature are recorded; these records are kept in a book, and post cards of corresponding form are provided on which the records are forwarded to the office each week.

In this northern climate the temperature has a very direct effect upon the discharge of the streams. The lowering of temperature may have the effect of reducing the ground water supply and so directly affect the flow, or what is of more importance, it may influence the variation in gauge height in such a way that the relation between gauge height and discharge will not hold true from day to day. The ways in which this influence may be brought about are as follows: Where the stream has open-water sections due to the presence of rapids, small falls, or swifts, a drop in temperature will cause the formation of frazil or needle ice; this ice may be formed in such quantities that practically the whole body of water is full of ice particles, which on arrival at some restricted section of the river, for instance, where an ice sheet occurs, may block the channel and materially reduce the flow. Should such a condition occur below the gauging station, the blocking of the channel will have the effect of backing up the water at the gauge. As such effect on the gauge height might occur over a wide range of conditions, it may readily be seen that estimates of discharge based on such records are not entirely reliable. The estimating of winter discharge, therefore, where there is a possibility of backwater effects, or where ice sheet occurs, is one which calls for considerable care and consideration of the governing features. A great deal of study is being given to this particular problem, not only by the different organizations here in Canada, but by engineers of the Water Resources Division of the United States Geological Survey. It is hoped, therefore, that the laws governing discharge under these conditions may eventually become better understood, and a great deal of labour involved in the computing of the discharges eliminated.

METERING STATIONS.

The selection and establishment of metering stations is the first step in the collection of river discharge data. On the careful selection of a suitable site at which measurements may be made depends to a very large extent the value of the data gathered. The primary requisites for a suitable metering station are permanency of section, approach to and delivery from the section such that stream lines will always be at right angles to the section, and permanent banks of such height that the river will be confined to its channel under all conditions of discharge. Another feature that should be considered in connection with the selection of a site is, that it should be so located that records taken at the point will indicate the complete run-off above that point. Where diversion of water from the stream by canals, pipelines, etc., occurs, the station should be located above these points. It is often necessary to locate a number of stations throughout the length of the stream in order that the full discharge may be recorded. In this country, where in many districts the population is sparse, the availability of an observer will often materially influence the location of the station. Close proximity to the place of residence of the gauge reader is, as a rule, very necessary to the obtaining of good records.

There are five general types of stations located by this survey; these are:—

1.—Bridge stations.
2.—Cable stations.
3.—Cable carrier stations.
4.—Wading stations.
5.—Boat stations.

Bridge Stations.

A gauging station located at a bridge is perhaps the most desirable, other conditions being favourable. By locating a station in such a position the hydrographer is afforded good facilities for making his measurements, the width of the bridge and stability of his position rendering him free to devote his whole attention to the actual metering. However, it is often found necessary to select some other location, as at times under high-water conditions the whole flow of the stream does not pass between the abutments. Again, the presence of the piers in the stream, especially where the velocities are high, introduces factors which prevent the obtaining of good results. In using a bridge for a station, the different points in the section are marked off on the bridge, and soundings taken at these points.

Cable Stations.

Where a bridge is not available in a favourable location and the stream to be observed is large, recourse is had to the establishment of a cable station. This consists of a steel cable stretched over wooden towers which rest on each bank; a small car, capable of carrying two men, is suspended from the cable. A light steel cable supported by the towers and tagged at intervals to locate the verticals in the cross-section is also stretched across the river. Where the velocities are high, a stay line for the meter is used; this is usually a ¼-inch guy wire, stretched across the stream 40 to 50 feet above the section, the meter being kept in the desired vertical by means of a stay line attached to the meter and rove through a small pulley which may be moved to any position along the stay wire. With this equipment the hydrographer is able to make observations at different points on the cross-section, change of location being obtained by moving the car along the cable.

Cable Carrier Station.

At various points throughout the province there are streams of too great a depth for measurements by wading, and without suitably located bridges. In such cases what are termed "cable carrier stations" are established. The installation may be described as follows: A galvanized iron pulley is attached to a tree or post on each side of the river and directly opposite the ends of the section, and through these a light steel cable is rove. The meter is suspended from a device which can be made to travel along this cable by manipulating it from either shore. To observe the velocity in the stream at any point the meter is first moved to the desired vertical and then lowered to the desired point by means of the usual suspension cable. The soundings are made by replacing the meter with the sounding weight, and operating it in the same way. For streams up to 100 feet in width this method of obtaining measurements has proved very satisfactory.

Wading Stations.

Where wading stations are established, a tagged line is stretched across the stream at the sections, the tags indicating the various verticals. The observer, while standing in the stream, obtains the velocities at the different points in the section, care being taken to stand to one side and below the meter in order that eddies caused may not influence the reading.

Boat Stations.

Bridges are not always available or suitably located for use as metering stations, nor is it always feasible to erect a cable or cable carrier station owing to excessive width of section, low banks, or possible interference by passing boats. What is termed a "boat station" is then made use of.

Several stations of this description are in use by this survey. At a boat station the method adopted is to stretch a stay line or rope across the river about two or three feet above the water surface and just above the section. A tagged line, upon which the intervals for the section are indicated, is also stretched across the river and directly on the section. The measurements are made in the usual way from a boat which is held at the desired location on the section by means of the stay line.

PREPARATION OF DATA.

The compilation of the data gathered calls for considerable time and study, for the gathering of the data such as metering and gauge heights is but one phase in the process of arriving at the final estimates of daily discharge and total run-off of a stream. The first step to be taken in estimating the daily discharge for each station is the construction of a discharge curve. From the results of the meterings, points are plotted to co-ordinates, the ordinates being the gauge heights observed at the time of metering, and the abscissæ the corresponding discharge in cubic feet per second. Through these plotted points a smooth curve is drawn, this is known as the "discharge curve." "Mean velocity" and "area" curves are also constructed for the station. The points on the curves have as ordinates the gauge heights observed, and as abscissæ the corresponding mean velocity and cross-sectional area of the stream, respectively. From a study of the "mean velocity" and "area" curves, points not defined on the discharge curve may be closely approximated.

Where the stream bottom at any gauging station is permanent, or changes very slowly, and measurements well distributed over the range in gauge height experienced at the station have been secured, a well-defined curve may be obtained. Where, however, these conditions are not found, and the discharge curve is, in consequence, not well defined, it may be necessary to obtain meterings at very close intervals in order that a fair estimate of the discharge from day to day may be made. In order that the discharge for the days intervening between those upon which actual measurements are made, may be obtained, one of two accepted methods of correcting the discharge curve to give the true discharge is used. These two methods are known as the Stout and Bolster methods.

Stout Method.

In the Stout method, an approximate rating curve and table are prepared from the discharge measurements and observed gauge heights, and the corrected gauge heights are used in conjunction with it. To correct the gauge heights, a curve is plotted with the difference between the actual gauge heights at the time of the various measurements and the gauge heights as given on the approximate curve, as ordinates, and the days of the month upon which the measurements were made, as abscissæ. Through the points an irregular curve is drawn and, from this, the correction to be applied to the gauge height for the days intervening between those of actual measurements can be obtained. The corrected discharges are then easily derived.

Bolster Method.

In the Bolster method the discharge measurements for the entire year are plotted, as for a discharge curve. The points plotted are then considered consecutively, and usually two or more curves are so defined. Where conditions change rapidly, there is practically a new curve for each day. To obtain the daily discharges a standard rating curve is used. For days on which there are discharge measurements, the curve passes through the plotted points. To define the position of the curve for intervening days, the consecutive points are joined and the line divided into parts of equal length, corresponding to the number of intervening days. By passing the standard curve through the points so defined, the discharge for the corresponding day is determined by applying the gauge height observed for that day.

With the discharge curve defined, the next step is the construction of a rating table; this will depend upon certain laws relating to the flow of water in open channels, which are as follows:—

1. The discharge will remain constant when the conditions at or near the station, known as the station control, are constant.
2. The discharge at the station will always be the same for each stage provided always that the slope of the stream remains constant at such stage.
3. The discharge is a function of and, under normal conditions increases with the stage.

In preparing the rating table the discharge for each difference in gauge height of one-tenth or one-half tenth of a foot, depending on the size of the stream, is taken from the curve, and these differences are so adjusted that they either remain constant or increase by regular amounts. These are then entered upon a rating sheet. After the discharge curve is constructed and the rating table compiled, the daily gauge heights are listed on separate sheets, and from the rating table the discharge corresponding to the gauge height is set down for each day. In passing, it should be noted that the gauge heights as recorded by the gauge reader are taken as the mean daily gauge height for the station; this is not always true, however, for there may easily occur fluctuations in the stage of the stream during each day. The results, however, are in most cases close enough for all practical purposes. Where the variation from the true mean is considerable and much depends upon the accuracy of results, the gauge readings are taken more than once a day or some type of recording gauge is installed. The table of discharges compiled from the gauge heights, therefore, is taken to represent the mean daily discharge at the station.

EXPLANATION OF DATA.

In this report the following data have been included for every regular station:—

1. Description of station.
2. Table of discharge measurements.
3. Table of daily gauge heights and discharges.
4. Table of monthly and yearly estimated discharges.

In the case of stations which are not regularly maintained, their location is described, the facts as to the drainage basin to which they belong are given, and the miscellaneous readings which have been taken at that station are listed. The description of all stations includes general information such as location of the gauge, equipment, location of initial point on the section, bench-marks, etc.; in short, a description such as would enable interested persons to locate the station with the least possible difficulty. A short history of the operation of the station covering any changes in the location of the gauge, section, or equipment made during the time of its operation is also given. The discharge table gives the results of the discharge measurements made from time to time by the hydrographers, since the installation of the station. It includes the date of the measurements, the name of the hydrographer, the gauge height at the time of measurement, the area of the section, the mean velocity and the discharge in second-feet. The daily gauge height and discharge table gives the daily height of the water surface at the gauge as observed by the gauge reader. These observations are generally made once a day but in some cases, where the records are of particular value, the readings are taken twice a day, and the mean of the two is given in the gauge height table. The daily mean discharge, as given in the table, is arrived at by applying the gauge height observed to the rating table for the station, and this figure is taken as being the rate or mean daily discharge in cubic feet per second. In the table of monthly and yearly discharges the following are given both for each month and for the year or period covered by the records; the *maximum* and *minimum* daily discharge, the *mean* discharge in cubic feet per second, the *run-off* in cubic feet per second per square mile the *run-off* depth in inches on drainage area, and the *total run-off* in acre-feet.

ACKNOWLEDGEMENTS.

Acknowledgement is made to the officers of the United States Geological Survey for assistance and advice received from time to time in connection with various points that have arisen in the operation of stations and in the matter of apparatus and equipment and also to the officers of the Winnipeg Street railway and the city of Winnipeg for assistance offered and records placed at the disposal of the survey. Mention should also be made of the hearty co-operation of the officials of the Lake of the Woods Milling Company, the Kenora Municipal Plant, and the engineering staff of the Hydro-Electric Power Commission of the province of Ontario, in gathering data relative to the Lake of the Woods outlets.

SUMMARY AND RECOMMENDATIONS.

The records contained in the report are the result of investigations carried on by the survey since its inception in 1912. Some stations have for various reasons been discontinued, while others have been established, the net result being a marked increase in the number of stations operated and, when the streams where miscellaneous readings are secured are considered, it will be seen that the southern part of the province is now well covered.

In the northern part of the province the work is being extended as opportunity offers and occasion arises, though, as far as possible, the need of stream flow data should be anticipated.

It is recommended that in view of the necessity of anticipating the requirement of data, that the work be extended to cover as much of the northern part of the province as possible. This extension will necessarily depend to a very great extent upon the accessibility of the various rivers and the possibility of securing continuous records. The work instituted on the Nelson should be vigorously carried on and an attempt made to secure a station that will permit of an all-year-round rating. In addition, slope gauges should be established, and if possible a suitable site for an automatic gauge selected and the same installed for the purpose of securing a rating of the river. The storage possibilities of Lac Seul should be looked into and an automatic gauge installed at some point on that lake, so that records of its variation in stage may be secured.

The necessity of some investigation into the underground water resources of the province is a question that is becoming pressing. The year 1914 was one of exceptionally low flow, and where the communities and individuals were dependent upon surface water for a domestic supply, hardship was experienced. A careful survey of the ground-water supply should make valuable and reliable information on the subject available to the general public, and as it is so closely allied to the gathering of data regarding the surface supply, it is suggested that it be carried out by this survey as soon as the necessary funds and assistance can be made available.

PROGRESS REPORT

OF

THE MANITOBA HYDROGRAPHIC SURVEY FOR 1912-13-14

PART II

HYDROGRAPHIC DATA

PART II

LAKE OF THE WOODS TRIBUTARIES AND OUTLETS.

GENERAL.

The lake of the Woods is drained into lake Winnipeg by the Winnipeg river, of which it forms one of the chief sources. It lies partly in Manitoba, partly in Ontario, and a considerable portion is in the United States. The area of the lake, including Shoal lake, is 1,500 square miles, and the drainage area tributary to it is 26,400 square miles. Naturally a lake with such an area and having a large tributary drainage area may have a very marked effect upon the run-off of the river draining it.

The power possibilities of the Winnipeg river are considerable, and these may be very materially increased by means of the proper utilization of the lake of the Woods as a storage or regulating basin. Of the total area tributary to the lake, 20,740 square miles is drained by Rainy river, which enters the lake at the southeast end.

Owing to the very direct influence the lake of the Woods and its tributaries may have upon the power output of the Winnipeg river, a careful study of the hydrology of the basin was undertaken; this included a study of the Rainy river and its tributaries and of the outlets of the lake of the Woods at Kenora and Keewatin.

RAINY RIVER.

Rainy river is the chief tributary of lake of the Woods. It drains Rainy lake and the territory above into the lake of the Woods, and forms the international boundary between the two lakes. It has a length of about 75 miles, and the basin drained by it is 20,740 square miles in extent; of this area, 14,400 square miles lies above Fort Frances, which is just below the outlet of Rainy lake, and 7,060 square miles is above the outlet of Namakan lake.

Namakan lake and Rainy lake are used as storage basins in connection with the Minnesota and Ontario Power Company's development at International Falls, which is just below the outlet of Rainy lake.

The country drained above Fort Frances is typical of the Laurentian formation. It abounds in small lakes, swamps, and muskegs, with rock outcrops everywhere. The country is well timbered, good stands of spruce and pine timber being found throughout the district. A considerable portion of the area has been cut over, and the product used for the manufacture of lumber, pulp and paper.

Below Fort Frances and bordering the river the land is flat and swampy, though when drained the land offers good opportunities for farming. The banks vary from a few feet in height to 20 or 30 feet, and are generally of clay, though rock outcrops occur at certain points.

The river is navigable from just below International Falls to the lake of the Woods, and is used during the summer months. In addition, the lumbermen drive their logs down it to the mills.

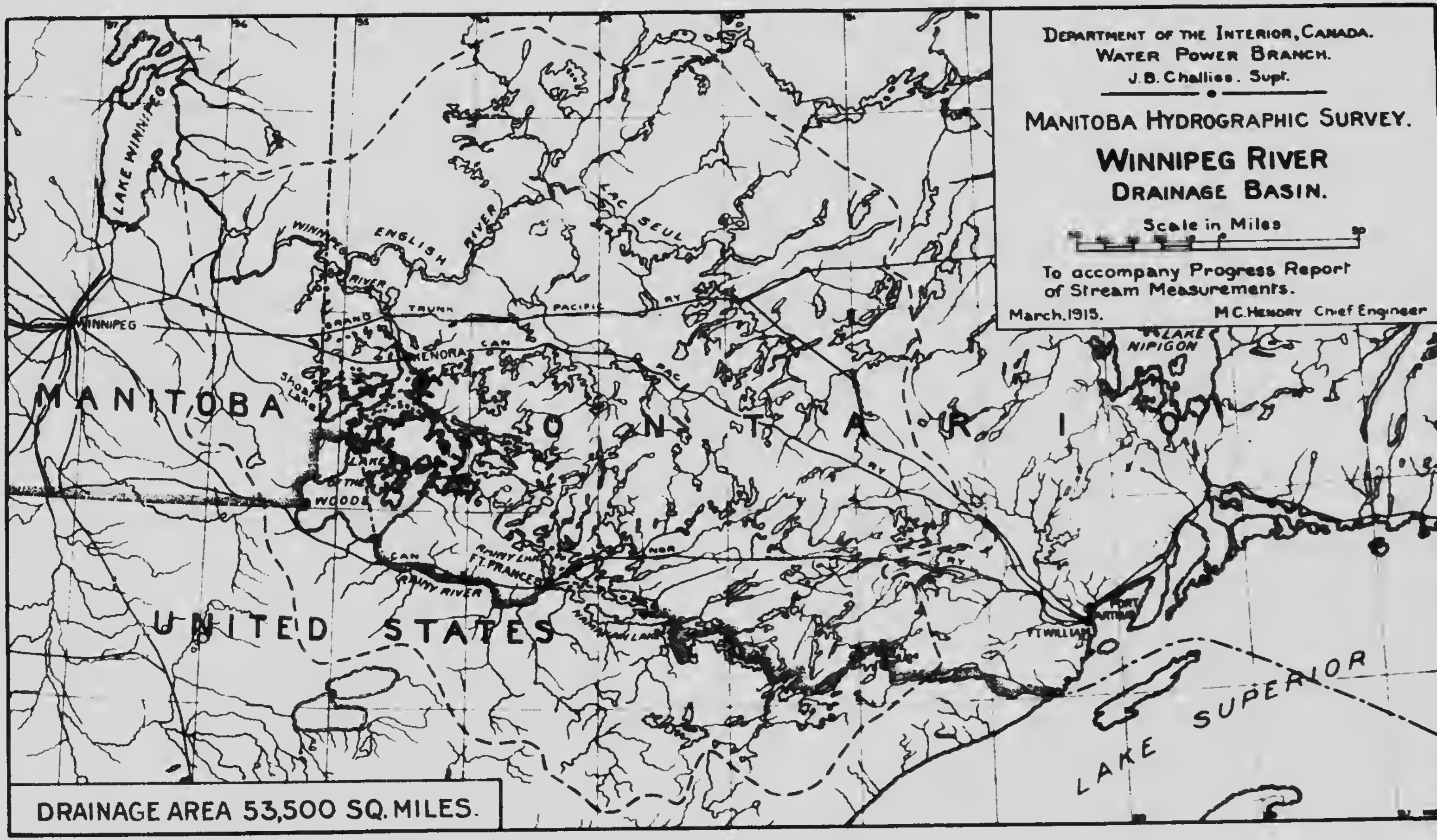
Metering stations have been established on this river by the Manitoba Hydrographic Survey above Kettle falls, below International Falls, in conjunction with the United States Geological Survey, and at Beaudette and Emo. The station below International Falls is, however, the most important on the river, and the records at this point cover the longest period, though the actual

Winnipeg River, Slave Falls, Cable Car Stati

Winnipeg River, Slave Falls. Cable Car Station.

Roseau River, Dominion City. M. H. S. Gauge.

PLATE I.



operation of the stations by the Manitoba Hydrographic Survey only covers a short period.

KETTLE FALLS, CANADIAN CHANNEL.

History.—The station was established on August 8, 1912, by Alexander Pirie, and was operated by the Manitoba Hydrographic Survey until 1913, when it was taken over by the Dominion Department of Public Works.

Location of Section.—The section on the Canadian channel is located at the foot of the first narrows, about 100 feet above the falls. The initial point is a hole drilled in the rock on Canadian island at the foot of the first narrows, and is marked "I. P. Elevation 503·5," it is referenced by a 15-inch spruce tree blazed on the side facing the river and marked "I. P. 48 feet southwest."

Records Available.—Records are available for the period August 8, 1912, to June 13, 1913, when the station was taken over by the Dominion Department of Public Works.

Drainage Area.—The drainage area above Kettle falls has an area of 7,060 square miles, and includes in its drainage area a large number of small lakes, the largest of which is Namakan.

Gauge.—The gauge is a 9-foot vertical staff located 100 feet above the metering section on the Canadian mainland, and is bolted to the rock; it is referred to the D.P.W. datum at Fort Frances.

Channel.—The channel has a permanent rock bed and is straight for about 1,500 feet above the section and about 300 feet below, the banks are high and rocky and not liable to overflow. It forms one of the outlets from Namakan lake the other being known as the International channel, Kettle falls.

Discharge Measurements.—Eleven discharge measurements were taken by the Manitoba Hydrographic Survey during the years 1912 and 1913, over a range in gauge height of about 6 feet. Sufficient meterings were obtained to define a discharge curve over the range in stage given above, and from this curve the daily discharges were estimated.

Accuracy.—The discharge measurements define the curve very well between the limits in elevation 497·6 and 500·6; beyond these limits the curve is not well defined.

It is necessary to obtain the discharge in both the International and Canadian channels in order that the actual discharge from Namakan lake may be ascertained. Owing to the presence of Kettle falls a short distance below the section the backwater effect under winter conditions was negligible.

DISCHARGE MEASUREMENTS of Canadian Channel, Kettle River at Kettle Falls, 1912–13.

Date	Hydrographer	Meter No.	Width.	Area of Section	Mean Velocity	Gauge Height.	Discharge
1912			Feet	Sq. ft.	Ft. per sec.	Feet	Sec. ft.
Aug. 8	S. S. Scovil	1374	119·5	1,273	1·127	500·69	1,435
Sept. 6	Alex. Pirie	1197	115·0	1,207	0·902	500·04	1,088
" 9	W. Richardson	1374	118·0	1,181	0·797	500·06	942
" 29	Alex. Pirie	1187	114·5	1,198	0·752	199·71	901
" 30	"	1187	114·5	1,191	0·700	499·64	834
Nov. 2	R. H. Nelson	1196	108	1,100	0·496	499·01	546
" 4	"	1196	108	1,184	0·517	498·99	561
1913.							
Jan. 9	Alex. Pirie	1462	102	975	0·336	498·13	328
" 9	"	1462	102	975	0·333	498·13	324
Mar. 15	"	1186	102	936	0·226	497·61	212
May 31	"	1197	182·5	17·19	2·38	503·39	4·088

Daily Gauge Height and Discharge of Kettle River, Canadian Channel, at Kettle Falls for 1912-13.

[Drainage Area, 7,400 square miles.]

Day	July, 1912 Gauge Height	July, 1912 Discharge	August, 1912 Gauge Height	August, 1912 Discharge	Sept., 1912 Gauge Height	Sept., 1912 Discharge	Oct., 1912 Gauge Height	Oct., 1912 Discharge	Nov., 1912 Gauge Height	Nov., 1912 Discharge	Dec., 1912 Gauge Height	Dec., 1912 Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1					499·96	1,005	499·62	810	499·06	575	498·53	409
2					499·92	975	499·53	760	499·03	550	498·53	409
3					499·86	947	499·54	760	498·98	549	498·54	409
4					499·86	947	499·55	760	498·97	546	498·53	409
5					500·05	1,035	499·56	785	498·93	533	498·53	409
6					500·03	1,045	499·57	785	498·91	527	498·53	409
7					500·03	1,035	499·58	785	498·88	517	498·52	406
8			500·67[1]	1,480	500·03	1,035	499·55	760	498·85	507	498·48	395
9			500·67	1,480	500·13	1,095	499·53	760	498·85	507	498·43	381
10			500·67	1,480	500·13	1,095	499·51	760	498·83	501	498·43	381
11			500·66	1,480	500·13	1,095	499·50	737	498·82	498	498·43	381
12			500·56	1,402	500·13	1,095	499·49	737	498·82	498	498·43	381
13			500·66	1,480	500·41	1,095	499·48	737	498·81	494	498·23	328
14			500·49	1,330	500·04	1,035	499·48	737	498·78	485	498·23	328
15			500·47	1,330	500·01	1,035	499·43	715	498·76	479	498·23	328
16			500·41	1,295	500·01	1,035	499·41	715	498·81	494	498·13	306
17			500·40	1,260	499·95	975	499·40	695	498·78	485	498·13	306
18			500·38	1,260	499·92	975	499·35	675	498·73	469	498·13	306
19			500·34	1,225	499·85	920	499·28	655	498·75	475	498·33	353
20			500·34	1,225	499·85	920	499·27	651	498·78	485	498·33	353
21			500·29	1,192	499·81	920	499·25	643	498·73	469	498·33	353
22			500·23	1,160	499·79	892	499·23	635	498·71	463	498·33	353
23			500·18	1,127	499·73	865	499·20	624	498·69	457	498·23	328
24			500·17	1,127	499·75	865	499·10	621	498·67	451	498·21	328
25			500·14	1,095	499·75	865	499·16	610	498·65	445	498·23	328
26			500·08	1,065	499·73	865	499·13	600	498·63	439	498·23	328
27			500·06	1,065	499·68	837	499·11	593	498·69	457	498·23	328
28			500·08	1,065	499·68	837	499·05	572	498·73	469	498·21	328
29			500·06	1,065	499·71	865	499·03	565	498·63	439	498·23	328
30			500·04	1,035	499·64	810	499·05	572	498·69	457	498·21	328
31			500·02	1,035			499·10	590			498·23	328

Day	Jan., 1913 Gauge Height	Jan., 1913 Discharge	Feb., 1913 Gauge Height	Feb., 1913 Discharge	Mar., 1913 Gauge Height	Mar., 1913 Discharge	April, 1913 Gauge Height	April, 1913 Discharge	May, 1913 Gauge Height	May, 1913 Discharge	June, 1913 Gauge Height	June, 1913 Discharge
1	498·23	328	497·91	266	497·63	217	497·56	207	499·98	1,065	503·63	4,375
2	498·23	328	497·93	266	497·63	217	497·56	207	500·08	1,065	503·83	4,575
3	498·13	306	497·93	266	497·63	217	497·58	210	500·18	1,127	504·01	4,775
4	498·13	306	497·93	266	497·63	217	497·58	210	500·28	1,192	504·11	4,875
5	498·13	306	497·93	266	497·63	217	497·59	211	500·38	1,260	504·27	5,025
6	498·13	306	497·93	266	497·63	217	497·59	211	500·38	1,260	504·35	5,075
7	498·13	306	497·83	248	497·63	217	497·59	211	500·53	1,365	504·43	5,175
8	498·13	306	497·83	248	497·63	217	497·59	211	500·68	1,480	504·45	5,175
9	498·13	306	497·83	248	497·63	217	497·60	213	500·75	1,520	504·49	5,225
10	498·13	306	497·83	248	497·54	203	497·60	213	500·83	1,605	504·55	5,275
11	498·13	306	497·83	248	497·53	203	497·60	213	500·93	1,690	504·55	5,275
12	498·13	306	497·83	248	497·57	208	497·61	214	501·13	1,875	504·55	5,275
13	498·13	306	497·83	248	497·58	210	497·65	220	501·05	1,780	504·55	5,275
14	498·13	306	497·83	248	497·60	213	497·81	245	501·13	1,875		
15	498·13	306	497·83	248	497·61	214	497·94	262	501·33	2,075		
16	498·13	306	497·83	248	497·61	214	498·05	290	501·43	2,175		
17	498·13	306	497·73	232	497·60	213	498·18	317	501·55	2,275		
18	498·13	306	497·73	232	497·60	213	498·33	354	501·63	2,375		
19	498·13	306	497·73	232	497·60	213	498·43	381	501·73	2,475		
20	498·03	286	497·73	232	497·59	211	498·61	433	501·78	2,525		
21	498·03	286	497·73	232	497·59	211	498·73	469	501·93	2,675		
22	498·03	286	497·73	232	497·59	211	498·83	501	502·03	2,775		
23	498·03	286	497·73	232	497·60	213	498·98	549	502·15	2,875		
24	498·03	286	497·73	232	497·61	214	499·08	581	502·23	2,975		
25	498·03	286	497·73	232	497·62	216	499·23	615	502·33	3,075		
26	498·03	286	497·63	217	497·61	214	499·38	695	502·48	3,125		
27	498·03	286	497·63	217	497·61	214	499·48	738	502·58	3,225		
28	497·93	266	497·63	217	497·64	214	499·62	810	502·71	3,475		
29	497·93	266			497·60	213	499·75	865	502·83	3,575		
30	497·93	266			497·58	210	499·83	920	503·11	3,875		
31	497·93	266			497·56	207			503·38	4,125		

Gauge heights marked thus [1] interpolated.

KETTLE FALLS, INTERNATIONAL CHANNEL.

History.—The meter section on the International channel at Kettle falls was established on August 8, 1912, by Alexander Pirie.

Location.—The meter section is located 300 feet above Kettle falls on the Canadian and International channel. The initial point is a hole drilled in the rock at the head of the first narrows above the falls on the American shore elevation 506·68 D.P.W. datum. It is referenced by a 14-inch spruce tree blazed and marked, "I. P. S. 7 feet south."

Records Available.—From August 8, 1912, to June 13, 1913, daily gauge heights have been recorded and the daily discharges have been computed for that period.

Drainage Area.—The drainage area above Kettle falls is 7,060 square miles.

Gauge.—The gauge which was located in connection with the meter section on the Canadian channel was used for rating both stations.

Channel.—The channel is permanent, the river flowing over solid rock bed. Above the section it is straight for approximately 1,500 feet, and continues in the same direction for about 300 feet below.

Discharge Measurements.—Ten discharge measurements were taken by the Manitoba Hydrographic Survey during 1912 and 1913, covering a range in gauge height of approximately 6 feet.

Accuracy.—The discharge curve for the station is well defined for a range of 3 feet between elevation 497·6 and 500·6, D.P.W. datum; beyond these limits it is not so well defined.

Owing to the presence of Kettle falls a short distance below the section, no serious backwater effects are noted under winter conditions. Under these circumstances the discharge measurements may be considered as fairly accurate.

DISCHARGE MEASUREMENTS of International Channel, Kettle River at Kettle Falls, 1912–13.

Date		Hydrographer	Meter No.	Width.	Area of Section	Mean Velocity	Gauge Height	Discharge
1912				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
Aug.	8	S. S. Scovil	1,374	213	4,351	0·769	500·67	3,345
Sept.	6	A. Pirie	1,197	213	4,353	0·680	500·05	2,900
"	9	W. Richardson	1,374	213	4,318	0·643	500·10	2,775
"	30	A. Pirie	1,187	213	4,341	0·587	499·65	2,548
Nov.	4	R. H. Nelson	1,196	213	4,156	0·481	498·98	1,999
	2	do	1,196	213	4,193	0·485	498·99	2,037
1913								
Jan.	10	A. Pirie	1,462	208	3,981	0·33	498·[illegible]3	1,312
"	16	do	1,462	208	3,981	0·328	498·43	1,298
Mar.	17	do	1,186	210	3,888	0·284	497·60	1,105
May	31	do	1,197	223	5,216	1·22	[illegible]	6,375

Daily Gauge Height and Discharge of Kettle River at International Channel, Kettle Falls for 1912-13.

[Drainage area 7,100 square miles.]

Day.	July, 1912		Aug., 1912		Sept., 1912		Oct., 1912		Nov., 1912.		Dec., 1912	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1					499·96	2,785	499·62	2,445	499·06	1,959	498·53	1,580
2					499·92	2,735	499·53	2,355	499·01	1,920	498·53	1,580
3					499·86	2,685	499·51	2,355	498·98	1,897	498·53	1,580
4					499·86	2,685	499·55	2,355	498·97	1,890	498·53	1,580
5					500·05	2,835	499·56	2,400	498·93	1,860	498·53	1,580
6					500·03	2,835	499·57	2,400	498·91	1,845	498·53	1,580
7					500·03	2,835	499·58	2,400	498·88	1,822	498·52	1,573
8			500·67	3,517	500·03	2,835	499·55	2,355	498·85	1,800	498·48	1,547
9			500·67	3,517	500·13	2,940	499·53	2,355	498·85	1,800	498·43	1,515
10			500·67	3,517	500·13	2,940	499·51	2,355	498·83	1,785	498·43	1,515
11			500·66	3,517	500·13	2,940	499·50	2,310	498·82	1,778	498·43	1,515
12			500·56	3,412	500·13	2,940	499·49	2,310	498·82	1,778	498·43	1,515
13			500·66	3,517	500·11	2,940	499·48	2,310	498·81	1,771	498·23	1,390
14			500·49	3,307	500·04	2,835	499·48	2,310	498·78	1,750	498·23	1,390
15			500·47	3,307	500·03	2,835	499·43	2,265	498·76	1,736	498·23	1,390
16			500·41	3,255	500·01	2,835	499·41	2,265	498·81	1,771	498·13	1,330
17			500·40	3,202	499·95	2,735	499·40	2,222	498·78	1,750	498·13	1,330
18			500·38	3,202	499·92	2,735	499·35	2,180	498·73	1,715	498·13	1,330
19			500·34	3,150	499·85	2,635	499·28	2,137	498·75	1,729	498·33	1,450
20			500·31	3,150	499·85	2,635	499·27	2,129	498·78	1,750	498·33	1,450
21			500·29	3,097	499·81	2,635	499·25	2,112	498·73	1,715	498·33	1,450
22			500·23	3,045	499·79	2,587	499·23	2,095	498·71	1,701	498·33	1,450
23			500·18	2,992	499·73	2,540	499·20	2,071	498·69	1,687	498·23	1,390
24			500·17	2,992	499·75	2,540	499·19	2,063	498·67	1,673	498·23	1,390
25			500·14	2,940	499·75	2,540	499·16	2,039	498·65	1,659	498·23	1,390
26			500·08	2,887	499·73	2,540	499·13	2,015	498·63	1,645	498·23	1,390
27			500·06	2,887	499·68	2,492	499·11	1,999	498·69	1,687	498·23	1,390
28			500·08	2,887	499·68	2,492	499·05	1,951	498·73	1,715	498·23	1,390
29			500·06	2,887	499·71	2,540	499·03	1,935	498·63	1,645	498·23	1,390
30			500·04	2,835	499·64	2,445	499·05	1,951	498·69	1,687	498·23	1,390
31			500·02	2,835			499·10	1,991			498·23	1,390

Day.	Jan., 1913		Feb., 1913.		March, 1913.		April, 1913.		May, 1913		June, 1913	
1	498·23	1,390	497·93	1,220	497·63	1,080	497·56	1,052	499·98	2,785	503·63	6,615
2	498·23	1,390	497·93	1,220	497·63	1,080	497·56	1,052	500·08	2,887	503·83	6,825
3	498·13	1,330	497·93	1,220	497·63	1,080	497·58	1,060	500·18	2,992	504·01	7,035
4	498·13	1,330	497·93	1,220	497·63	1,080	497·58	1,060	500·28	3,097	504·11	7,140
5	498·13	1,330	497·93	1,220	497·63	1,080	497·59	1,064	500·38	3,202	504·27	7,297
6	498·13	1,330	497·93	1,220	497·63	1,080	497·59	1,064	500·38	3,202	504·35	7,350
7	498·13	1,330	497·83	1,170	497·63	1,080	497·59	1,064	500·53	3,360	504·43	7,455
8	498·13	1,330	497·83	1,170	497·63	1,080	497·59	1,064	500·68	3,517	504·45	7,455
9	498·13	1,330	497·83	1,170	497·63	1,080	497·60	1,068	500·75	3,570	504·49	7,507
10	498·13	1,330	497·83	1,170	497·53	1,040	497·60	1,068	500·83	3,675	504·55	7,560
11	498·13	1,330	497·83	1,170	497·53	1,040	497·60	1,068	500·93	3,780	504·55	7,560
12	498·13	1,330	497·83	1,170	497·57	1,056	497·61	1,072	501·13	3,990	504·55	7,560
13	498·13	1,330	497·83	1,170	497·58	1,060	497·65	1,089	501·05	3,885	504·55	7,560
14	498·13	1,330	497·83	1,170	497·60	1,068	497·81	1,161	501·13	3,990		
15	498·13	1,330	497·83	1,170	497·61	1,072	497·91	1,210	501·33	4,200		
16	498·13	1,330	497·83	1,170	497·61	1,072	498·05	1,286	501·43	4,305		
17	498·13	1,330	497·73	1,125	497·60	1,068	498·18	1,360	501·55	4,410		
18	498·13	1,330	497·73	1,125	497·60	1,068	498·33	1,450	501·63	4,515		
19	498·13	1,330	497·73	1,125	497·60	1,068	498·43	1,515	501·73	4,620		
20	498·03	1,275	497·73	1,125	497·59	1,064	498·61	1,632	501·78	4,672		
21	498·03	1,275	497·73	1,125	497·59	1,064	498·73	1,715	501·93	4,830		
22	498·03	1,275	497·73	1,125	497·59	1,064	498·83	1,785	502·03	4,935		
23	498·03	1,275	497·73	1,125	497·60	1,068	498·98	1,897	502·15	5,040		
24	498·03	1,275	497·73	1,125	497·61	1,072	499·08	1,975	502·23	5,143		
25	498·03	1,275	497·73	1,125	497·62	1,076	499·23	2,095	502·33	5,250		
26	498·03	1,275	497·63	1,080	497·61	1,072	499·38	2,222	502·48	5,407		
27	498·03	1,275	497·63	1,080	497·61	1,072	499·48	2,310	502·58	5,512		
28	497·93	1,220	497·63	1,080	497·61	1,072	499·63	2,445	502·71	5,670		
29	497·93	1,220			497·60	1,068	499·75	2,540	502·83	5,775		
30	497·93	1,220			497·58	1,060	499·83	2,635	504·11	6,090		
31	497·93	1,220			497·56	1,052			503·38	6,352		

Note.—Gauge heights marked thus (*) interpolated.

Daily Gauge Height and Discharge of Combined Channels, Kettle River, at Kettle Falls for 1912-13.

[Drainage area, 7,100 square miles.]

Day.	July, 1912.		Aug., 1912.		Sept., 1912.		Oct., 1912.		Nov., 1912.		Dec., 1912.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1					499·96	3,790	499·62	3,255	499·06	2,534	498·53	1,989
2				.....	499·92	3,710	499·53	3,115	499·01	2,479	498·53	1,989
3				..	499·86	3,632	499·51	3,115	498·98	2,446	498·53	1,989
4				..	499·86	3,632	499·55	3,115	498·97	2,436	498·53	1,989
5				..	500·05	3,870	499·56	3,185	498·93	2,393	498·53	1,989
6			....	...	500·03	3,870	499·57	3,185	498·91	2,372	498·53	1,989
7				.	500·03	3,870	499·58	3,185	498·88	2,339	498·52	1,979
8			500·67	4,997	500·03	3,870	499·55	3,115	498·85	2,307	498·48	1,942
9			500·67	4,997	500·13	4,035	499·53	3,115	498·85	2,307	498·43	1,896
10			500·67	4,997	500·13	4,035	499·51	3,115	498·83	2,286	498·43	1,896
11			500·66	4,997	500·13	4,035	499·50	3,047	498·82	2,276	498·43	1,896
12			500·56	4,814	500·13	4,035	499·49	3,047	498·82	2,276	498·43	1,896
13			500·66	4,997	500·11	4,035	499·48	3,047	498·81	2,265	498·23	1,718
14			500·49	4,637	500·04	3,870	499·48	3,047	498·78	2,235	498·23	1,718
15			500·47	4,637	500·03	3,870	499·43[1]	2,980	498·76	2,215	498·23	1,718
16			500·41	4,550	500·01	3,870	499·41[1]	2,980	498·81	2,265	498·13	1,636
17		.	500·40	4,462	499·95	3,710	499·40[1]	2,917	498·78	2,235	498·13	1,636
18			500·38	4,462	499·92	3,710	499·35[1]	2,855	498·73	2,184	498·13	1,636
19		.	500·34	4,375	499·85	3,555	499·28[1]	2,792	498·75	2,204	498·33	1,803
20			500·31	4,375	499·85	3,555	499·27[1]	2,780	498·78	2,235	498·33	1,803
21			500·29	4,289	499·81	3,555	499·25[1]	2,755	498·73	2,184	498·33	1,803
22		.	500·23	4,205	499·79	3,479	499·23[1]	2,730	498·71	2,164	498·33	1,803
		.	500·18	4,119	499·73	3,405	499·20[1]	2,695	498·69	2,144	498·23	1,718
		...	500·17	4,119	499·75	3,405	499·19[1]	2,684	498·67	2,124	498·23	1,718
		..	500·14	4,035	499·75	3,405	499·16[1]	2,649	498·65	2,104	498·23	1,718
26		..	500·08	3,952	499·73	3,405	499·13[1]	2,615	498·63	2,084	498·23	1,718
27		...	500·06	3,952	499·68	3,329	499·11[1]	2,592	498·69	2,144	498·23	1,718
28		...	500·08	3,952	499·68	3,329	499·05[1]	2,523	498·73	2,184	498·23	1,718
29		..	500·06	3,952	499·71	3,405	499·03	2,500	498·63	2,084	498·23	1,718
30		.	500·04	3,870	499·64	3,255	499·05	2,523	498·69	2,144	498·23	1,718
31			500·02	3,870	..	..	499·10	2,581		.....	498·23	1,718

Day.	Jan., 1913.		Feb., 1913.		March, 1913.		April, 1913.		May, 1913.		June, 1913.	
1	498·23	1,718	497·93	1,486	497·63	1,297	497·56	1,259	499·98	3,790	503·63	10,990
2	498·23	1,718	497·93	1,486	497·63	1,297	497·56	1,259	500·08	3,952	503·83	11,400
3	498·13	1,636	497·93	1,486	497·63	1,297	497·58	1,270	500·18	4,119	504·01	11,810
4	498·13	1,636	497·93	1,486	497·63	1,297	497·58	1,270	500·28	4,289	504·11	12,015
5	498·13	1,636	497·93	1,486	497·63	1,297	497·59	1,275	500·38	4,462	504·27	12,322
6	498·13	1,636	497·93	1,486	497·63	1,297	497·59	1,275	500·38	4,462	504·35	12,425
7	498·13	1,636	497·83	1,418	497·63	1,297	497·59	1,275	500·53	4,725	504·43	12,630
8	498·13	1,636	497·83	1,418	497·63	1,297	497·59	1,275	500·68	4,997	504·45	12,630
9	498·13	1,636	497·83	1,418	497·63	1,297	497·60	1,281	500·75	5,090	504·49	12,732
10	498·13	1,636	497·83	1,418	497·53	1,243	497·60	1,281	500·83	5,280	504·55	12,835
11	498·13	1,636	497·83	1,418	497·53	1,243	497·60	1,281	500·93	5,470	504·55	12,835
12	498·13	1,636	497·83	1,418	497·57	1,264	497·61	1,286	501·13	5,865	504·55	12,835
13	498·13	1,636	497·83	1,418	497·58[1]	1,270	497·65	1,309	501·05	5,665	504·55	12,835
14	498·13	1,636	497·83	1,418	497·60[1]	1,281	497·81	1,406	501·13	5,865		
15	498·13	1,636	497·83	1,418	497·61	1,286	497·91	1,472	501·33	6,275		
16	498·13	1,636	497·83	1,418	497·61	1,286	498·05	1,576	501·43	6,480		
17	498·13	1,636	497·73	1,357	497·60	1,281	498·18	1,677	501·55	6,685		
18	498·13	1,636	497·73	1,357	497·60	1,281	498·33	1,803	501·63	6,890		
19	498·13	1,636	497·73	1,357	497·60	1,281	498·43	1,896	501·73	7,095		
20	498·03	1,561	497·73	1,357	497·59	1,275	498·61	2,065	501·78	7,197		
21	498·03	1,561	497·73	1,357	497·59	1,275	498·73	2,184	501·93	7,505		
22	498·03	1,561	497·73	1,357	497·59	1,275	498·83	2,286	502·03	7,710		
23	498·03	1,561	497·73	1,357	497·60	1,281	498·98	2,446	502·15	7,915		
24	498·03	1,561	497·73	1,357	497·61	1,286	499·08	2,558	502·23	8,118		
25	498·03	1,561	497·73	1,357	497·62	1,292	499·23	2,730	502·33	8,325		
26	498·03	1,561	497·63	1,297	497·61	1,286	499·38	2,917	502·48	8,532		
27	498·03	1,561	497·63	1,297	497·61	1,286	499·48	3,048	502·58	8,737		
28	497·93	1,486	497·63	1,297[1]	497·61	1,286	499·63	3,255	502·71	9,145		
29	497·93	1,486	....	....	497·60	1,281	499·75	3,405	502·83	9,350		
30	497·93	1,486	......	.. .	497·58	1,270	499·83	3,555	503·11	9,955		
31	497·93	1,486	...	...	497·56	1,259			503·38	10,477		

Note.—Gauge heights marked thus [1] interpolated.

Monthly Discharge of Kettle River at Kettle Falls, for 1912-13.

[Drainage area, 7,100 square miles.]

Month	Discharge in Second-feet				Run-off	
	Maximum	Minimum.	Mean	Per square mile.	Depth in inches on Drainage area	Total in acre-feet
1912						
August	4,997	3,870	4,400	0·620	0·715	270,500
September	4,035	3,255	3,685	0·519	0·580	219,300
October	3,255	2,500	2,900	0·408	0·470	178,300
November	2,534	2,084	2,255	0·317	0·354	134,200
December	1,989	1,636	1,810	0·255	0·294	111,300
The period	4,997	1,636	3,010	0·424	2·413	913,600
1913						
January	1,718	1,486	1,600	0·225	0·259	98,400
February	1,486	1,297	1,400	0·197	0·205	77,800
March	1,297	1,243	1,280	0·180	0·207	78,700
April	3,555	1,259	1,895	0·267	0·298	112,800
May	10,477	3,790	6,595	0·928	1·068	405,500
The period	10,477	1,243	2,554	0·359	2·037	773,200

Note.—This table gives the total combined discharge, run-off, etc., of the Canadian and International Channels of the Kettle River at Kettle Falls.

Rainy River at Fort Frances.

History.—The station was established by the United States Geological Survey in 1909. On August 13, 1911, the maintenance of the station was taken over by the Dominion Department of Public Works, though the United States Geological Survey still co-operated in the securing of discharge measurements. During the years 1912 and 1913, a similar co-operation was carried on by the Manitoba Hydrographic Survey.

Location of Section.—The section is located 80 feet below the steamboat wharf at International Falls, and is about 1,800 feet below the dam of the Minnesota and Ontario Power Company. The initial point of the section is marked by an iron bolt which is imbedded in a rock outcrop just below the steamboat wharf on the American side of the river.

Records Available.—Gauging records from March 1, 1907, to August 12, 1911, have been secured by the Minnesota and Ontario Power Company and the United States Geological Survey. Subsequent to the latter date, continuous records have been secured by the United States Geological Survey and the Dominion Department of Public Works. From March 1, 1907, to August 12, 1911, the estimated daily discharges are based on the gauge records referred to a computed discharge curve. Subsequent to August 12, 1911, the discharges, published herein, have been furnished by the Dominion Department of Public Works, and are based on records of turbine gate and sluice openings in the plant of the Minnesota and Ontario Power Company.

Drainage Area.—The drainage area which is tributary to the Rainy river above International Falls is, according to determinations of the United States Geological Survey, 14,600 square miles. A later determination, made from the best maps available by the Dominion Water Power Branch, gives this area as being 14,100 square miles.

Gauge.—A vertical staff gauge is fastened to a pile at the southwest corner of the steamboat landing, about 80 feet above the section; the zero of this gauge is referred to the Ontario D.P.W. datum.

Channel.—There is only one channel in the river at this point, the bed of the stream is of sandy clay and reasonably permanent, the average depth across the section at normal stage being about 9 feet. There is a slight curve both above and below the section.

Discharge Measurements.—Meterings are made from a boat at all stages of the river, the discharge curve being based upon meterings made by the United States Geological Survey, the Dominion Department of Public Works, and the Manitoba Hydrographic Survey. These cover a range in gauge height of about 6 feet.

Storage.—Records of discharge following the summer of 1909 do not represent natural run-off, as Rainy lake, and later Namakan lake were both used as regulation basins, and therefore the supply and levels of these two lakes have to be considered on arriving at natural run-off.

Accuracy.—Previous to August, 1911, the estimated discharges are based primarily on gauging records to which corrections have been applied for backwater due to the Little and Big Fork rivers in the open season, and for backwater due to ice effects in winter months. At certain intervals, therefore, in the above period the records are only approximate. Since August, 1911, the estimated discharges are of high accuracy.

DAILY GAUGE HEIGHT AND DISCHARGE of Rainy River at Fort Frances for 1911.

(Drainage area, 14,400 square miles.)

Day	August		September		October		November		December	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1				6,480		5,180		4,970		5,630
2				6,515		4,110		4,850		5,615
3				6,580		5,250		4,890		4,815
4				5,845		5,505		4,400		4,605
5				6,056		5,500		4,220		5,570
6				6,415		5,560		4,260		5,575
7				6,180		5,220		4,770		5,605
8				6,300		4,475		4,785		5,690
9				6,120		4,460		5,012		6,095
10				5,700		4,680		4,987		5,090
11				5,600		5,470		4,760		4,635
12				5,984		5,480		4,715		5,645
13				5,300		5,490		4,250		5,670
14		4,820		5,950		5,050		5,000		5,660
15		6,750		5,930		4,180		5,550		5,650
16		6,730		5,990		4,400		5,420		5,705
17		6,470		4,948		4,675		5,445		4,940
18		6,385		4,445		5,300		5,555		4,370
19		6,650		6,055		5,490		5,070		5,670
20		5,134		5,858		5,470		5,895		5,700
21		4,847		5,660		4,884		5,630		5,670
22		6,540		5,600		4,500		5,620		5,790
23		6,585		5,170		4,480		5,595		5,640
24		6,711		4,595		5,015		5,915		4,080
25		6,520		4,225		5,475		6,100		2,000
26		6,740		5,150		5,445		5,410		5,555
27		5,294		5,270		5,475		4,990		5,990
28		4,968		5,570		5,260		5,620		6,100
29		6,500		5,520		4,410		5,650		6,085
30		6,540		5,500		5,900		5,675		5,735
31		6,590				4,840				3,330

Daily Gauge Height and Discharge of Rainy River at Fort Frances, for 1912.

[Drainage Area, 14,400 square miles.]

Day.	January.		February.		March.		April		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge
	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.
1	...	4,490	...	5,085	...	4,856	...	3,953	...	5,880	...	6,315
2	...	5,695	...	5,440	...	4,888	...	5,022	...	5,885	...	5,440
3	...	5,665	...	5,845	...	4,197	...	5,028	...	5,915	...	5,325
4	...	5,695	...	4,620	...	4,102	...	4,997	...	6,190	...	6,437
5	...	5,640	...	3,995	...	5,101	...	5,002	...	5,250	...	6,382
6	...	5,815	...	5,105	...	5,037	...	4,984	...	4,795	...	6,410
7	...	4,450	...	5,090	...	5,090	...	3,725	...	6,185	...	6,305
8	...	3,995	...	5,050	...	5,102	...	3,616	...	6,570	...	6,159
9	...	5,725	...	4,985	...	5,063	...	5,049	...	6,610	...	5,971
10	...	5,720	...	4,870	...	4,205	...	5,068	...	6,692	...	5,889
11	...	5,725	...	4,105	...	4,108	...	5,096	...	6,734	...	6,267
12	...	5,940	...	3,990	...	5,105	...	5,119	...	5,435	...	6,239
13	...	6,220	...	5,030	...	5,060	...	5,052	...	4,800	...	6,283
14	...	3,700	...	5,035	...	5,025	...	4,031	...	6,690	...	6,312
15	...	5,030	...	5,000	...	5,046	...	4,409	...	6,695	...	6,255
16	...	5,855	...	5,069	...	4,960	...	5,100	...	6,690	...	5,570
17	...	5,930	...	5,047	...	3,828	...	5,060	...	6,350	...	5,730
18	...	5,900	...	4,119	...	3,890	...	5,045	...	6,355	...	6,042
19	...	5,915	...	3,976	...	4,812	...	5,055	...	4,855	...	6,093
20	...	5,915	...	5,035	...	5,045	...	5,048	...	5,200	...	6,180
21	...	4,700	...	5,044	...	5,096	...	4,130	...	6,730	...	6,261
22	...	4,320	...	5,057	...	5,095	...	3,950	...	6,743	...	6,415
23	...	5,915	...	5,063	...	5,004	...	5,045	...	6,720	...	5,823
24	...	5,920	...	5,014	...	3,560	...	5,055	...	6,770	...	5,693
25	...	5,875	...	4,169	...	4,429	...	5,385	...	6,577	...	6,190
26	...	5,760	...	4,080	...	5,070	...	5,800	...	4,892	...	5,835
27	...	5,495	...	5,068	...	5,022	...	5,900	...	5,175	...	5,969
28	...	4,255	...	5,066	...	5,057	...	4,597	...	6,680	...	5,853
29	...	3,935	...	5,056	...	5,090	...	4,348	...	6,495	...	5,555
30	...	5,080	...	..	...	4,910	...	5,865	...	6,350	...	5,267
31	...	5,080	...	..	...	4,012	...		...	5,814	...	..

Day.	July	August	September	October	November	December.
1	6,078	10,091	6,448	7,279	7,087	5,801
2	5,660	10,072	5,892	7,202	7,122	6,433
3	5,880	10,077	6,470	7,039	6,184	6,725
4	5,472	9,462	8,408	7,089	6,095	7,001
5	5,402	8,953	8,490	7,078	7,199	6,968
6	5,905	9,825	8,363	6,199	7,146	6,655
7	5,394	9,837	7,997	6,543	7,100	6,149
8	5,835	9,714	7,254	7,063	7,073	5,828
9	6,932	9,333	7,266	7,060	6,791	5,860
10	7,043	9,332	8,057	7,039	6,175	6,913
11	8,074	8,442	7,962	7,045	5,998	6,973
12	8,285	8,299	7,799	7,100	6,568	6,972
13	8,218	8,208	7,831		6,923	6,962
14	7,570	8,246	7,880	6,664	7,020	6,675
15	7,494	7,965	7,260	7,083	6,955	5,412
16	8,613	7,048	7,234	7,044	7,041	5,532
17	8,835	7,528	7,812	7,047	5,261	7,267
18	8,148	7,720	7,579	6,852	6,511	6,987
19	6,981	7,530	6,996	6,987	6,999	6,850
20	7,604	8,416	6,923	6,594	7,015	6,989
21	8,633	8,194	6,588	5,824	7,089	6,762
22	8,405	6,865	5,910	7,076	7,033	5,900
23	8,936	6,728	6,063	7,111	7,051	4,650
24	9,012	6,932	6,930	7,070	6,174	6,581
25	8,940	5,885	7,315	7,056	5,978	5,011
26	9,061	6,166	8,892	7,078	7,002	4,591
27	8,105	6,614	8,223	6,135	7,054	5,905
28	8,572	6,839	7,179	5,927	7,047	6,549
29	9,048	[illegible]	6,980	6,968	6,687	5,762
30	9,560	7,152	7,021	7,076	6,422	5,137
31	10,087	7,177		7,112		6,751

Daily Gauge Height and Discharge of Rainy River at Fort Frances, for 1913.

[Drainage Area, 14,400 square miles.]

Day.	January.		February.		March.		April		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft.	Feet.	Sec.-ft
1	...	6,805	...	6,841	...	6,850	...	6,846	...	6,826	...	5,535
2	...	6,795	...	5,647	...	5,602	...	6,246	...	6,831	...	6,216
3	...	6,827	...	6,385	...	5,675	...	5,870	...	6,814	...	6,960
4	...	6,978	...	6,864	...	6,749	...	6,187	...	5,978	...	6,852
5	...	5,980	...	6,887	...	6,751	...	6,634	...	6,331	...	6,868
6	...	5,216	...	6,895	...	6,900	...	4,406	...	6,827	...	6,904
7	...	6,858	...	6,853	...	6,905	...	5,438	...	6,827	...	6,820
8	...	6,796	...	6,900	...	6,919	...	6,621	...	6,814	...	6,273
9	...	6,892	...	5,738	...	5,840	...	6,801	...	6,881	...	6,343
10	...	6,920	...	5,849	...	5,725	...	6,865	...	6,820	...	6,795
11	...	6,921	...	6,879	...	6,750	...	6,792	...	5,938	...	6,870
12	...	5,778	...	6,884	...	6,780	...	6,783	...	6,172	...	6,911
13	...	6,124	...	6,878	...	6,716	...	5,883	...	6,761	...	6,902
14	...	6,911	...	6,872	...	6,798	...	5,419	...	6,788	...	7,052
15	...	6,932	...	6,853	...	6,739	...	6,715	...	6,730	...	6,729
16	...	6,941	...	5,618	...	5,464	...	6,837	...	6,765	...	6,398
17	...	6,909	...	5,477	...	5,653	...	6,801	...	6,820	...	7,492
18	...	6,947	...	6,865	...	6,730	...	6,71[illegible]	...	5,994	...	7,410
19	...	6,015	...	6,877	...	6,747	...	6,7[illegible]1	...	6,163	...	7,336
20	...	5,073	...	6,853	...	6,682	...	5,324	...	6,772	...	7,473
21	...	6,956	...	6,894	...	6,752	...	6,254	...	6,796	...	7,468
22	...	6,945	...	6,844	...	6,715	...	6,368	...	6,777	...	6,689
23	...	6,909	...	5,631	...	5,598	...	6,706	...	6,760	...	7,324
24	...	6,937	...	6,054	...	4,921	...	6,758	...	6,785	...	7,814
25	...	6,955	...	6,864	...	6,840	...	6,726	...	6,162	...	7,840
26	...	5,896	...	6,847	...	6,813	...	6,746	...	6,088	...	7,856
27	...	6,273	...	6,830	...	6,811	...	5,873	...	6,749	...	8,798
28	...	6,856	...	6,830	...	6,775	...	6,180	...	6,550	...	8,832
29	...	6,928	...		...	6,800	...	6,696	...	6,889	...	9,673
30	...	6,977		...	...	5,946	...	6,913	...	6,896	...	9,863
31	...	6,981	...		...	5,990	...	...	...	6,906	...	...

Day.	July.		August.		September		October.		November.		December	
1	...	11,023	...	9,490	...	5,251	...	6,126	...	5,965	...	5,823
2	...	11,058	...	8,829	...	6,328	...	6,892	...	5,406	...	6,980
3	...	11,004	...	9,223	...	6,935	...	6,980	...	5,445	...	6,987
4	...	11,606	...	9,048	...	7,019	...	6,970	...	6,110	...	6,540
5	...	11,438	...	9,134	...	6,703	...	6,456	...	6,055	...	6,077
6	...	11,503	...	9,139	...	6,997	...	6,040	...	5,994	...	6,542
7	...	10,343	...	9,176	...	5,885	...	8,565	...	6,080	...	5,430
8	...	10,106	...	10,414	...	7,262	...	6,435	...	6,075	...	5,877
9	...	9,633	...	10,022	...	6,821	...	6,633	...	5,493	...	6,901
10	...	10,820	...	9,503	...	7,016	...	6,920	...	5,759	...	6,930
11	...	13,475	...	8,758	...	7,014	...	6,940	...	6,105	...	6,864
12	...	13,510	...	9,108	...	6,964	...	6,207	...	6,100	...	6,963
13	...	12,246	...	9,076	...	7,010	...	7,389	...	6,135	...	6,944
14	...	13,539	...	9,207	...	6,238	...	7,170	...	5,889	...	6,222
15	...	14,49[illegible]	...	9,261	...	6,455	...	6,932	...	6,222	...	6,394
16	...	13,715	...	8,968	...	6,960	...	6,257	...	5,310	...	6,974
17	...	14,576	...	8,758	...	7,094	...	6,360	...	5,242	...	6,778
18	...	14,243	...	8,654	...	7,000	...	6,150	...	6,115	...	6,988
19	...	15,290	...	9,019	...	6,985	...	6,048	...	6,305	...	6,988
20	...	14,019	...	8,914	...	6,975	...	5,545	...	6,440	...	6,966
21	...	13,187	...	9,136	...	6,535	...	6,080	...	5,675	...	6,205
22	...	13,221	...	9,118	...	6,909	...	6,140	...	6,558	...	5,945
23	...	13,254	...	8,888	...	7,069	...	6,105	...	6,237	...	6,095
24	...	13,331	...	6,232	...	7,026	...	6,100	...	6,468	...	6,118
25	...	13,225	...	7,229	...	7,015	...	6,120	...	6,780	...	4,908
26	...	13,262	...	7,022	...	6,994	...	5,474	...	7,175	...	4,608
27	...	12,802	...	6,965	...	6,915	...	5,550	...	6,931	...	5,201
28	...	12,844	...	7,005	...	6,121	...	6,070	...	6,979	...	6,225
29	...	13,292	...	6,987	...	6,900	...	6,105	...	6,696	...	5,525
30	...	13,732	...	6,665	...	7,030	...	6,026	...	5,519	...	6,095
31	...	9,794	...	5,660	...	...	...	6,075	...	...	...	6,299

Daily Gauge Height and Discharge of Rainy River at Fort Frances, for 1914.

[Drainage area 14,400 square miles.]

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft
1		6,070		6,439		6,164		6,898		6,868		7,874
2		6,097		6,586		6,418		6,908		6,784		8,834
3		6,933		6,949		6,980		6,912		5,988		8,976
4		6,251		7,000		6,896		6,892		6,396		9,043
5		5,492		7,020		6,956		6,050		6,598		8,749
6		6,935		6,938		6,942		6,320		6,798		8,792
7		6,877		6,976		6,922		6,936		6,840		6,646
8		6,870		6,468		5,775		6,916		6,788		7,751
9		6,785		6,482		6,394		6,918		6,752		9,054
10		6,856		6,970		7,064		6,928		5,997		9,421
11		6,218		6,978		7,008		6,910		6,214		8,906
12		6,536		7,078		7,030		6,077		6,802		8,415
13		6,961		7,050		6,986		6,244		6,814		8,860
14		6,951		6,944		7,010		6,902		6,842		6,673
15		6,957		6,312		5,589		6,895		6,846		7,203
16		6,980		6,436		6,384		6,894		6,848		8,686
17		7,021		7,280		6,950		6,932		6,260		8,953
18		6,245		6,744		7,002		6,852		6,272		9,126
19		6,455		6,978		7,022		5,878		6,804		9,070
20		6,920		7,042		7,000		6,280		6,818		9,050
21		6,950		8,021		7,016		6,900		6,864		6,968
22		6,921		5,907		6,180		6,834		6,832		7,644
23		6,959		6,410		6,392		6,868		6,856		8,745
24		6,957		6,974		6,958		6,878		6,102		8,910
25		6,326		6,988		6,850		6,876		6,620		9,466
26		7,140		7,018		6,944		6,052		7,398		9,504
27		7,036		6,998		6,928		6,252		7,432		9,104
28		6,958		7,020		6,928		6,862		7,940		6,606
29		7,004				6,056		6,796		8,630		8,198
30		6,936				6,270		6,856		8,954		8,670
31		6,685				6,880				6,961		

Day	July	August	September	October	November	December
1	7,778	10,703	10,410	10,520	7,601	11,040
2	8,316	8,331	10,580	10,510	8,935	10,929
3	8,966	9,081	10,540	10,005	10,839	11,060
4	8,416	10,984	10,528	7,019	10,778	10,853
5	6,181	10,854	10,528	8,651	10,824	10,390
6	7,216	10,937	7,630	10,353	10,781	7,458
7	10,058	10,772	4,270	10,570	10,788	8,272
8	9,829	10,895	9,216	10,454	8,271	10,661
9	10,346	8,816	10,590	10,482	9,170	11,171
10	10,669	9,021	10,600	10,540	10,788	10,711
11	10,739	10,907	10,590	7,641	10,810	10,740
12	7,815	10,948	10,570	8,833	10,800	10,948
13	10,756	10,992	7,713	10,508	10,566	7,225
14	11,023	10,855	8,889	9,996	9,946	8,681
15	10,953	10,877	10,600	9,269	7,783	9,308
16	10,933	7,730	10,522	9,660	8,959	10,218
17	11,376	8,618	10,520	9,680	10,285	9,290
18	11,819	10,654	10,514	7,456	10,762	9,925
19	9,503	10,740	10,500	8,371	11,144	9,991
20	10,472	10,590	8,045	10,533	10,741	6,911
21	12,061	10,578	8,848	10,462	11,145	7,834
22	12,441	10,519	10,512	10,671	8,192	9,124
23	12,775	8,549	10,542	10,991	9,190	9,313
24	12,541	8,871	10,595	10,297	11,059	9,666
25	[illegible]	[illegible]	10,515	7,007	10,913	3,448
26	[illegible]	[illegible]	10,414	8,977	10,801	1,224
27	[illegible]	10,628	8,187	10,648	10,003	3,710
28	[illegible]	10,658	8,674	10,848	9,416	8,318
29	[illegible]	10,628	[illegible]	10,808	[illegible]	[illegible]
30	11,247	7,735	[illegible]	10,801	8,171	10,410
31	[illegible]	8,725		10,739		10,017

Daily Gauge Height and Discharge of Rainy River at Fort Frances, for 1915.

[Drainage area 14,400 square miles.]

Day	January		February	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge
	Feet	Sec.-ft.	Feet	Sec.-ft.
1		10,092		7,153
2		10,320		8,292
3		6,610		8,175
4		9,030		8,291
5		10,460		8,083
6		10,052		8,281
7		10,057		6,792
8		10,277		7,193
9		10,360		8,245
10		6,981		8,247
11		8,635		8,360
12		10,352		8,178
13		10,330		7,746
14		10,137		
15		8,595		
16		9,565		
17		9,183		
18		8,220		
19		9,555		
20		9,545		
21		9,508		
22		9,451		
23		8,882		
24		7,938		
25		8,714		
26		9,425		
27		8,807		
28		8,564		
29		9,090		
30		9,201		
31		7,529		

MONTHLY DISCHARGES of Rainy River at Fort Frances.

Month.	Discharge in Second-Feet.				Run-off	
	Maximum	Minimum	Mean.	Per square mile.	Depth in inches on Drainage Area.	Billions of cub. ft.
1911.						
September	6,880	4,730	5,990	0·416	0·464	15·52
October	5,890	4,320	5,210	0·362	0·418	13·95
November	6,070	4,020	5,410	0·376	0·419	14·03
December	. . .	. . . . . .	5,900	0·410	0·473	15·80
The Period	6,880	4,020	5,377	0·391	1·774	59·30
1912.						
January	6,220	3,700	5,330	0·370	0·427	14·27
February	5,840	3,980	4,830	0·336	0·349	11·68
March	5,100	3,560	4,740	0·329	0·380	12·70
April	5,900	3,620	4,850	0·337	0·376	12·57
May	6,770	4,800	6,090	0·423	0·488	16·31
June	6,430	5,240	6,020	0·418	0·467	15·60
July	10,100	5,150	7,680	0·534	0·616	20·57
August	10,100	5,880	8,120	0·564	0·651	21·73
September	8,890	5,890	7,360	0·512	0·570	19·08
October	7,280	5,820	6,880	0·478	0·552	18·41
November	7,200	5,260	6,730	0·468	0·522	17·45
December	7,267	4,591	6,280	0·436	0·504	16·82
The Year	10,100	3,560	6,243	0·434	5·90	197·19
1913.						
January	6,978	5,073	6,620	0·460	0·530	17·73
February	6,900	5,477	6,561	0·456	0·474	15·87
March	6,919	4,921	6,420	0·446	0·514	17·20
April	6,913	4,406	6,405	0·445	0·497	16·60
May	6,906	5,938	6,620	0·460	0·531	17·73
June	9,863	5,535	7,274	0·506	0·564	18·85
July	15,290	9,633	12,597	0·876	1·010	33·71
August	10,414	5,660	8,544	0·594	0·685	22·89
September	7,262	5,251	6,770	0·470	0·525	17·55
October	8,565	5,474	6,318	0·439	0·506	16·91
November	7,175	5,242	6,129	0·426	0·475	15·89
December	6,988	4,608	6,309	0·438	0·506	16·90
The Year	15,290	4,406	7,214	0·501	6·82	227·83
1914.						
January	7,140	5,492	6,718	0·467	0·538	17·98
February	8,023	5,967	6,823	0·474	0·493	16·50
March	7,064	5,589	6,707	0·466	0·538	17·96
April	6,998	5,878	6,694	0·465	0·519	17·35
May	8,954	5,988	6,866	0·477	0·550	18·39
June	9,504	6,606	8,464	0·588	0·656	22·11
July	12,775	6,184	10,464	0·727	0·839	28·02
August	10,984	7,730	10,044	0·698	0·805	26·90
September	10,600	4,270	9,749	0·677	0·756	25·28
October	10,991	7,019	9,787	0·680	0·784	26·21
November	11,145	7,783	9·927	0·690	0·770	25·72
December	11,171	1,224	8,994	0·625	0·721	24·09
The Year	12,775	1,224	8,436	0·586	7·97	266·51

[1]Estimated

RAINY RIVER AT EMO.

History.—The station on the Rainy river at Emo was established on October 2, 1912, by Alexander Pirie, and was in operation by the Manitoba Hydrographic Survey until March, 1913, when it was taken over by the Dominion Department of Public Works.

Location of Section.—On the Rainy river at Emo, Ont., the section is at the foot of the road leading from the C.N.R. station to the river in that town. The initial point is marked by a hub driven at the foot of a 2-foot stump which is on the left hand side of the road about one-half way down the river bank.

Records Available.—Four discharge measurements have been taken at this point, and these have not been sufficient to define a discharge curve for the station. Records of gauge heights taken at this point for the years 1906 to 1912 during the open-water season have been secured.

Gauge.—A 6-foot vertical staff gauge was nailed to the fourth pile from the shore on the downstream side of the old dock below Emo hotel, and 600 feet below the initial point of the metering section. The zero of the gauge is referred to Ontario Department of Public Works datum.

Channel.—The river is confined to one channel at this point and has an approximate depth under normal conditions of about 12 feet; the bottom is of clay and fairly permanent. The channel is straight for 1,500 feet above the section and 1,000 feet below, the banks are high and wooded, and are not liable to overflow.

Discharge Measurements.—Four discharge measurements have been taken of the river at this point and cover a range in stage of 1·2 feet.

DISCHARGE MEASUREMENTS of Rainy River at Emo, Ont., for 1912 13.

Date.	Hydrographer	Meter No	Width	Area of Section	Mean Velocity.	Gauge Height	Discharge
1912			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct 3	A. Pirie	1,187	731	5,962	1·75	457·93	10,419
Nov 7	R. H. Nelson	1,197	717	4,603	1·408	456·57	6,482
1913							
Jan 14	A. Pirie	1,469	722	5,009	1·29	456·66	[1]6,455
Mar 21	"	1,187	690	4,808	1·43	458·53	6,876

[1]Measurement taken under ice conditions.

RAINY RIVER AT BEAUDETTE.

History.—The meter section at this point on the Rainy river was established by G. W. Worden on August 19, 1912, and was continued in operation by the Manitoba Hydrographic Survey till March, 1913, when the Dominion Department of Public Works took it over.

Location of Section.—On the Rainy river on the downstream side of the C.N.R. bridge below the mouth of the Beaudette river. The initial point of the section is at the northeast corner of the C.N.R. bridge, and is marked at the intersection of the steel work with the top of the board walk.

Records Available.—Daily gauge heights were secured during the open-water period from August 19 to November 27, 1912, and gauge heights at various times during the winter period up till February 10, 1913.

Drainage Area.—The drainage area tributary to the Rainy river above this point is approximately 15,000 square miles.

Gauge.—A vertical staff gauge fastened to the upstream or west side of the centre pier of the C.N.R. bridge. Zero of gauge is referred to Ontario Department of Public Works datum.

Channel.—The river at the section is divided into six channels by piers of the C.N.R. bridge. The bottom is composed of sandy loam and clay, and is fairly permanent. Above the section the channel is straight for about 200 feet, and below there is a slight curve to the west. The banks are high and wooded and are not liable to overflow at the section.

Discharge Measurements.—Three discharge measurements have been taken at this point.

Accuracy.—This station is primarily dependent on the level of the lake of the Woods, and therefore no discharge rating curve referred to one gauging point can be secured.

Discharge Measurements of Rainy River at Beaudette Bridge, 1912.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height.	Discharge.
1912			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 3	W. Richardson	1,374	1,010	16,008	0·676	59·53	10,824
" 21	W. G. Worden	1,187	1,014	16,378	0·506	59·68	8,287
Sept. 3	Alex. Pirie	1,197	1,000	15,925	0·340	59·50	5,415

LAKE OF THE WOODS OUTLETS.

The outflow from the lake of the Woods into the Winnipeg river below the lake is through several natural and artificial channels. The flow through all these outlets is controlled by the operation of hydraulic plants or the manipulation of dams placed upon them. The outlets from the lake in order from the east are: eastern outlet, completely controlled by the Municipal Power Plant of Kenora; the western outlet, upon which has been built the Norman dam, the head-race of mill "C," Lake of the Woods Milling Co. and artificial outlet; the head-race of mill "A," belonging to the same company, and also an artificial channel; and last, the artificial head-race of the Keewatin Lumber and Manufacturing Company's plant discharging into Mink bay, which in turn drains into Darlington bay, an arm of the Winnipeg river.

Below the outlets the Winnipeg river is split up into a number of branches, the tail-races of mills "A" and "C," the outlet of Darlington bay, and the western outlet form the West Branch, and river below the eastern outlet forms the East Branch of the Winnipeg river. These unite below Old Fort island to form the main river.

The manipulation and operation of the dams and plants at the various outlets renders it difficult to ascertain the discharge from the lake of the Woods. In order that correct estimates may be made it has been necessary to establish and operate a number of metering stations and maintain gauges at various points in the district. The location of the metering stations are as follows:-

1. Eastern outlet, above the Kenora power-house.
2. Western outlet, Norman traffic bridge.
3. Head-race, mill "C."
4. Head-race, mill "A."
5. Head-race, Keewatin Lumber and Manufacturing Company.
6. C.P.R. culvert, outlet of Mink bay.
7. North Tunnel Island station.

In addition to the records obtained at these regular stations, observations of the discharge at different controlling sections below the outlets have been made from time to time.

East Branch Winnipeg River, Kenora Power House.

History.—The discharge of the East Branch or eastern outlet, lake of the Woods, depends upon the operation of the Kenora Municipal Power Plant. To determine the discharge under these circumstances it was necessary to rate the power plant. At first an attempt was made to determine the discharge directly, and to this end a station was established by Mr. S. S. Scovil, June 27, 1912, about half-mile below the power-house, near Old Fort island; this proved unsatisfactory so a station was established by Alexander Pirie, October 8, 1913, about 150 feet above the power-house, in the eastern outlet. This section was used to rate the power station.

Location of Section.—The metering station is about 150 feet above the Kenora power-house on the eastern outlet of the lake of the Woods. The initial point is located on the bank, and is marked by an iron bolt set in the rock.

Records Available.—Daily gauge height readings are available for the head- and tail-race of the plant from August 21, 1907, and daily estimates of discharge based upon the load of the plant are available for a like period.

Drainage Area.—As in the case of the other outlets of the lake of the Woods the drainage area above for the individual outlets is not significant.

Gauge.—Tail-race and head-race gauges were established at the power plant in 1907, and are the ones used in the records until 1912, when on June 24 and 27, head- and tail-race gauges were respectively established by Mr. Scovil, the former being on the upstream side of the timber platform in the head-race and the latter 200 feet below the power-house. Both were referred to W.P.S. datum.

Channel.—The channel is permanent, being in solid rock and boulders, is fairly uniform and free from cross eddies. It is straight for 50 feet above the section and 100 feet below, and fairly uniform. All the water passes through the power-house except for a small part escaping in the log chute.

Discharge Measurements.—Sufficient measurements were made to rate the station under the range in loads and heads occurring, and a rating curve of load-discharges constructed for various heads. A boat station is used for the measurements.

Accuracy.—Except for conditions due to small loads the rating may be considered good.

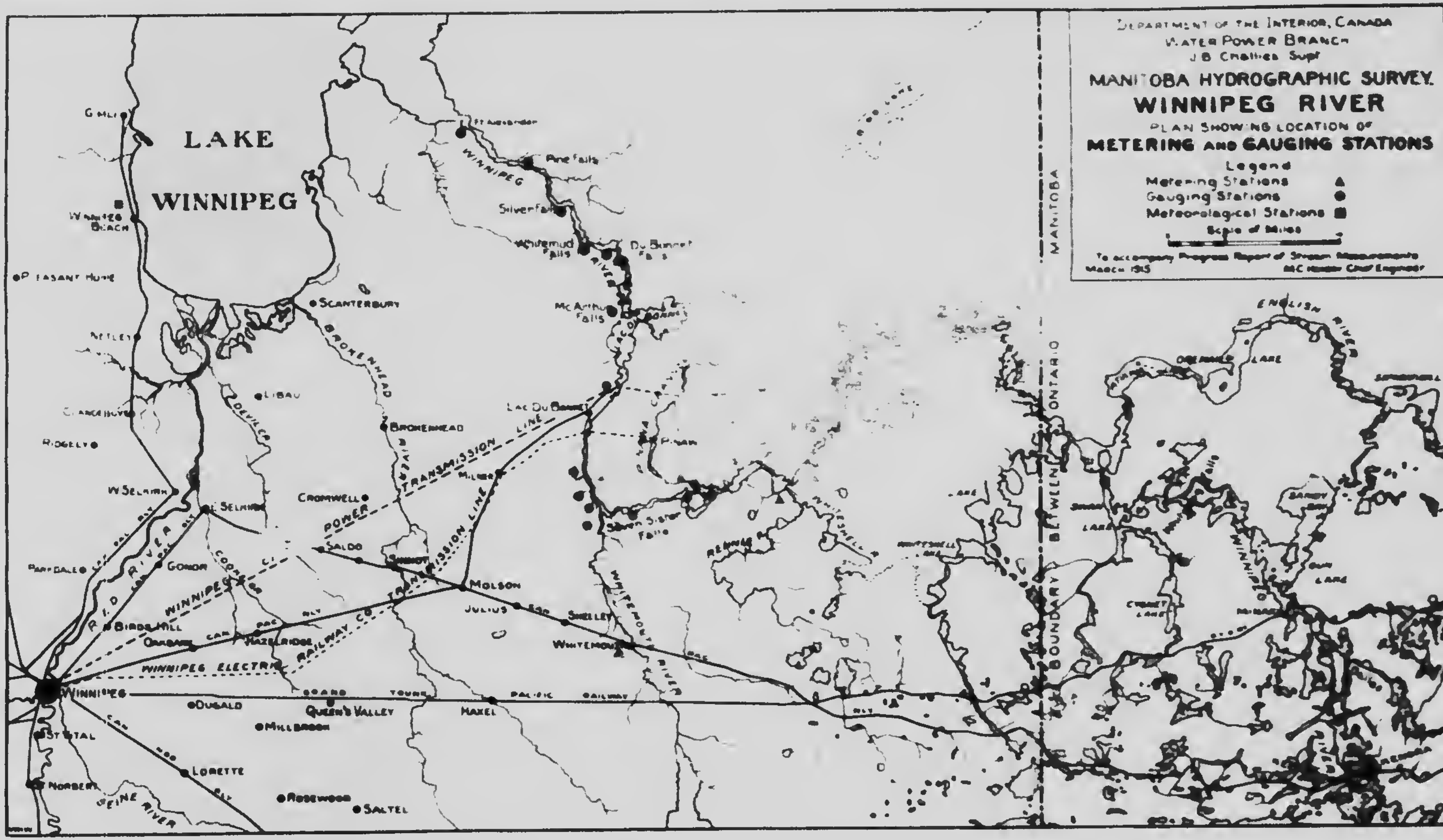
DISCHARGE MEASUREMENTS of East Branch Winnipeg River at Kenora Power House, 1912-14.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
			Feet	Sq. ft.	Ft. per sec.	Feet Tailrace	Sec.-ft.
1912							
June 27	S. S. Scovil	1,374	142	818	1·30	36·18	1,095
July 18	"	1,374	143	856	1·27	36·25	1,090
" 31	W. H. Richardson	1,374	149	832	1·25	36·23	1,043
Aug 13	W. G. Worden	1,187	141	828	1·29	36·20	1,068
" 31	"	1,187	141	770	1·28	36·26	985
Sept 27	W. H. Richardson	1,462	138	723	0·97	35·61	704
Oct 1	"	1,462	136	700	0·76	35·55	530
" 2	"	1,462	136	699	0·81	35·49	562
" 3	"	1,462	136	696	0·78	35·49	541
" 7	"	1,462	150	848	1·15	36·24	987
" 8	A. Pare	1,462	163	910	1·18	35·57	1,070
" 9	"	1,462	163	914	1·21	36·35	1,109
" 13	"	1,462	153	814	0·54	35·42	143
" 11	"	1,462	163	929	1·05	36·26	982
" 11	"	1,462	163	925	1·07	36·27	997
" 14	"	1,462	161	934	1·05	36·29	989
" 15	"	1,462	163	946	1·07	36·35	1,020
" 17	"	1,462	161	943	1·09	36·35	1,035
" 15	"	1,462	163	943	1·11	36·36	1,048
						Forebay	
" 15	"	1,462	89	1,393	0·78	59·45	1,095
" 17	"	1,462	89	1,392	0·75	59·41	1,042
" 17	"	1,462	89	1,392	0·77	59·41	1,084
" 17	"	1,462	89	1,393	0·7	59·42	1,049
" 17	"	1,462	89	1,393	0·75	59·42	1,044
" 17	"	1,462	89	1,395	0·83	59·41	1,176
" 19	"	1,462	89	1,592	0·74	59·39	1,038
						Tailrace.	
Nov 22	G. J. Lamb	1,187	164	1,025	1·11	36·47	1,137
" 22	"	1,187	164	1,025	1·10	36·49	1,127
" 28	"	1,187	166	998	1·11	36·49	1,108
						Forebay.	
1913							
Feb 24	G. J. Lamb	1,375	79	[illegible]	0·84	59·00	1,048
" 24	"	1,375	79	1,214	1·07	58·98	1,330
" 25	"	1,375	79	1,211	1·05	58·98	1,312
" 25	"	1,375	79	1,244	1·00	58·98	1,242
" 25	"	1,375	79	1,244	1·03	58·98	1,282
" 25	"	1,375	79	1,244	1·05	58·98	1,309
" 26	"	1,375	79	1,244	1·12	58·99	1,394
Mar 2	"	1,375	79	1,244	0·57	59·00	711
" 2	"	1,375	79	1,244	0·62	58·97	777
" 3	"	1,375	79	1,244	1·12	59·05	1,393
" 3	"	1,375	79	1,244	1·18	59·05	1,464
" 3	"	1,375	79	1,244	1·21	59·05	1,506
" 7	"	1,375	79	1,244	1·01	59·02	1,259
" 7	"	1,375	79	1,244	1·55	59·02	1,312
" 7	"	1,375	79	1,244	0·99	59·01	1,236

Discharge Measurements of East Branch Winnipeg River at Kenora Power House, 1912-14—*Continued*.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity.	Gauge Height	Discharge
			Feet	Sq. ft.	Ft. per sec	Feet Forebay	Sec.-ft
1913							
March 7	G. J. Lamb	1,375	79	1,244	1·01	59·06	1,254
" 7	"	1,375	79	1,244	1·00	59·05	1,242
" 7	"	1,375	79	1,244	0·96	59·05	1,200
" 7	"	1,375	79	1,244	1·01	59·06	1,256
" 7	"	1,375	79	1,251	1·00	59·08	1,250
" 8	"	1,375	79	1,241	0·97	59·07	1,205
" 8	"	1,375	79	1,244	1·00	59·05	1,239
" 8	"	1,375	79	1,244	0·99	59·06	1,224
" 8	"	1,375	79	1,244	1·00	59·04	1,249
" 8	"	1,375	79	1,244	1·02	59·03	1,266
" 8	"	1,375	79	1,241	1·01	59·03	1,263
" 9	"	1,375	79	1,251	0·65	59·12	816
" 9	"	1,375	79	1,251	0·62	59·12	771
" 9	"	1,375	79	1,251	0·62	59·13	777
" 9	"	1,375	79	1,251	0·61	59·11	765
" 9	"	1,375	79	1,251	0·57	59·15	719
" 9	"	1,375	79	1,251	0·60	59·14	749
" 9	"	1,375	79	1,251	0·49	59·13	613
" 10	"	1,375	79	1,241	1·17	59·07	1,454
" 10	"	1,375	79	1,251	1·21	59·08	1,518
" 10	"	1,375	79	1,244	1·18	59·07	1,469
" 15	"	1,375	79	1,214	1·16	59·07	1,442
" 15	"	1,375	79	1,244	1·24	59·07	1,541
" 15	"	1,375	79	1,214	1·16	59·06	1,439
" 19	"	1,375	79	1,214	1·05	59·05	1,304
" 19	"	1,375	79	1,244	1·02	59·05	1,270
" 19	"	1,375	79	1,244	1·03	59·05	1,280
" 19	"	1,375	79	1,244	0·97	59·06	1,203
" 20	"	1,375	79	1,251	1·01	59·11	1,266
" 20	"	1,375	79	1,251	1·05	59·11	1,318
" 20	"	1,375	79	1,251	1·05	59·11	1,318
" 20	"	1,375	79	1,251	1·01	59·11	1,270
April 4	"	1,375	79	1,259	0·55	59·17	694
" 4	"	1,375	79	1,259	0·58	59·18	729
" 4	"	1,375	79	1,259	0·60	59·19	755
" 4	"	1,375	79	1,259	0·56	59·19	713
" 4	"	1,375	79	1,259	0·51	59·19	644
" 4	"	1,375	79	1,259	0·55	59·17	687
" 4	"	1,375	79	1,259	0·56	59·18	703
" 4	"	1,375	79	1,259	0·52	59·17	657
" 5	"	1,375	79	1,259	0·58	59·19	672
" 5	"	1,375	79	1,259	0·53	59·19	667
" 5	"	1,375	79	1,259	0·57	59·19	711
" 5	"	1,375	79	1,259	0·55	59·19	691
" 5	"	1,375	79	1,259	0·49	59·20	619
" 5	"	1,375	79	1,259	0·53	59·20	668
" 5	"	1,375	79	1,259	0·45	59·20	563
" 5	"	1,375	79	1,259	0·57	59·20	720
" 5	"	1,375	79	1,259	0·49	59·20	620
" 5	"	1,375	79	1,259	0·56	59·18	709
" 24	"	1,375	79	1,290	1·07	59·63	1,377
" 24	"	1,375	79	1,290	0·98	59·63	1,259
Sept 9	"	1,374	79	1,284	0·49	59·48	626
" 9	"	1,374	79	1,284	0·47	59·51	605
" 10	"	1,374	79	1,252	0·48	59·16	598
" 10	"	1,374	79	1,252	0·47	59·14	590
" 10	"	1,374	79	1,252	0·51	59·12	635
" 10	"	1,374	79	1,252	0·46	59·13	579
" 10	"	1,374	79	1,252	0·46	59·14	580
" 10	"	1,374	79	1,252	0·45	59·13	568
" 11	"	1,374	79	1,252	0·52	59·13	646
" 11	"	1,374	79	1,252	0·49	59·12	612
" 11	"	1,374	79	1,252	0·49	59·10	608
" 11	"	1,374	79	1,252	0·49	59·13	609
" 12	"	1,374	79	1,242	0·51	59·01	630
" 12	"	1,374	79	1,244	0·50	59·01	625
" 12	"	1,374	79	1,244	0·43	59·01	536
Dec. 13	S. C. O'Grady	1,186	79	1,228	0·79	58·82	964
" 13	"	1,186	79	1,228	0·74	58·82	911
" 14	"	1,186	79	1,228	0·52	58·83	620
" 14	"	1,186	79	1,228	0·50	58·83	629
1914							
Mar 6	S. C. O'Grady	1,196	79	1,237	1·11	58·66	1,372
" 6	"	1,196	79	1,238	1·08	58·65	1,329
" 6	"	1,196	79	1,237	1·07	58·64	1,317
" 6	"	1,196	79	1,238	1·04	58·64	1,287
" 17	"	1,196	79	1,237	1·00	58·60	1,249
" 24	"	1,196	79	1,229	1·06	58·52	1,306
" 24	"	1,196	79	[illegible]	1·07	58·52	1,324
" 24	"	1,196	79	1,230	0·98	58·52	1,214
April 4	"	1,196	79	1,230	0·62	58·60	763
" 4	"	1,196	79	1,230	0·67	58·60	821

PLATE II.


DEPARTMENT OF THE INTERIOR, CANADA
WATER POWER BRANCH
J.B. Challies Supt
MANITOBA HYDROGRAPHIC SURVEY.
WINNIPEG RIVER
PLAN SHOWING LOCATION OF
METERING AND GAUGING STATIONS
Legend
Metering Stations
Gauging Stations
Meteorological Stations
Scale of Miles
To accompany Progress Report of Stream Measurements
March 1915
LAKE WINNIPEG
MANITOBA
ONTARIO
BOUNDARY BETWEEN
ENGLISH RIVER
WINNIPEG RIVER
Pine Falls
Silver Falls
Whitemud Falls
Du Bonnet Falls
McArthur Falls
Lac Du Bonnet
Seven Sisters Falls
WHITEMOUTH RIVER
BROKENHEAD RIVER
POWER TRANSMISSION LINE
WINNIPEG ELECTRIC RAILWAY CO. TRANSMISSION LINE
RED RIVER
SEINE RIVER
DEVILS CREEK
COOKS CREEK
Gimli
Winnipeg Beach
Netley
Clandeboye
Rigsby
W. Selkirk
E. Selkirk
Scanterbury
Libau
Brokenhead
Cromwell
Saldo
Molson
Julius
Shelley
Whitemouth
Milner
Pinawa
Gonor
Birds Hill
Hazelridge
Winnipeg
Dugald
Queen's Valley
Millbrook
Hazel
Lorette
Rosewood
Saltel
Norbert
St. Vital
Grand Trunk Pacific Railway

DAILY GAUGE HEIGHT AND DISCHARGE of East Branch Winnipeg River at Kenora Power House for 1907.

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1					59.52	554	60.42	567	60.60	586	60.61	567
2					[illegible]	567	60.47	567	60.50	597	60.55	659
3					59.42	554	60.42	567	60.72	597	60.53	[illegible]
4					59.52	554	60.47	567	60.60	567	60.53	629
5					59.57	554	60.47	567	60.62	583	60.70	607
6					59.62	574	60.42	567	60.60	571	60.61	604
7					59.72	554	60.27	567	60.80	589	60.59	625
8					59.72	554	60.52	567	60.81	579	60.51	567
9					59.42	554	60.27	581	60.52	598	60.73	604
10					59.81	574	60.42	581	60.45	581	60.55	590
11					59.77	559	60.72	581	60.55	587	60.70	648
12					59.67	554	60.52	617	60.50	588	60.73	648
13					59.82	554	60.82	567	60.22	600	60.52	635
14					59.82	554	60.57	567		601	60.51	674
15					60.12	541	60.62	567	60.62	581	60.53	554
16					59.87	554	60.61	567	60.64	597	60.53	629
17					59.62	541	60.52	581	60.70	567	60.53	674
18					60.12	541	60.57	567	60.77	581	60.55	626
19					59.82	554	60.57	567	60.75	580	60.54	648
20					60.02	554	60.60	567	[illegible]	600	60.50	626
21			59.32	541	60.17	511	60.80	567	60.70	594	60.51	649
22			59.42	541	60.20	554	60.60	567	60.64	607	60.78	590
23			59.47	541	59.82	541	60.70	567	60.73	600	60.44	708
24			59.42	529	59.87	554	60.68	567	60.72	617	60.45	680
25			59.37	554	60.12	554	60.65	567	60.61	[illegible]		617
26			59.72	554	60.17	567	[illegible]	558	60.51	594	[illegible]	627
27			59.52	541	60.22	567	60.57	581	60.51	594	60.41	739
28			59.42	554	60.42	567	60.74	567	60.61	594	60.24	709
29			59.52	554	[illegible]	567	60.57	567	60.62	592	59.44	762
30			59.52	554	[illegible]	567	60.74	572	60.61	605	[illegible]	699
31			59.62	541			[illegible]	567			[illegible]	696

Note.—Gauge [illegible] gauge.

Brokenhead River, Sinnot. Bridge, showing gauge.

Daily Gauge Height and Discharge of East Branch Winnipeg River at Kenora Power House for 1908.

[Drainage Area, 26,400 square miles.]

Day	January Gauge Height	January Dis-charge	February Gauge Height	February Dis-charge	March Gauge Height	March Dis-charge	April Gauge Height	April Dis-charge	May Gauge Height	May Dis-charge	June Gauge Height	June Dis-charge
	Feet	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft.
1	60·42	598	60·06	762	59·78	567	59·22	581	59·37	595	59·82	610
2	60·42	628	60·06	740	59·77	592	59·22	581	59·47	581	59·82	626
3	60·42	615	60·06	740	59·73	598	59·22	581	59·52	595	59·82	626
4	60·42	620	60·06	762	59·75	586	59·22	581	59·52	581	59·92	626
5	60·42	561	60·06	760	59·72	588	59·22	581	59·52	581	59·92	626
6	60·42	665	60·05	760	59·71	575	59·22	581	59·52	581	60·02	626
7	60·42	668	60·02	761	59·70	572	59·22	581	59·56	581	60·02	644
8	60·32	645	60·04	744	59·69	567	59·22	581	59·57	581	59·72	644
9	60·32	647	60·03	723	59·70	567	59·17	584	59·57	581	59·72	644
10	60·28	667	59·96	740	59·70	570	59·17	581	59·59	581	59·92	644
11	60·22	738	59·96	740	59·70	574	59·17	581	59·52	581	60·12	644
12	60·28	554	59·97	740	59·60	567	59·17	581	59·42	595	60·02	644
13	60·23	734	59·96	741	59·61	567	59·12	581	59·52	595	60·02	644
14	60·24	724	59·92	739	59·59	577	59·12	581	59·52	595	59·72	644
15	60·17	581	59·90	741	59·59	567	59·12	581	59·52	595	59·92	644
16	60·14	587	59·92	721	59·59	579	59·12	581	59·52	595	59·92	644
17	60·14	581	59·90	723	59·59	572	59·12	581	59·52	595	60·32	644
18	60·13	597	59·89	741	59·59	567	59·22	584	59·52	595	59·92	644
19	60·13	567	59·85	740	59·59	567	59·12	595	59·52	610	60·02	644
20	60·27	570	59·93	742	59·59	567	59·12	595	59·32	611	59·92	644
21	60·22	581	59·93	742	59·52	567	59·12	595	59·52	610	59·92	644
22	60·22	585	59·92	742	59·42	567	59·12	595	59·82	595	59·92	644
23	60·20	590	59·92	723	59·32	581	59·12	595	59·72	610	59·92	644
24	60·17	584	59·85	740	59·27	581	59·12	595	59·82	595	59·92	644
25	60·13	594	59·84	763		617	59·12	595	59·72	610	60·02	644
26	60·12	567	59·83	767	59·27	581	59·22	595	59·72	610	60·12	644
27	60·14	592	59·83	768	59·27	581	59·28	595	59·72	610	60·02	644
28	60·12	589	59·83	768	59·32	581	59·32	595	59·62	626	60·02	644
29	60·10	594	59·77	782	59·27	581	59·41	595	59·72	626	59·72	662
30	60·10	673			59·22	581	59·40	581	59·82	610	58·72	662
31	60·07	590			59·22	581			59·82	626		

Day	July Gauge Height	July Dis-charge	August Gauge Height	August Dis-charge	September Gauge Height	September Dis-charge	October Gauge Height	October Dis-charge	November Gauge Height	November Dis-charge	December Gauge Height	December Dis-charge
1	59·92	644	59·44	664	59·07	690	58·90	581	58·72	613	58·32	604
2	60·02	644	59·67	644	59·22	667	59·21	581	58·60	641	58·34	639
3	60·02	644	59·71	644	59·20	650	58·75	624	58·47	634	58·22	628
4	60·07	655	59·67	657	59·24	668	58·77	598	58·50	636	58·30	640
5	59·94	654	59·42	653	59·07	632	58·92	586	58·67	631	57·92	682
6	59·77	644	59·32	647	59·20	623	58·91	595	58·42	634	57·82	604
7	59·87	644	59·42	648	59·32	611	58·67	595	58·54	647	57·57	691
8	59·97	644	59·43	661	59·14	619	58·90	601	58·52	607	57·57	700
9	59·82	644	59·37	644	59·34	618	58·82	615	58·44	616	51·57	697
10	59·77	644	59·41	640	59·12	614	58·47	643	58·47	642	57·57	695
11	59·79	644	59·32	651	59·07	632	58·72	629	58·52	641	57·57	695
12	59·[illegible]	644	59·25	644	59·09	597	58·92	634	58·32	640	57·57	692
13	59·73	644	59·20	653		¹600	58·80	641	58·12	647	57·57	610
14	59·61	644	59·32	652	59·07	619	58·80	636	58·47	644	57·57	690
15	59·64	644	59·32	680	59·24	613	58·72	648	58·32	613	57·37	689
16	59·72	644	59·32	644	59·33	623	59·62	654	58·42	631	57·57	694
17	59·62	644	59·24	648	59·12	621	58·32	674	58·42	640	57·57	694
18	59·54	644	59·37	649	58·84	620	58·62	599	58·42	628	57·57	702
19	59·75	644	59·12	645	59·14	653	58·72	606	58·42	626	57·57	697
20	59·87	644	59·27	650	59·05	615	58·87	634	58·47	626	57·57	678
21	59·62	644	59·23	658		¹600	58·77	615	58·42	610	57·57	691
22	59·62	644	59·07	653	59·34	581	58·75	627	58·44	582	57·57	674
23	59·67	614	59·05	644	58·95	595	58·62	611	58·32	614	57·57	668
24	59·72	641	59·04	647	58·77	596	58·57	645	58·17	616	57·57	657
25	59·73	641	59·12	660	58·75	607	58·42	627	58·22	619	57·57	655
26	59·85	644	59·22	681	58·74	620	59·12	630	58·22	629	57·57	690
27	59·64	644	59·24	663	58·93	595	58·70	632	58·42	620	57·57	643
28	59·66	644	59·04	665	58·77	595	58·60	629	58·44	622	57·57	662
29	59·65	644	59·02	666	58·90	608	58·60	633	58·41	591	57·57	656
30	59·77	644	59·12	659	58·72	600	58·52	618	58·32	[illegible]	57·57	660
31	[illegible]	615	59·12	[illegible]			58·62	642			[illegible]	685

Note.—Gauge heights refer to forebay gauge. Discharges marked thus ¹ estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of East Branch Winnipeg River at Kenora Power House for 1909.

[Drainage Area, 26,400 square miles.]

Day	January		February.		March.		April		May		June	
	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft	Sec.-ft	Sec.-ft
1		[1]700	57·57	762		859	57·07	775	56·67	1,226	57·62	750
2		[1]700	57·57	701		868	57·06	921	56·70	728	57·62	740
3		[1]700	57·57	689		865	57·12	907	56·72	975	57·72	751
4		[1]700	57·57	689		850	57·42	657	56·73	1,175	57·52	766
5		[1]700	57·57	737		900	57·12	982	56·80	1,058	57·52	762
6		[1]700	57·57	754	57·32	842	57·02	1,129	56·67	1,094	57·82	535
7	57·57	769	57·57	701	57·32	711	57·02	1,001	56·84	804	57·69	735
8	57·57	759	57·57	819	57·32	881	56·99	1,146	57·27	745	57·70	731
9	57·57	799	57·57	793	57·32	848	57·02	1,131	56·30	697	57·64	774
10	57·57	754	57·57	848	57·32	724	57·32	927	56·93	965	57·60	752
11	57·57	699	57·57	848	57·32	703	57·32	712	56·90	1,170	57·67	756
12	57·57	801	57·57	875	57·12	815	56·92	1,071	56·91	1,130	57·73	743
13	57·57	807	57·57	915	57·12	836	56·82	1,223	57·04	1,040	57·72	534
14	57·57	798	57·57	812	57·12	677	56·82	1,216	57·13	1,087	57·64	734
15	57·57	793	57·57	933	57·12	898	56·90	1,204	57·22	1,070	57·74	745
16	57·57	789	57·57	898	57·12	974	56·84	1,165	57·58	664	57·63	750
17	57·57	729	57·57	911	57·12	947	56·97	1,145	57·32	784	57·62	755
18	57·57	738	57·57	903	56·92	908	57·32	691	57·37	1,025	57·70	759
19	57·57	735	57·57	867	56·92	857	56·87	950	57·42	966	57·82	692
20	57·57	693	57·57	888	56·92	857	56·82	1,128	57·50	1,049	58·02	529
21	57·57	714	57·57	697	56·92	660	56·83	1,145	57·52	1,057	57·96	721
22	57·57	700	57·57	876	56·92	799	56·72	1,229	57·57	1,026	58·21	694
23	57·57	698	57·57	868	56·92	807	56·77	1,213	57·82	670	58·03	731
24	57·57	695	57·57	961	56·92	819	56·74	1,197	57·82	561	57·92	731
25	57·57	710	..	957	56·92	822	57·22	618	57·57	737	57·82	724
26	57·57	685		937	56·92	821	56·72	981	57·62	735	57·87	731
27	57·57	606		949		808	56·72	1,266	57·57	747	58·02	529
28	57·57	734		747		648	56·70	1,150	57·62	750	57·92	731
29	57·57	747			56·82	746	56·70	1,203	57·62	755	58·09	721
30	57·57	781			56·82	696	56·62	1,217	57·82	565	57·84	718
31	57·57	756			57·04	781			57·62	743		

Day	July		August		September		October		November		December	
1	58·17	530	58·32	526	58·62	556	58·22	1,019	58·57	755	58·52	1,178
2	57·82	732	58·32	537	58·62	595	58·30	1,006	58·64	1,084	58·52	1,192
3	57·94	729	58·12	714	58·32	793	58·42	652	58·60	1,210	58·51	1,194
4	58·24	517	58·22	733	58·52	639	58·42	703	58·60	1,174	58·56	1,014
5	58·02	739	58·11	733	58·62	547	58·42	991	58·55	1,159	58·77	743
6	57·94	736	58·15	582	58·27	558	58·30	1,022	58·62	1,136	58·74	1,100
7	58·07	731	58·12	745	58·62	518	58·28	1,027	58·72	659	58·72	1,250
8	58·22	734	58·32	530	58·22	587	58·52	876	58·58	862	58·52	1,263
9	58·36	850	58·22	709	58·34	710	58·05	1,056	58·92	1,056	58·62	1,285
10	58·92	868	58·22	714	58·02	717	58·22	652	58·69	1,109	58·52	1,290
11	58·29	531	58·32	542	58·32	664	57·80	812	58·60	1,160	58·72	1,140
12	58·22	521	58·22	683	58·42	549	57·79	1,060	58·50	1,158		786
13	58·02	730	58·47	599	58·32	606	58·02	1,079	58·52	1,009	58·72	1,076
14		746	58·42	559	58·35	622	58·10	1,079	57·92	692	58·80	1,170
15		751	58·42	529	58·14	728	58·10	1,063	58·52	1,132	58·90	1,222
16	57·94	750	58·22	703	59·15	723	58·21	1,099	58·59	1,130	58·82	1,213
17	58·02	754	58·32	714	58·32	722	58·42	669	58·60	1,182	58·89	1,205
18	58·24	529	58·27	697	58·50	717	58·42	764	58·72	1,161	58·80	1,052
19	58·22	718	58·14	634	58·60	536	58·42	1,094	58·70	1,155		854
20	58·02	730	58·44	526	58·52	688	58·42	1,120	58·57	1,055	58·92	1,093
21	58·02	729	58·82	559	58·32	715	58·22	1,127	58·67	739	58·92	1,193
22	58·12	539	58·52	519	58·12	731	58·34	1,132	58·49	1,024	58·92	1,168
23	58·21	551	58·62	572	58·22	832	58·52	1,135	58·52	1,156	58·99	1,207
24	58·12	735	58·32	573	58·24	1,002	59·02	653	58·52	1,145	58·95	1,197
25	58·40	518	58·54	560	58·30	1,030	58·64	809	58·52	1,215	59·12	845
26	58·13	712	58·52	555	58·64	627	58·22	1,109	58·32	1,259	59·13	770
27	58·12	719	58·74	558	58·62	763	58·32	1,142	58·52	1,203	58·97	1,059
28	58·21	709	58·43	575	58·12	1,014	58·72	1,196	58·72	730	58·97	1,217
29	58·21	551	58·43	527	58·10	1,029	58·72	1,190	58·64	1,032	59·02	1,222
30	58·32	551	58·62	556	58·21	1,027	58·42	1,144	58·59	1,132	58·94	1,214
31	58·27	563	58·52	554			58·72	646			59·02	1,207

NOTE.—Gauge heights refer to forebay gauge. Discharges marked thus [1] estimated.

Daily Gauge Height and Discharge of East Branch Winnipeg River at Kenora Power House for 1910.

(Drainage area, 26,400 square miles.)

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1	59·12	1,088	59·17	1,116	59·12	1,129	59·65	1,127	60·00	800	59·22	917
2	59·12	876	59·20	1,116	59·12	1,060	59·62	1,090	59·92	1,075	59·20	978
3	59·02	1,146	59·22	1,120	59·32	734	59·81	744	60·02	1,291	59·42	894
4	59·12	1,240	59·20	1,137	59·12	731	59·67	1,045	60·02	1,278	59·52	912
5	59·12	1,211	59·19	1,031	59·32	715	59·72	1,232	59·97	1,262	59·62	663
6	59·10	1,217	59·32	805	59·47	727	59·72	1,267	59·92	1,254	59·32	864
7	59·20	792	59·19	1,001	59·34	725	59·73	1,248	60·06	1,209	59·32	865
8	59·09	1,116	59·32	990	59·34	716	59·72	1,270	60·22	810	59·32	864
9		884	59·14	1,150	59·32	739	59·72	1,151	59·86	1,026	59·30	858
10	59·12	1,090	59·12	1,161	59·33	916	59·82	767	59·72	1,325	59·25	860
11	59·14	1,166	59·12	1,142	59·13	1,076	59·52	1,049	59·60	1,401	59·32	884
12	59·12	1,198	59·12	905	59·12	1,036	59·79	1,225	59·70	1,405	59·48	610
13	59·12	1,200	59·32	788	59·14	746	59·75	1,240	59·74	1,381	59·34	911
14	59·20	1,179	59·13	1,027	59·33	893	59·72	1,229	60·02	1,173	59·32	1,094
15	59·22	948	59·14	1,155	59·37	868	59·72	1,306	59·98	816	59·34	1,125
16	59·25	816	59·32	919	59·12	1,002	59·87	1,194	59·82	1,112	59·25	1,106
17	59·12	1,065	59·12	1,183	59·20	1,070	59·45	827	59·52	1,371	59·22	1,093
18	59·12	1,163	59·12	1,161	59·22	1,032	59·62	1,089	59·77	852	59·32	905
19	59·12	1,145	59·12	1,021	59·22	967	59·92	1,311	59·82	1,354	59·32	736
20	59·12	1,168	59·42	812	59·37	690	59·92	1,258	59·52	1,184	59·32	874
21	59·12	1,159	59·12	1,073	59·32	888	60·17	1,281	59·72	1,502	59·32	[illegible]
22	59·22	1,067	59·12	1,175	59·27	895	59·64	1,285	59·84	803	59·32	1,006
23	59·30	890	59·12	1,171	59·52	643	59·41	1,105	59·62	1,135	59·22	1,083
24	59·13	1,018	59·12	1,160	59·52	778	60·04	741	59·53	846	59·12	1,057
25	59·12	1,135	59·12	1,158	59·32	1,081	60·06	1,010	59·55	1,128	[illegible]	990
26	59·12	1,136	59·32	944	59·32	1,068	60·04	1,253	59·54	1,284	59·22	758
27	59·12	1,104	59·32	823	59·52	695	59·84	1,287	59·75	1,266	59·22	859
28	59·14	1,123	59·12	1,029	59·52	840	60·03	1,287	59·74	1,147	59·12	942
29	59·13	1,022			59·42	1,119	60·01	1,293	59·62	804	59·22	985
30	59·32	787			59·52	1,086	60·01	1,209	59·52	908	59·22	[illegible]
31	59·22	1,035			59·62	1,062			59·42	1,020		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	59·22	701	58·15	805	57·72	604	57·22	1,135	56·79	1,240		1,300
2	58·88	862	58·90	987	57·72	593	57·42	663	56·62	1,087	56·62	1,324
3	58·92	745	58·12	1,010		595	57·32	840	57·02	925	56·62	1,285
4	58·72	852	57·94	1,010	57·82	530	57·45	1,125	57·12	713	56·72	907
5	58·90	1,035	58·05	[illegible]	57·81	596	57·52	1,168	56·62	[illegible]	56·62	1,255
6	58·74	1,117	58·05	970	57·80	613	[illegible]	1,092	56·92	747	56·62	1,387
7	58·79	1,109	58·37	652	57·55	846	57·22	1,133	56·62	1,164	56·62	1,312
8	58·72	1,091	58·03	834	57·42	802	57·12	1,000	56·80	1,274	56·58	1,374
9	58·67	925	57·84	1,022	57·47	846	57·12	683	56·70	1,294	56·55	1,370
10	58·82	718	58·00	1,020	57·82	769	57·20	924	56·64	1,277	56·62	1,376
11	58·62	846	58·31	808	57·42	535	56·92	1,196	56·69	1,277	56·72	960
12	58·62	1,048	58·21	654	57·52	884	56·80	1,208	56·65	1,157	56·57	1,202
13	58·61	1,044	57·94	788	57·44	731	57·02	1,211	56·82	798	56·62	1,347
14	58·72	1,060	58·12	529	57·52	609	57·02	1,203	56·54	1,176	56·54	1,328
15	58·64	1,013	58·22	547	57·52	760	57·17	1,052	56·64	1,324	56·72	[illegible]
16	58·52	864	58·12	529	57·47	768	57·17	678	56·72	1,293	56·52	1,150
17	58·63	672	58·10	503	57·12	780	57·00	986	56·70	1,330	56·53	1,201
18	58·64	787	58·05	501	57·52	559	56·95	1,154	56·72	1,316	56·72	820
19		688	58·07	705	57·22	939	56·32	1,188	56·72	1,242	56·52	1,245
20		604	58·05	815	57·19	1,062	56·92	1,246	56·80	802	56·52	1,332
21	58·42	740	58·11	549	57·07	1,104		1,161	56·62	1,181	56·50	[illegible]
22	58·32	748	57·74	855	57·29	1,121		1,186	56·72	1,279	56·52	1,330
23	58·52	734	57·82	843	57·22	1,126		785	56·72	1,330	56·43	1,358
24	58·52	534	57·54	723	57·22	1,163		1,149	56·71	1,294	56·42	1,350
25	58·37	720	57·62	757	57·22	691	57·10	1,205	56·72	1,320	56·53	989
26	58·22	731	57·82	737	57·12	652	56·92	1,254	56·62	1,348	56·51	919
27	58·22	729	57·52	743	57·32	1,042	56·72	1,202	56·81	806	56·50	1,188
28	58·22	732	57·82	548	57·32	1,131	56·71	1,250	56·70	1,211	56·41	1,352
29	58·18	727	57·72	848	57·35	1,100	57·20	1,172	56·70	1,250	56·35	1,286
30	58·18	733	57·37	686	57·32	1,121	57·02	713	56·64	1,358	56·33	1,375
31	58·32	533	57·80	584			56·85	989			56·30	1,361

NOTE.—Gauge heights refer to forebay gauge. Discharges marked thus [1], estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of East Branch Winnipeg River at Kenora Power House for 1911.

(Drainage area, 26,400 square miles.)

Day.	January		February		March.		April		May.		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	56·54	948	56·19	1,343	56·15	1,255	55·54	838	55·51	847	55·59	1,052
2	56·34	1,252	56·19	1,342	56·15	1,259	55·54	803	55·42	1,261	55·39	1,407
3	56·34	1,353	56·19	1,377	56·15	1,270	55·54	828	55·51	1,259	55·56	1,283
4	56·34	1,349	56·19	1,196	56·15	1,284	55·34	1,184	55·53	1,252		795
5	56·34	1,353	56·22	862	56·17	822	55·34	1,338	55·62	1,254	55·75	867
6	56·34	1,346	56·19	1,247	56·16	806	55·34	1,328	55·63	1,200	55·86	1,231
7	56·34	1,363	56·19	1,390	56·15	1,049	55·34	1,434	55·80	735	55·74	1,249
8	56·59	872	56·19	1,378	56·16	1,198	55·34	1,294	55·61	891	55·72	1,272
9	56·24	1,172	56·16	1,366	56·16	1,237	55·36	768	55·38	1,216	55·76	1,252
10	56·24	1,355	56·16	1,366	56·17	858	55·34	1,055	55·44	1,217	55·80	1,138
11	56·24	1,346	56·16	1,371	56·04	771	55·32	1,306	56·04	1,221		697
12	56·24	1,358	56·19	863	56·05	730	55·32	1,295	55·50	1,256		652
13	56·24	1,268	56·14	1,247	56·04	734	55·34	1,301	55·69	1,270		1,009
14	56·24	1,357	56·19	1,360	56·04	1,265	55·34	1,284	..	793	55·83	1,227
15	56·44	956	56·19	1,334	56·04	1,267	55·34	1,302	..	878	55·99	1,250
16	56·24	1,264	56·20	1,250	56·04	1,272	55·54	803		1,247	55·88	1,251
17	56·24	1,340	56·18	1,317	56·04	1,267	55·34	926	....	1,171	55·92	1,260
18	56·19	1,345	56·19	1,070	56·04	1,264	55·35	1,253	....	1,119	56·14	724
19	56·19	1,354	[illegible]	841	56·04	765	55·35	1,274		1,171	56·18	819
20	56·19	1,333	56·17	1,165	56·04	809	55·74	1,282		1,224	56·01	1,266
21	56·19	1,340	56·18	1,261	55·54	1,204	55·54	1,274		773	56·07	807
22	56·34	948	56·17	1,246	55·54	1,286	55·55	1,274		845	56·04	640
23	56·19	1,141	56·14	1,294	55·54	1,288	55·65	796		1,218	55·77	1,029
24	56·19	1,311	56·17	1,272	55·52	1,157	55·56	965		800	56·04	1,254
25	56·19	1,294	56·15	1,281	55·52	1,269	55·69	1,244		1,024	56·15	750
26	56·19	1,314	56·19	947	55·59	795	55·61	1,222		803	56·10	921
27	56·19	1,110	56·14	1,317	55·52	1,174	55·59	1,209	55·85	1,066	55·51	1,267
28	56·19	1,294	56·14	1,277	55·52	1,274	55·62	1,248	56·45	738	55·97	946
29	56·20	926			55·52	1,267	55·60	1,272	55·56	954	56·16	627
30	56·20	1,037			55·54	811	55·46	795	55·64	1,257	55·88	781
31	56·19	1,326			55·54	801			55·65	1,248		

Day.	July		August		September		October		November		December	
1	56·18	659	55·47	666	55·29	[illegible]	55·43	776	54·96	1,481	55·42	1,160
2	56·15	590	55·61	661	55·17	900	55·29	961	55·22	1,489	55·33	1,322
3	56·01	701	55·61	663	55·53	675	55·27	1,344	55·62	1,455		804
4	55·96	723	55·64	669	55·44	728	54·97	1,295	55·41	1,489	55·39	1,173
5	55·96	676	55·64	655	54·85	1,112	54·92	1,315	55·59	822	55·40	1,339
6	55·99	669	55·74	630	55·03	911	55·37	1,326	54·99	1,154	55·38	1,390
7	55·88	930	55·6[illegible]	668	55·15	1,061	55·54	1,351	55·21	1,477	55·38	1,400
8	56·02	867	55·64	652	55·25	1,078	55·89	738	55·00	1,495	55·43	1,273
9	56·31	585	55·55	655	55·36	1,051	55·74	887	55·54	1,446	55·36	1,385
10	56·41	88[illegible]	55·56	690	55·42	676	55·49	900	55·49	1,426	55·57	788
11	55·95	1,230	55·56	661	54·91	807	55·44	845	54·90	1,527	55·66	1,016
12	55·90	848	55·71	669	55·19	1,032	55·39	1,166	55·17	982	55·12	1,201
13	55·90	1,194	55·57	623	55·14	1,033	55·39	1,384		1,200	55·42	1,153
14	55·84	1,131	55·61	673	55·29	1,074	55·39	1,308	55·20	1,459	55·44	1,376
15	55·55	925	55·52	575	55·36	1,071	55·56	778	55·26	1,461	55·54	1,411
16	55·83	610	55·75	680	55·44	876	55·47	899	55·24	1,485	55·42	1,405
17	55·72	686	55·52	741	55·57	692	55·34	1,300	55·38	1,016	55·59	903
18	55·63	1,005	[illegible]	785	55·82	926	55·51	1,358	55·28	1,298	55·59	1,094
19	55·68	908	[illegible]	1,136	55·26	1,078	55·24	1,342	55·47	920	55·49	1,406
20	55·69	1,035	55·75	639	55·27	1,310	55·22	1,382	55·26	1,335	55·44	1,405
21	55·54	848	55·64	1,057	55·52	1,290	55·37	1,345	55·26	1,363	55·44	1,379
22	55·63	1,314	56·1[illegible]	905	55·07	1,339	55·70	779	55·25	1,385	55·49	1,370
23	55·50	634	[illegible]	1,111	54·41	1,401	55·14	1,112	55·36	1,327	55·49	1,396
24	55·44	672	55·47	1,100	55·40	775	55·19	1,401	55·34	1,336	55·69	875
25	55·51	640	55·20	1,086	55·16	910	55·24	1,464	55·35	1,256	55·64	823
26	55·75	630	55·12	610	55·45	1,329	55·29	1,426	55·32	853	55·19	1,479
27	55·82	634	55·18	663	54·86	1,377	55·29	1,429	55·39	1,081	55·49	1,424
28	55·66	634	55·08	1,029	55·16	989	55·09	1,354	55·28	1,398	55·42	1,500
29	55·64	670	55·29	1,060	55·15	1,373	55·31	848	55·31	1,443	55·49	1,514
30	55·50	625	55·59	1,170	55·36	1,305	55·27	1,050	55·29	1,510	55·44	1,406
31	55·49	663	55·33	800			55·01	1,347			55·74	998

NOTE.—Gauge heights refer to forebay gauge. Discharges marked thus [1] estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of East Branch Winnipeg River at Kenora Power House for 1912.

[Drainage area 26,400 square miles.]

Day	January.		February.		March.		April.		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet	Sec.-ft.
1	55·63	956	55·66	1,372	55·73	1,547	55·90	1,300	56·38	1,425	57·33	1,276
2	55·58	1,302	55·69	1,325	55·83	1,532	55·85	1,469	55·33	1,421	57·31	758
3	55·58	1,436	55·70	1,473	55·83	1,047	55·84	1,501	56·35	1,381	57·35	688
4	55·53	1,408	55·85	946	55·73	1,354	55·85	1,494	56·59	766	57·35	1,072
5	55·63	1,243	55·73	1,284	55·73	1,496	55·85	1,492	56·39	1,404	57·35	1,252
6	55·63	1,073	55·72	1,366	55·83	1,449	55·73	1,519	56·52	1,072	57·15	1,267
7	55·68	985	55·77	1,432	55·73	1,527	56·00	1,311	56·50	1,320	57·40	1,138
8	55·48	1,347	55·76	1,454	55·83	1,500	55·83	1,325	56·48	1,369	57·45	691
9	55·53	1,565	55·68	1,458	55·83	1,539	55·89	1,496	56·73	1,313	57·51	672
10	55·53	1,526	55·71	1,427	55·93	1,011	55·88	1,399	56·68	1,323	57·63	721
11	55·53	1,522	55·85	929	55·93	1,201	55·81	1,451	56·70	1,358	57·22	911
12	55·53	1,497	55·83	1,121	55·83	1,492	55·83	1,460	56·83	777	57·45	873
13	55·58	1,470	55·75	1,390	55·73	1,484	55·87	1,512	56·76	1,035	57·43	1,217
14	55·63	1,011	55·76	1,342	55·73	1,491	56·00	852	56·89	1,316	57·42	1,294
15	55·61	1,141	55·81	1,433	55·73	1,507	55·95	1,220	56·73	1,355	57·24	1,313
16	55·55	1,473	55·75	1,496	55·75	1,440	56·01	1,416	56·94	1,278	57·24	1,313
17	55·60	1,416	55·63	1,548	55·87	974	56·01	1,446	56·94	1,366	57·04	1,088
18	55·58	1,465	55·93	1,028	55·75	1,340	56·04	1,365	56·73	1,397	57·43	1,280
19	55·62	1,422	55·83	1,330	55·75	1,535	56·07	1,388	57·03	790	57·33	1,272
20	55·63	1,326	55·73	1,583	55·75	1,539	56·05	1,423	56·96	1,090	57·26	1,283
21	55·77	928	55·83	1,621	55·74	1,492	56·15	821	56·93	1,358	57·33	1,256
22	55·75	1,197	55·83	1,445	55·80	1,443	56·15	1,059	56·94	1,378	57·43	1,205
23	55·67	1,387	55·73	1,738	55·93	1,238	56·07	1,408	56·98	1,365	57·53	685
24	75·61	1,393	55·73	1,532	55·94	1,001	56·12	1,386	57·05	1,337	57·53	975
25	55·58	1,326	55·93	1,028	55·80	1,356	56·07	1,385	57·14	1,340	57·32	1,234
26	55·59	1,413	55·83	1,384	55·83	1,516	56·15	1,447	57·18	776	57·39	1,256
27	55·60	1,394	55·73	1,555	55·80	1,164	56·23	1,459	57·15	753	57·44	1,206
28	55·79	976	55·63	1,601	55·83	1,486	56·41	816	56·76	1,315	57·45	1,198
29	55·75	1,112	55·73	1,511	55·78	1,495	56·36	1,124	56·23	1,005	57·43	1,157
30	55·65	1,362			55·77	1,202	56·34	1,417	56·33	1,300	57·53	634
31	55·69	1,306			56·05	819			56·36	1,304		

Day	July		August		September		October		November.		December	
1	57·68	555	57·82	1,222	58·43	596	59·22	635	59·23	1,245	59·31	714
2	57·73	896	57·80	1,228	58·23	1,009	59·23	714	59·35	1,242	59·24	1,001
3	57·48	1,149	57·79	1,247	58·26	1,234	59·21	631	59·54	667	59·22	1,297
4	57·42	1,083	57·99	686	58·24	1,153	59·25	659	59·35	944	59·24	1,278
5	57·53	1,091	57·99	1,014	58·25	934	59·23	1,157	59·41	1,239	59·18	1,285
6	57·63	1,160	58·00	1,241	58·48	637	59·03	621	59·51	1,244	59·23	1,311
7	57·63	671	58·06	1,229	58·43	638	59·43	967	59·45	1,230	59·23	1,316
8	57·58	715	58·02	731	58·15	595	59·32	1,230	59·23	1,216	59·25	908
9	57·73	635	58·02	1,228	58·23	636	59·01	1,229	59·41	1,201	59·25	1,055
10	57·40	1,141	58·03	1,161	58·33	713	59·13	1,234	59·43	652	59·22	1,322
11	57·72	1,192	58·13	658	58·53	825	59·33	1,186	59·21	968	59·23	1,308
12	57·61	1,186	58·22	1,010	58·48	821	59·33	1,213	59·33	1,237	59·22	1,316
13	57·55	1,207	58·15	1,233	58·65	830	59·39	653	59·33	1,230	59·21	1,291
14	57·93	660	57·95	1,242	58·65	857	59·33	994	59·38	1,242	59·15	1,256
15	57·73	862	58·13	1,234	58·43	610	59·36	1,211	59·53	1,218	59·23	889
16	58·10	1,191	58·13	1,235	58·53	881	59·54	1,197	59·33	1,237	59·22	1,108
17	57·63	1,049	58·15	1,243	58·53	836	59·41	1,194	59·45	682	59·13	1,269
18	57·64	1,202	58·15	676	58·69	640	59·53	1,206	59·57	907	59·13	1,302
19	57·93	1,149	58·11	1,038	58·73	635	59·33	1,208	59·34	1,243	59·13	1,306
20	57·73	1,175	58·12	1,169	58·64	644	59·52	661	59·33	943	59·13	1,311
21	57·64	670	58·22	1,247	58·75	631	59·31	848	59·23	1,158	59·13	1,321
22	57·80	905	58·03	1,252	58·63	599	59·33	676	59·33	1,188	59·23	912
23	57·74	1,152	58·13	1,245	58·63	641	59·61	1,207	59·15	1,298	59·23	1,150
24	57·81	1,191	58·12	1,245	58·33	655	59·61	1,198	59·35	722	59·23	1,223
25	57·63	1,177	58·15	870	58·29	630	59·35	1,175	59·35	965	59·23	873
26	57·92	1,092	58·04	1,024	58·63	643	59·23	1,194	59·18	1,300	59·23	1,128
27	57·84	1,157	58·23	776	59·02	585	59·42	642	59·10	1,300	59·28	1,257
28	57·92	632	58·11	1,054	58·99	638	59·25	891	59·70	1,250	59·14	1,279
29	57·88	930	58·23	1,245	59·31	577	59·93	1,228	59·20	1,420	59·13	858
30	57·74	1,099	58·33	1,032	59·09	630	59·31	1,286	59·28	1,255	59·13	1,117
31		1,000[1]	58·27	861			59·33	1,230			59·13	1,274

NOTE.—Gauge heights refer to forebay gauge. Discharges marked thus (1) estimated.

DAILY GAUGE HEIGHT AND DISCHARGE of East Branch Winnipeg River at Kenora Power House for 1913.

[Drainage area, 26,400 square miles.]

Day.	January		February.		March.		April.		May.		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft
1	59·26	1,233	58·98	1,388	59·04	931	59·11	1,251	59·64	1,275	59·61	815
2	59·16	1,264	59·23	1,347	59·05	928	59·09	1,096	59·65	1,262	59·73	929
3	59·11	1,309	59·09	1,275	59·08	1,158	59·13	684	59·68	1,266	59·53	1,354
4	59·16	1,389	58·96	1,382	58·98	1,360	59·18	689	59·91	638	59·79	1,301
5	59·19	914	58·97	1,303	58·02	1,346	59·19	694	59·78	950	59·68	1,361
6	59·16	1,215	58·98	1,394	59·05	1,319	59·20	657	59·73	1,220	59·29	1,332
7	59·11	1,517	58·98	1,358	59·02	1,276	59·18	769	59·77	1,258	59·60	1,369
8	59·04	1,506	58·99	1,364	59·08	1,187	59·23	1,060	59·57	1,234	59·74	817
9	59·13	1,592	58·99	1,021	59·13	942	59·18	1,218	59·70	1,250	59·85	961
10	59·13	1,484	58·91	1,162	59·13	1,038	59·18	845	59·79	1,250	59·89	1,349
11	59·12	1,505	58·96	1,309	59·02	1,308	59·24	680	59·98	787	59·86	1,363
12	59·16	1,066	58·96	1,391	59·03	1,309	59·29	664	59·76	996	59·75	884
13	59·15	1,236	58·98	1,366	59·05	1,256	59·29	628	59·58	1,299	59·68	789
14	59·11	1,486	58·93	1,368	58·96	1,297	59·35	645	59·74	1,317	59·74	778
15	59·14	1,361	58·93	1,372	59·00	1,303	59·33	640	59·70	1,328	59·70	747
16	58·99	1,465	59·00	961	59·08	935	59·38	936	59·77	1,339	59·65	780
17	59·08	1,517	58·99	1,158	59·09	1,134	59·47	1,086	59·67	1,347	59·49	1,153
18	59·05	1,317	58·97	1,345	59·03	1,312	59·43	1,146	59·68	810	59·59	1,352
19	59·10	1,072	58·98	1,347	59·05	1,306	59·45	1,155	59·73	738	59·53	1,352
20	59·10	1,373	58·98	1,340	59·10	1,293	59·54	652	59·71	792	59·48	1,331
21	59·00	1,559	58·97	1,343	59·10	1,300	59·61	874	59·53	1,150	59·45	1,331
22	59·05	1,607	58·94	1,364	59·13	1,354	59·59	1,117	59·71	1,338	59·54	785
23	59·06	1,583	58·99	948	59·10	885	59·56	1,168	59·78	1,356	59·69	1,104
24	58·99	1,483	59·03	1,158	59·10	1,051	59·64	1,172	59·52	823	59·61	1,227
25	59·05	1,430	58·99	1,358	59·09	1,382	59·66	1,172	60·27	761	59·55	1,316
26	59·08	1,015	58·98	1,380	59·09	1,265	59·63	1,207	59·83	772	59·33	1,342
27	59·07	1,148	58·99	1,211	59·10	1,312	59·69	676	59·83	789	59·18	1,400
28	58·98	1,378	59·02	935	59·09	1,310	59·69	812	59·65	1,090	59·44	1,348
29	58·99	1,279			59·14	1,300	59·68	1,205	59·65	1,323	59·45	782
30	59·08	1,298			59·14	740	59·68	1,193	59·59	1,373	59·67	737
31	59·98	1,373			59·14	911			59·72	1,323		

Day.	July		August		September		October		November		December	
1	59·72	724	59·60	855	59·41	675	58·59	1,307	58·87	1,347	58·75	1,217
2	59·52	936	59·67	884	59·20	690	58·62	1,312	58·64	717	58·73	1,382
3	59·37	1,376	59·55	671	59·14	700	58·68	1,302	58·73	1,132	58·78	1,407
4	59·27	1,354	59·57	867	59·35	706	58·52	1,337	58·85	1,317	58·80	1,392
5	59·17	820	59·41	714	59·35	704	58·27	737	58·93	1,312	58·74	1,377
6	59·39	704	59·52	703	59·17	606	58·57	1,067	58·74	1,332	58·75	1,417
7	59·44	742	59·74	701	59·08	662	58·91	1,307	58·53	1,372	58·51	827
8	59·10	1,214	59·66	690	59·09	693	58·52	1,352	58·58	1,377	58·80	1,277
9	59·05	1,296	59·51	720	59·43	698	58·58	1,337	58·71	737	58·76	1,392
10	59·44	1,271	59·48	683	59·24	704	58·85	1,242	58·66	1,137	58·72	1,412
11	59·60	1,241	59·68	724	59·14	718	58·83	1,312	58·92	1,357	58·72	1,407
12	59·50	1,238	59·52	705	59·00	728	58·74	692	58·71	1,337	58·71	1,407
13	59·54	732	59·58	697	58·90	729	58·88	1,147	58·80	1,372	58·71	1,272
14	59·51	1,014	59·49	702	59·20	675	58·81	1,342	58·72	1,352	58·82	712
15	59·66	1,216	59·40	712	59·05	699	58·71	1,352	58·80	1,372	58·77	817
16	59·62	1,224	59·44	717	58·93	728	58·71	1,352	59·02	697	58·84	907
17	59·60	1,224	59·39	700	58·98	734	58·92	1,292	58·71	1,392	58·78	1,132
18	59·62	1,246	59·38	700	59·11	721	58·73	1,357	58·82	1,352	58·72	1,357
19	59·55	911	59·54	708	59·18	814	58·64	722	58·82	1,387	58·73	947
20	59·63	617	59·47	698	58·37	1,211	58·54	1,162	58·62	1,372	58·75	1,017
21	59·80	667	59·46	691	58·31	787	58·71	1,397	58·82	1,057	58·78	932
22	59·73	669	59·39	709	58·67	1,160	58·92	1,347	58·88	1,332	58·70	992
23	59·58	665	59·44	701	58·76	1,300	58·74	1,377	58·97	722	58·70	1,332
24	59·66	869	59·46	681	58·66	1,346	58·72	1,347	58·75	1,227	58·70	1,482
25	59·83	861	59·51	693	58·67	1,326	58·72	1,377	58·70	1,362	58·71	1,072
26	59·70	901	59·31	695	58·73	1,421	58·73	767	58·73	1,392	58·70	1,352
27	59·60	651	59·41	708	58·79	1,314	58·76	1,152	58·79	1,397	58·68	1,457
28	59·73	860	59·27	696	58·91	710	58·30	1,417	58·71	1,377	58·73	1,002
29	59·68	937	59·27	702	58·53	1,121	58·67	1,377	58·79	1,402	58·72	1,292
30	59·71	920	59·38	702	58·70	1,242	58·78	1,380	58·80	712	58·71	1,442
31	59·67	831	59·27	667			58·82	1,357			58·67	1,497

NOTE.—Gauge heights refer to forebay gauge.

Daily Gauge Height and Discharge of East Branch Winnipeg River at Kenora Power House for 1914.

(Drainage area, 26,400 square miles.)

Day.	January		February.		March.		April.		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	58·64	1,432	58·78	947	58·76	942	58·61	712	58·88	673	59·67	869
2	58·66	1,422	58·74	887	58·76	1,207	58·61	742	58·92	663	59·72	919
3	58·64	1,397	58·74	962	58·78	1,147	58·64	777	58·92	653	59·68	924
4	58·60	937	58·77	987	58·75	1,117	58·62	807	58·93	648	59·56	887
5	58·72	927	58·74	1,032	58·60	1,132	58·62	737	58·96	673	59·74	944
6	58·70	882	58·75	1,007	58·62	1,102	58·63	792	59·02	843	59·71	909
7	58·73	842	58·75	1,062	58·63	1,142	58·53	857	59·03	848	59·73	639
8	58·68	1,227	58·80	957	58·66	812	58·57	832	59·12	808	59·71	879
9	58·68	1,397	58·76	1,047	58·62	1,232	58·61	767	59·15	853	59·87	896
10	58·70	1,382	58·74	1,077	58·58	1,257	58·61	702	59·05	648	59·98	904
11	58·72	1,082	58·76	1,102	58·63	1,262	58·62	772	59·10	920	59·88	931
12	58·70	1,332	58·74	1,087	58·59	1,232	58·51	737	59·17	965	59·94	896
13	58·68	1,517	58·76	1,072	58·63	1,182	58·56	752	59·16	960	59·94	981
14	58·68	1,387	58·76	1,047	58·64	1,137	58·55	727	59·14	945	60·02	684
15	58·68	1,317	58·73	962	58·70	702	58·52	892	59·27	695	59·91	886
16	58·68	1,047	58·75	997	58·62	832	58·53	922	59·24	920	60·02	879
17	58·71	912	58·74	1,002	58·55	1,182	58·50	937	59·40	635	60·09	882
18	58·73	817	58·76	957	58·56	1,132	58·50	972	59·37	660	59·74	894
19	58·72	797	58·76	1,012	58·58	892	58·64	687	59·30	875	59·94	901
20	58·67	897	58·76	1,037	58·53	1,127	58·64	937	59·34	860	60·16	892
21	58·73	947	58·77	1,017	58·53	1,137	58·67	857	59·33	895	59·88	678
22	58·68	972	58·75	1,002	58·61	802	58·71	687	59·36	900	60·03	914
23	58·67	917	58·75	1,052	58·55	1,087	58·71	602	59·40	925	60·10	1,067
24	58·60	1,007	58·80	997	58·54	1,077	58·74	687	59·54	635	59·90	1,016
25	58·73	927	58·74	937	58·47	982	58·78	687	59·58	650	59·73	1,009
26	58·70	967	58·75	892	58·57	882	58·82	642	59·52	905	59·78	1,027
27	58·72	967	58·78	882	58·56	867	58·78	687	59·54	900	59·61	1,002
28	58·69	967	58·78	1,182	58·60	817	58·71	712	59·57	870	59·84	687
29	58·76	997			58·60	712	58·80	692	59·54	880	59·87	736
30	58·76	1,027			58·59	722	58·81	682	59·65	910	50·87	711
31	58·80	1,027			58·60	712			59·66	665		

Day.	July		August		September		October		November		December	
1	59·75	731	59·71	769	58·98	992	59·18	874	59·26	656	59·38	965
2	59·95	732	59·58	701	58·94	712	59·25	875	59·50	876	59·41	1,006
3	59·90	741	59·78	767	58·68	712	59·14	913	59·14	946	59·12	1,010
4	59·81	782	59·58	966	58·98	702	59·14	[illegible]	59·30	945	59·42	979
5	59·84	819	59·54	985	58·88	992	59·02	1,092	59·28	939	59·44	981
6	59·98	784	59·31	995	58·80	667	59·08	1,297	59·41	951	59·48	714
7	59·50	771	59·46	758	58·85	942	58·98	1,297	59·12	960	59·42	900
8	59·83	959	59·50	759	58·88	1,182	59·02	1,317	59·48	711	59·34	1,013
9	[illegible]	741	59·46	693	59·03	982	59·08	1,307	59·45	731	59·37	1,019
10	[illegible]	[illegible]	59·40	747	59·01	1,092	58·92	1,362	59·37	989	59·41	1,129
11	59·72	819	[illegible]	760	59·00	722	59·24	700	59·27	962	59·42	1,033
12	59·87	684	59·34	761	59·10	892	59·02	647	59·32	975	59·40	1,016
13	59·73	731	59·23	765	59·26	856	59·19	1,004	59·32	960	59·48	787
14	59·85	739	59·13	758	58·94	1,182	59·36	1,336	59·25	967	59·42	1,105
15	59·98	749	59·13	758	59·11	992	59·28	1,265	59·50	756	59·45	1,124
16	60·07	[illegible]	59·12	[illegible]	59·13	1,153	59·34	1,271	59·32	943	59·46	1,240
17	59·61	[illegible]	59·12	[illegible]	59·03	942	59·16	1,283	59·31	1,020	59·47	1,094
18	59·88	1,028	59·11	787	59·18	1,164	59·49	687	59·28	1,049	59·44	1,069
19	59·87	684	59·06	992	59·25	865	59·34	966	59·31	1,040	59·43	1,075
20	59·87	819	[illegible]	1,247	59·30	640	59·32	1,271	59·36	1,040	59·19	826
21	[illegible]	761	[illegible]	1,257	59·18	904	59·26	1,035	59·30	989	[illegible]	1,223
22	59·77	[illegible]	[illegible]	1,012	58·92	1,117	59·30	1,261	59·41	731	59·44	1,131
23	[illegible]	[illegible]	[illegible]	722	59·11	878	59·08	727	59·17	952	59·43	1,241
24	[illegible]	737	[illegible]	1,262	58·90	1,100	59·36	656	59·12	970	59·43	1,154
25	[illegible]	744	[illegible]	1,342	59·12	892	59·32	621	59·11	[illegible]	59·48	889
26	[illegible]	694	58·88	[illegible]	59·24	[illegible]	59·03	682	[illegible]	954	59·46	929
27	59·72	[illegible]	58·98	[illegible]	59·14	658	59·48	717	59·44	1,001	59·52	823
28	[illegible]	[illegible]	59·07	1,222	59·16	887	59·23	695	59·38	962	59·41	1,128
29	58·88	[illegible]	59·11	727	59·02	887	59·32	1,026	59·17	[illegible]	59·43	1,205
30	[illegible]	[illegible]	[illegible]	677	59·13	[illegible]	59·47	1,041	59·11	917	59·44	1,231
31	[illegible]	[illegible]	[illegible]	727			59·42	877			59·41	1,100

Note.—Gauge [illegible] gauge.

MONTHLY DISCHARGE of East Branch Winnipeg River at Kenora Power House for the year 1907-14.

(Drainage area, 26,400 square miles.)

Month	Discharge in Second-Feet		
	Maximum	Minimum	Mean
1907			
September	567	541	554
October	581	558	569
November	607	567	588
December	719	554	633
The period	719	541	586
1908			
January	738	554	616
February	782	723	750
March	617	567	577
April	595	581	586
May	626	581	598
June	662	610	641
July	661	644	645
August	681	644	655
September	690	581	619
October	674	581	624
November	647	582	625
December	702	604	668
The year	782	567	614
1909			
January	807	685	[illegible]
February	961	689	814
March	974	648	816
April	1,266	618	1,040
May	1,226	561	896
June	786	529	712
July	868	517	671
August	745	519	607
September	1,030	518	715
October	1,144	646	968
November	1,259	659	1,060
December	1,290	743	1,120
The year	1,290	517	848
1910			
January	1,211	787	1,070
February	1,181	805	1,050
March	1,129	643	893
April	1,111	741	1,150
May	1,562	800	1,140
June	1,125	610	928
July	1,117	533	820
August	1,022	529	760
September	1,163	535	826
October	1,259	660	1,060
November	1,358	713	1,170
December	1,387	820	1,250
The year	1,562	529	1,010
1911			
January	1,363	872	1,230
February	1,399	841	1,240
March	1,288	730	1,080
April	1,434	768	1,140
May	1,270	735	1,070
June	1,283	627	1,010
July	1,314	585	820
August	1,179	621	800
September	1,401	675	1,040
October	1,461	748	1,200
November	1,527	822	1,310
December	1,514	788	1,240
The year	1,527	585	1,100
1912			
January	1,565	928	1,300
February	1,738	929	1,390
March	1,547	819	1,360
April	1,512	816	1,340
May	1,425	753	1,220
June	1,313	634	1,070
July	1,207	555	1,000
August	1,252	658	1,080
September	1,234	577	732
October	1,286	621	1,010
November	1,420	652	1,120
December	1,322	714	1,170
The year	1,738	555	1,150

Whitemouth River at Whitemouth. Gauge at bridge.

MONTHLY DISCHARGE of East Branch Winnipeg River at Kenora Power House for the year 1907–14—*Continued.*

Month	Discharge in Second-Feet		
	Maximum	Minimum	Mean
1913			
January	1,607	914	1,360
February	1,394	935	1,270
March	1,382	740	1,190
April	1,251	628	926
May	1,473	638	1,110
June	1,400	737	1,120
July	1,376	637	967
August	884	667	716
September	1,349	662	877
October	1,417	692	1,240
November	1,402	697	1,230
December	1,497	712	1,220
The year	1,607	628	1,100
1914			
January	1,432	797	1,090
February	1,182	882	1,010
March	1,262	702	1,020
April	972	642	770
May	965	635	802
June	1,067	639	883
July	1,026	684	740
August	1,342	677	894
September	1,182	640	908
October	1,362	621	991
November	1,108	656	924
December	1,241	714	1,040
The year	1,432	621	921

Western Outlet Norman Traffic Bridge.

History.—Station was established on June 5, 1912, by S. S. Scovil.

Location of Section.—The section is located on the downstream side of the Norman traffic bridge which spans the western outlet of the lake of the Woods about two miles west of Kenora on the highway leading from Kenora to Keewatin. The initial point is marked on the wooden handrail at the west end of the bridge, the meterings being taken from the deck.

Records Available.—Estimates of daily discharge are available for this station from May 1, 1913, and are based upon gauge readings taken at the D.P.W. forebay gauge, Norman dam, from May 1 to August 25, 1913, and from August 26, 1913 on, the gauge heights are those recorded by the Manitoba Hydrographic Survey gauge above the Norman dam.

Drainage Area.—The drainage area above this section is 26,400 square miles, but owing to the fact that there are several other outlets of the lake of the Woods, this drainage area should not be used in computing run-off.

Gauge.—When the station was first established a reference point was marked on the northeast corner of the west pier of the bridge, to which water levels at the time of metering were referred. This was later replaced by a vertical staff gauge which was referred to W.P.S. datum.

Owing to the fact that the discharge past this section depends entirely upon the operation of the Norman dam, the discharge measurements have been referred to the gauge height at that point, and daily discharges are also referred to the same gauge. Two gauges were established above the Norman dam, the first being that of the Ontario D.P.W. which was used until August 25, 1913. On August 26, 1913, a vertical staff gauge was established by the Manitoba Hydrographic Survey, which was referred to the W.P.S. datum.

Channel.—There is but one channel for all stages of the river, the average depth over the section being approximately 40 feet under normal conditions. The bed of the river is loose rock and boulders but is not subject to appreciable change. The velocity at the section is fairly high, and some eddies are formed due to the section being located at the apex of a curve.

Discharge Measurements.—Some 180 discharge measurements have been made at this station, but owing to the fact that the water at this point is practically at lake level the range in stage has not been great, amounting to 2.2 feet.

Accuracy.—The Norman dam, which is located about 4,000 feet below the station, forms the control, and the discharge is therefore dependent upon the manipulation of the dam; considerable range in discharge may occur for the same gauge height recorded at the section.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)

1.0 2.8 2.5 4.5 5.0 3.2 2.2 5.6 6.3 3.6 7.1 2.0 4.0 8.0

1.1 1.8

1.25 1.4 1.6

DISCHARGE MEASUREMENTS of Winnipeg River at Western Outlet, Norman Traffic Bridge, Kenora, 1912–14.

Date.		Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity	Gauge Height.	Dis-charge.	Remarks
1912.				Feet.	Sec.-ft.	Ft. per sec	Feet.	Sec.-ft.	No. of Logs out of Dam.
June	5	S. S. Scovil	1,374	193	4,740	0·57	....	2,694	....
July	15	"	1,374	193	4,820	0·64	....	3,070	....
"	30	W. Richardson	1,374	193	4,831	0·56	57·75	2,715	....
Aug.	13	S. S. Scovil	1,187	205	4,946	0·77	58·09	3,823	....
"	30	W. H. Worden	1,187	205	4,853	0·80	....	3,863	....
Sept.	27	W. Richardson	1,462	205	4,992	0·83	....	4,154	....
"	30	"	1,462	205	5,001	0·79	....	3,995	....
Oct.	4	"	1,462	205	5,090	1·38	58·94	7,010	20
"	11	Alex Pirie	1,462	209	5,045	1·39	59·07	7,027	20
"	12	"	1,462	206	5,038	1·28	59·10	6,476	20
"	16	"	1,462	206	5,082	1·35	....	6,874	20
"	18	"	1,462	211	5,077	1·67	59·08	8,495	30
Nov.	20	G. J. Lamb	1,187	213	4,992	1·68	....	8,386	28
"	27	"	1,187	213	4,968	1·68	....	8,346	28
1913.									
Feb.	12	G. J. Lamb	1,375	212	4,986	1·57	58·66	7,821	29
"	19	"	1,375	212	5,028	0·85	....	4,259	29
Mar.	10	"	1,375	212	4,351	0·89	....	4,443	1
"	11	"	1,375	212	4,930	0·83	....	4,103	1
April	1	"	1,375	212	4,951	0·88	59·04	4,331	1
"	9	"	1,375	212	4,951	0·88	....	4,374	1
"	16	"	1,375	212	4,993	0·92	59·23	4,587	1
"	17	"	1,375	212	5,014	0·98	59·28	4,895	1
May	21	"	1,375	212	4,910	3·58	57·28	17,588	107
June	26	"	1,375	205	4,856	3·27	57·11	15,903	107
July	2	G. Emery	1,375	207	4,900	3·45	57·29	16,919	107
"	11	"	1,375	212	5,013	1·84	58·82	9,250	50
Aug	1	"	1,375	205	4,979	2·82	58·35	14,034	70
"	6	"	1,375	205	4,919	2·73	58·21	13,409	70
"	8	"	1,375	205	1,979	2·71	58·29	13,510	70
"	26	C. O. Allen	1,435	205	4,898	2·45	58·00	11,991	70
"	26	"	1,135	205	4,898	2·76	58·00	13,518	70
"	27	"	1,435	205	4,939	2·70	58·12	13,334	70
"	27	"	1,435	205	4,939	2·70	58·12	13,334	70
"	28	"	1,435	205	4,898	2·66	57·96	13,028	70
"	28	"	1,435	205	1,898	2·71	57·96	13,273	70
"	29	"	1,435	205	4,898	2·63	57·98	12,881	70
"	29	"	1,135	205	4,898	2·75	57·98	13,469	70
"	30	"	1,435	205	4,918	2·66	58·06	13,082	70
"	30	"	1,435	205	4,918	2·68	58·06	13,181	70
Sept	1	"	1,435	205	4,918	2·66	58·06	13,082	70
"	1	"	1,435	205	4,918	2·69	58·06	13,230	70
"	3	"	1,435	205	4,878	2·55	57·92	12,438	70
"	3	"	1,435	205	4,878	2·57	57·92	12,535	70
"	5	"	1,435	205	4,878	2·58	57·92	12,584	70
"	5	"	1,435	205	1,878	2·58	57·92	12,584	70
"	9	"	1,435	205	4,939	2·66	58·11	13,136	70
"	9	"	1,435	206	4,939	2·65	58·11	13,087	70
"	20	G. Emery	1,760	205	4,737	2·46	57·32	11,677	70
"	21	"	1,760	205	4,737	2·47	57·42	11,825	70
"	22	"	1,760	205	4,818	2·32	57·87	11,167	[illegible]
"	23	"	1,760	205	1,812	1·75	58·23	8,526	
"	23	"	1,760	205	4,857	1·72	58·29	8,342	20
"	24	"	1,760	205	4,818	1·49	58·25	7,200	23
"	25	"	1,760	205	4,838	1·57	58·27	7,615	23
"	25	"	1,760	205	5,033	1·55	58·27	7,780	23
"	26	"	1,760	205	4,860	1·54	58·26	7,503	23
"	26	"	1,760	205	4,839	1·56	58·26	7,584	23
"	27	"	1,760	205	4,859	1·30	58·54	6,327	13
"	27	"	1,760	205	4,875	1·19	58·54	5,812	13
"	28	"	1,760	205	1,875	1·20	58·52	5,826	13
"	28	"	1,760	205	4,859	1·20	58·52	5,831	13
"	29	"	1,760	205	1,821	1·21	58·37	5,915	4
"	29	"	1,760	205	1,821	1·19	58·37	5,713	4
"	30	"	1,760	205	4,860	1·18	58·50	5,758	
"	30	"	1,760	205	4,860	1·11	58·50	5,381	
Oct	1	"	1,760	205	4,838	1·15	58·42	5,565	
"	1	"	1,760	205	4,838	1·13	58·42	5,470	
"	[illegible]	"	1,760	205	1,860	1·12	58·51	5,463	
"	[illegible]	"	1,760	205	1,860	1·17	58·51	5,602	
"	[illegible]	"	1,760	205	4,860	1·16	58·46	5,638	
"	3	"	1,760	205	1,858	1·20	58·46	5,808	
"	4	"	1,760	205	1,821	1·14	58·33	5,477	
"	5	"	1,760	205	1,740	1·17	58·03	5,559	
"	[illegible]	"	1,760	205	4,848	1·19	58·41	5,759	

Discharge Measurements of Winnipeg River at Western outlet Norman Traffic Bridge, Kenora—*Continued*.

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge	Remarks
				Feet	Sq. ft.	Ft. per sec.	Feet	Sec. ft.	No. of Logs out of Dam
1913									
Oct	23	E. J. Budge	1,186	205	4,897	1·19	58·69	5,841	
"	25	"	1,186	205	4,852	1·14	58·58	5,540	
"	28	"	1,186	205	4,775	1·10	58·77	5,235	
"	30	"	1,186	205	4,877	1·13	58·62	5,530	
Nov.	1	"	1,186	205	4,897	1·12	58·73	5,515	
"	4	"	1,186	205	4,897	1·13	58·74	5,540	
"	6	E. J. Budge	1,186	205	4,877	1·15	58·63	5,593	
"	10	"	1,186	205	4,857	1·1[illegible]	58·52	5,192	
"	12	"	1,186	205	4,857	1·11	58·52	5,388	
"	14	"	1,186	205	4,877	1·16	58·62	5,651	
"	17	"	1,186	205	4,878	1·11	58·63	5,438	
"	19	"	1,186	205	4,877	1·13	58·66	5,515	
"	21	"	1,186	205	4,857	1·16	58·57	5,612	
"	24	"	1,186	205	4,877	1·18	58·73	5,725	
"	26	S. C. O'Grady	1,186	205	4,857	1·09	58·53	5,393	
"	27	"	1,186	205	4,877	1·09	58·67	5,335	
"	28	"	1,186	205	4,857	1·14	58·57	5,527	
"	29	"	1,186	205	4,877	1·13	58·65	5,522	
Dec	2	E. J. Budge	1,186	205	4,877	1·08	58·60	5,239	
"	5	"	1,186	205	4,857	1·13	58·63	5,467	
"	29	"	1,186	205	4,946	1·08	58·59	5,355	
"	29	"	1,186	205	4,946	1·11	58·59	5,458	
1914									
Jan	6	M. S. Madden	1,186	205	4,946	1·13	58·59	5,554	
"	13	S. C. O'Grady	1,186	205	4,925	1·05	58·54	5,154	
"	19	M. S. Madden	1,196	205	4,926	1·07	58·52	5,272	
"	28	S. C. O'Grady	1,196	205	4,927	1·11	58·54	5,458	...
"	28	"	1,196	205	4,927	1·08	58·54	5,297	...
Feb.	4	"	1,196	205	4,915	1·10	58·60	5,461	
"	4	"	1,196	206	4,945	1·09	58·60	5,390	
"	9	"	1,196	205	4,946	1·10	58·59	5,421	
"	9	"	1,196	206	4,946	1·09	58·59	5,385	
"	17	"	1,196	205	4,946	1·13	58·59	5,582	..
"	17	"	1,196	205	4,945	1·07	58·59	5,280	
"	24	"	1,196	205	4,926	1·40	58·39	6,860	35
"	24	"	1,196	205	4,926	1·45	58·39	7,172	35
"	26	"	1,196	205	4,926	1·70	58·26	8,350	35
"	26	"	1,196	205	4,926	1·67	58·26	8,207	35
Mar	3	"	1,196	205	4,904	1·68	58·20	8,273	..
"	3	"	1,196	205	4,904	1·62	58·20	7,962	
"	5	T. J. Moore	1,196	206	4,906	1·60	58·20	7,824	
"	20	S. C. O'Grady	1,196	205	4,885	1·62	58·20	7,930	.
"	20	"	1,196	205	4,885	1·66	58·20	8,097	..
"	24	"	1,196	205	4,885	1·59	58·18	7,774	
"	27	T. J. Moore	1,196	205	4,884	1·63	58·14	7,[illegible]	
"	27	"	1,196	205	4,884	1·56	58·14	7,[illegible]	.
"	31	"	1,196	205	4,886	1·57	58·13	7,662	
"	31	"	1,196	205	4,885	1·60	58·13	7,837	
April	1	S. C. O'Grady	1,196	206	4,885	1·61	58·13	7,893	
"	2	"	1,196	205	4,885	1·63	58·14	7,945	
"	9	T. J. Moore	1,196	205	4,885	1·63	58·13	7,980	
"	9	"	1,196	205	4,885	1·59	58·13	7,762	
"	15	S. C. O'Grady	1,196	205	4,885	1·66	58·10	8,111	.
"	15	"	1,196	205	4,885	1·52	58·10	7,407	
"	17	T. J. Moore	1,196	205	4,885	1·54	58·11	7,527	
"	17	"	1,196	205	4,885	1·42	58·11	6,949	
"	22	S. C. O'Grady	1,196	206	4,905	1·57	58·16	7,678	.
"	22	"	1,196	205	4,905	1·64	58·16	8,074	.
"	25	T. J. Moore	1,196	205	4,926	1·71	58·19	8,437	..
"	25	"	1,196	205	4,926	1·59	58·19	8,294	..
"	27	"	1,196	205	4,926	1·65	58·36	8,119	.. .
"	27	"	1,196	205	4,926	1·68	58·36	8,282	
"	29	S. C. O'Grady	1,196	205	4,946	1·68	58·37	8,321	.
"	29	"	1,196	206	4,946	1·73	58·37	8,573	..
May	1	"	1,196	205	4,946	1·67	58·38	8,272	
"	1	"	1,196	205	4,946	1·75	58·38	8,618	... .
"	9	T. J. Moore	1,196	205	5,007	1·78	58·63	8,929	
"	9	S. C. O'Grady	1,196	205	5,007	1·75	58·63	8,751	
"	15	T. J. Moore	1,196	205	4,987	1·76	58·73	8,775	
"	15	"	1,196	205	5,028	1·76	58·73	8,873	.
"	15	"	1,196	205	5,028	1·78	58·73	8,936	
"	19	"	1,196	205	5,028	1·83	58·77	9,208	
"	23	"	1,196	205	5,048	2·39	58·54	12,112	54
"	23	"	1,196	205	5,048	2·37	58·54	11,963	... ..
"	27	C. Galloway	1,196	205	5,048	2·60	58·45	13,113	72
"	27	"	1,196	206	5,048	2·68	58·45	13,526	.. ....

Discharge Measurements of Winnipeg River at Western outlet Norman Traffic Bridge, Kenora—*Concluded.*

Date.		Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge	Remarks
1914.				Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.	Number Logs out of Dam.
June	5	T. J. Moore	1,196	205	5,088	2·99	58·29	15,217	......
"	5	"	1,196	205	5,088	2·94	58·29	14,991	......
"	12	"	1,196	205	5,129	3·07	58·33	15,749	......
"	12	"	1,196	205	5,129	3·03	58·33	15,545	......
"	19	"	1,196	205	5,109	3·33	58·17	17,045	79
"	19	"	1,196	205	5,109	3·32	58·17	16,993	......
"	26	"	1,196	205	5,088	3·62	57·55	18,447	89
"	26	"	1,196	205	4,088	3·58	57·55	18,236	......
"	30	"	1,196	205	5,068	3·64	57·60	18,436	......
"	30	"	1,196	205	5,068	3·67	57·60	18,602	......
July	10	C. Galloway	1,196	205	5,068	3·58	57·50	18,155	......
"	10	"	1,196	205	5,068	3·60	57·50	18,287	......
"	24	S. C. O'Grady	1,196	212	5,081	3·35	57·50	16,952	......
"	27	C. Galloway	1,196	212	5,041	3·51	57·42	17,686	......
"	27	"	1,196	212	5,041	3·49	57·42	17,064	......
Aug	8	S. C. O'Grady	1,196	205	4,997	3·33	57·2[illegible]	16,396	......
"	8	"	1,196	205	4,997	3·30	57·25	16,507	......
"	15	"	1,196	205	4,946	3·39	57·20	16,720	......
"	15	"	1,196	205	4,946	3·39	57·20	16,731	......
"	21	"	1,196	205	4,926	3·33	56·[illegible]7	16,399	......
"	21	"	1,196	205	4,926	3·27	56·97	16,110	......
Sept.	12	"	1,196	205	4,997	2·24	58·62	11,151	44
"	22	"	1,196	205	4,946	2·12	58·32	10,468	......
"	29	"	1,196	201	4,966	2·14	58·40	10,622	......
Oct.	3	C. Galloway	1,196	205	4,967	2·23	58·35	11,125	......
"	3	"	1,196	205	4,967	2·19	58·35	10,905	......
Nov.	9	S. C. O'Grady	1,196	212	5,112	1·51	59·15	7,713	10
"	11	"	1,196	212	5,050	1·46	59·10	7,395	......
"	27	"	1,196	212	5,080	1·42	59·00	7,203	......
Dec.	12	"	1,196	212	5,091	1·48	59·09	7,517	......
"	29	C. Galloway	1,196	212	5,104	1·45	59·14	7,375	......
"	29	"	1,196	212	5,104	1·44	59·14	7,339	......

NOTE.—All gauge heights read on forebay gauge at Norman Dam. All gauge heights prior to Aug. 26 are readings of D.P.W. gauge at forebay of Norman Dam. Datum of gauge 1,000.

Daily Gauge Height and Discharge of Winnipeg River at Western outlet Norman Traffic Bridge, Kenora, for 1913.

[Drainage area, 26,400 square miles.]

Day.	January.		February		March.		April.		May.		June.	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	....	....	....	....	....	58·54	13,300	57·34	17,500
2	....	....	....	....	....	....	....	....	58·49	13,400	57·39	17,500
3	....	....	....	....	....	....	....	....	58·54	13,600	57·31	17,423
4	....	....	....	....	....	....	....	....	58·64	13,800	57·44	17,500
5	....	....	....	....	....	....	....	....	58·54	13,800	57·44	17,709
6	....	....	....	....	....	....	....	....	58·54	13,800	57·29	17,600
7	....	....	....	....	....	....	....	....	58·54	13,800	57·34	17,600
8	....	....	....	....	....	....	....	....	58·49	13,800	57·39	17,600
9	....	....	....	....	....	....	....	....	58·49	13,900	57·44	17,600
10	....	....	....	....	....	....	....	....	58·59	14,200	57·49	17,567
11	....	....	....	....	....	....	....	....	58·59	14,200	57·49	17,694
12	....	....	....	....	....	....	....	....	58·49	14,500	57·39	17,848
13	....	....	....	....	....	....	....	....	58·09	15,200	57·34	17,826
14	....	....	....	....	....	....	....	....	57·69	16,000	57·34	17,628
15	....	....	....	....	....	....	....	....	57·49	16,900	57·34	17,532
16	....	....	....	....	....	....	....	....	57·39	17,200	57·34	17,532
17	....	....	....	....	....	....	....	....	57·39	17,200	37·34	17,435
18	....	....	....	....	....	....	....	....	57·39	17,200	57·34	17,501
19	....	....	....	....	....	....	....	....	57·44	17,200	57·34	17,545
20	....	....	....	....	....	....	....	....	57·39	17,300	57·24	16,900
21	....	....	....	....	....	....	....	....	57·34	17,400	57·29	16,300
22	....	....	....	....	....	....	....	....	57·39	17,700	57·29	17,300
23	....	....	....	....	....	....	....	....	57·44	17,700	57·29	17,300
24	....	....	....	....	....	....	....	....	57·39	17,700	57·29	17,300
25	....	....	....	....	....	....	....	....	57·49	17,800	57·29	17,300
26	....	....	....	....	....	....	....	....	57·49	17,800	57·11	16,000
27	....	....	....	....	....	....	....	....	57·39	17,700	57·09	16,000
28	....	....	....	....	....	....	....	....	57·44	17,700	57·24	16,800
29	....	....	....	....	....	....	....	....	57·49	17,700	57·29	17,400
30	....	....	....	....	....	....	....	....	57·39	17,900	57·29	17,400
31	....	....	....	....	....	....	....	....	57·49	18,000	....	....

Day.	July.		August		September.		October.		November.		December	
1	57·14	16,100	58·29	13,600	58·06	13,243	58·42	5,520	58·73	5,565	58·67	5,540
2	57·29	16,800	58·29	13,600	57·99[1]	13,000	58·51	5,515	58·75[1]	5,575	58·69	5,525
3	57·34	17,000	58·19	13,500	57·92	12,609	58·46	5,530	58·57	5,520	58·71	5,550
4	57·29	16,000	58·19	13,500	57·92[1]	13,000	58·33	5,460	58·74	5,550	58·73	5,565
5	57·19	15,800	58·09	13,500	57·92	12,721	58·03	4,950	58·79	5,595	58·63	5,535
6	57·29	16,500	58·19	13,500	57·94[1]	12,810	58·41	5,475	58·63	5,540	58·58	5,535
7	57·19	16,500	58·49	13,500	57·96[1]	12,870	58·46[1]	5,540	58·56[1]	5,500	58·55	5,150
8	57·79	16,500	58·29	13,500	57·99[1]	12,800	58·48	5,475	58·56	5,500	58·65	5,495
9	57·99	15,900	58·29	13,300	58·11	13,197	58·42	5,500	58·52[1]	5,510	58·64	5,540
10	58·19	12,200	58·19	13,300	58·04[1]	12,850	58·75	5,550	58·52	5,515	58·62	5,535
11	58·69	10,400	58·29	13,300	57·97[1]	12,800	58·68	5,540	58·75	5,565	58·61	5,535
12	58·74	10,300	58·21	13,300	57·90[1]	12,610	58·54	5,530	58·52	5,525	58·61	5,530
13	58·79	10,300	58·19	13,300	57·83[1]	12,570	58·73	5,535	58·57	5,510	58·62	5,535
14	58·79	10,300	58·19	13,300	57·76[1]	13,040	58·69	5,550	58·62	5,530	58·63	5,520
15	58·84	10,300	57·99	13,300	57·70[1]	12,650	58·56	5,525	58·65	5,530	58·61	5,530
16	58·81	10,300	58·19	13,300	57·63[1]	12,500	58·60	5,725	58·75	5,590	58·63	5,535
17	58·89	10,300	58·19	13,200	57·55[1]	12,550	58·71	5,565	58·63	5,540	58·64	5,530
18	58·84	10,200	58·09	13,200	57·48[1]	12,800	58·61	5,535	58·49	5,510	58·61	5,535
19	58·89	10,100	58·24	13,300	57·40[1]	12,900	58·48	5,500	58·66	5,550	58·64	5,530
20	58·99	10,100	58·09	13,300	57·32	11,751	58·40	5,485	58·67	5,545	58·59	5,530
21	59·09	10,100	58·09	13,300	57·42[1]	11,800	58·59	5,530	58·57	5,525	58·60	5,540
22	59·04	10,100	58·14	13,300	57·87	11,105	58·75	5,565	58·56	5,525	58·60	5,530
23	58·89	12,000	57·99	13,300	58·29	8,071	58·69	5,540	58·75[1]	5,570	58·59	5,525
24	58·49	13,000	57·99	13,300	58·25	7,600	58·55	5,510	58·53	5,535	58·60	5,530
25	58·29	13,600	57·99	13,300	58·27	7,697	58·58	5,515	58·46	5,525	58·59	5,530
26	57·44	13,600	58·00	13,000	58·26	7,534	58·53	5,510	58·53	5,525	58·58	5,525
27	57·39	13,600	58·12	13,300	58·51	6,069	58·75	5,565	58·67	5,550	58·59	5,525
28	57·39	13,600	57·96	13,100	58·52	5,830	58·77	5,225	58·57	5,525	58·61	5,540
29	57·39	13,600	57·98	13,100	58·57	5,829	58·52	5,525	58·65	5,540	58·59	5,545
30	57·39	13,600	58·06	13,200	58·50	5,567	58·62	5,540	58·65[1]	5,540	58·59	5,530
31	57·39	13,600	58·06[1]	13,200	....	....	58·73	5,550	....	....	58·59	5,525

Note—Gauge heights marked thus ([1]) interpolated
Gauge heights read on forebay gauge at Norman dam
Gauge heights prior to August 26 are readings of D P W. gauge at forebay of Norman dam.

Daily Gauge Height and Discharge of Winnipeg River at Norman Traffic Bridge, Kenora, for 1914.

(Drainage area, 26,400 square miles.)

Day.	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.
1	58·50	5,525	58·55	5,400	58·20	7,815	58·13	7,830	58·48	8,114	58·18	14,800
2	58·57	5,525	58·50	5,400	58·24	7,855	58·14	7,860	58·42	8,500	58·21	14,925
3	58·54	5,530	58·55	5,400	58·20	7,815	58·13	7,830	58·44	8,530	58·23	14,800
4	58·56	5,535	58·60	5,400	58·18	7,790	58·13	7,830	58·47	8,575	58·27	14,850
5	58·59	5,535	58·58	5,400	58·20	7,815	58·15	7,885	58·50	8,630	58·29	15,100
6	58·59	5,525	58·59	5,425	58·21	7,825	58·14	7,860	58·51	8,700	58·23	15,025
7	58·57	5,530	58·59	5,400	58·23	7,850	58·13	7,840	58·57	8,780	58·22	15,175
8	58·58	5,525	58·62	5,425	58·09	7,790	58·13	7,830	58·59	8,790	58·22	15,200
9	58·58	5,530	58·59	5,425	58·24	7,855	58·13	7,830	58·63	8,830	58·24	15,400
10	58·57	5,530	58·58	5,400	58·25	7,870	58·13	7,830	58·63	8,839	58·34	15,600
11	58·58	5,510	58·59	5,400	58·28	7,900	58·15	7,885	58·61	8,775	58·34	15,575
12	58·56	5,530	58·57	5,400	58·28	7,900	58·10	7,760	58·60	8,770	58·33	15,650
13	58·54	5,510	58·59	5,400	58·23	7,850	58·12	7,810	58·60	8,770	58·36	15,675
14	58·57	5,525	58·59	5,400	58·28	7,900	58·10	7,760	58·66	8,875	58·39	15,790
15	58·50	5,530	58·58	5,425	58·23	7,850	58·10	7,760	58·73	8,901	58·31	15,650
16	58·51	5,525	58·58	5,425	58·28	7,900	58·10	7,760	58·77	9,070	58·26	15,725
17	58·54	5,530	58·59	5,400	58·25	7,870	58·11	7,785	58·80	9,120	58·16	15,825
18	58·57	5,535	58·58	5,400	58·21	7,825	58·17	7,935	58·77	9,208	58·11	16,025
19	58·52	5,530	58·58	5,400	58·18	7,790	58·18	7,960	58·77	12,155	58·17	16,825
20	58·53	5,525	58·57	5,400	58·20	7,815	58·20	8,010	58·80	12,555	58·19	17,000
21	58·60	5,530	58·54	5,800	58·18	7,790	58·17	7,935	58·66	12,555	58·20	16,650
22	58·59	5,530	58·15	5,800	58·18	7,790	58·16	7,910	58·50	12,555	58·20	17,300
23	58·57	5,530	58·12	6,400	58·18	7,790	58·16	7,910	58·54	12,555	58·15	18,200
24	58·60	5,535	58·30	7,000	58·18	7,790	58·17	7,935	58·59	12,900	57·90	18,575
25	58·59	5,530	58·30	7,700	58·18	7,790	58·19	7,985	58·59	12,900	57·66	18,275
26	58·57	5,530	58·26	8,275	58·17	7,780	58·26	8,165	58·57	12,900	57·55	18,350
27	58·53	5,530	58·27	8,275	58·14	7,750	58·36	8,120	58·45	12,900	57·58	18,050
28	58·54	5,525	58·21	8,275	58·11	7,750	58·37	8,445	58·28	13,500	57·60	18,525
29	58·55	5,535	.....		58·14	7,750	58·37	8,415	58·23	14,900	57·60	18,525
30	58·59	5,535	.....		58·13	7,710	58·36	8,420	58·20	15,000	57·60	18,525
31	58·60	5,535			58·13	7,750			58·13	15,000		

Day.	July		August		September.		October.		November		December.	
1	57·60	18,560	57·38	17,400	58·21	10,270	58·40	10,811	58·87	7,350	59·00	7,390
2	57·60	18,560	57·38	17,400	58·28	10,520	58·39	10,784	58·85	7,462	58·99	7,379
3	57·53	18,150	57·36	17,325	58·30	10,370	58·35	10,675	58·85	7,112	58·97	7,358
4	57·48	17,850	57·32	17,150	58·35	10,170	58·31	10,557	58·85	7,337	58·93	7,316
5	57·42	17,500	57·30	17,050	58·11	10,720	58·30	10,522	58·87	7,350	58·97	7,358
6	57·40	17,400	57·30	17,050	58·46	10,955	58·31	10,557	58·86	7,444	59·00	7,390
7	57·39	17,450	57·29	17,025	58·53	10,980	58·32	10,558	58·82	7,293	59·00	7,390
8	57·43	17,550	57·25	16,850	58·50	10,980	58·17	10,917	58·87	7,450	58·96	7,348
9	57·46	17,750	57·25	16,850	58·59	11,290	58·61	11,406	59·15	7,690	58·97	7,358
10	57·50	17,975	57·24	16,825	58·62	11,265	58·82	11,587	59·13	7,597	59·00	7,390
11	57·50	17,975	57·21	16,700	58·65	11,240	58·90	12,100	59·10	7,520	59·00	7,390
12	57·50	17,975	57·20	16,675	58·62	11,315	58·93	12,157	59·07	7,516	59·09	7,492
13	57·53	18,150	57·20	16,675	58·53	11,080	58·95	10,987	59·05	7,530	59·00	7,390
14	57·59	18,450	57·20	16,675	58·45	10,770	59·00	8,647	59·12	7,538	59·00	7,390
15	57·61	18,575	57·20	16,675	58·39	10,795	59·05	7,477	59·17	7,583	59·00	7,390
16	57·60	18,560	57·20	16,675	58·32	10,720	59·05	7,530	59·13	7,547	59·00	7,390
17	57·58	18,475	57·23	16,800	58·28	10,545	58·88	7,361	58·95	7,455	59·05	7,447
18	57·57	18,400	57·03	16,150	58·29	10,570	58·98	7,518	58·87	7,400	59·01	7,401
19	57·57	18,400	57·01	16,100	58·29	10,570	58·93	7,438	59·10	7,570	58·95	7,327
20	57·58	18,475	57·01	16,100	58·31	10,570	58·98	7,170	59·00	7,545	59·17	7,590
21	57·57	18,400	56·97	15,860	58·31	10,545	58·93	7,423	58·95	7,405	59·10	7,504
22	57·54	18,225	56·94	15,640	58·32	10,470	58·92	7,437	59·05	7,555	59·10	7,504
23	57·52	18,100	56·91	15,420	58·34	10,545	58·[illegible]	7,280	59·03	7,564	59·10	7,504
24	57·50	17,975	56·87	15,200	58·35	10,495	59·00	7,518	59·00	7,515	59·00	7,390
25	57·50	17,975	56·86	13,800	58·37	10,795	58·80	7,302	59·00	7,545	59·10	7,504
26	57·46	17,750	57·25	11,990	58·38	10,795	58·83	7,291	59·00	7,490	59·10	7,504
27	57·42	17,500	57·86	10,560	58·40	10,820	58·92	7,486	59·00	7,515	59·10	7,504
28	57·39	17,350	58·27	10,545	58·40	10,795	58·98	7,431	59·00	7,515	59·11	7,516
29	57·39	17,350	58·64	11,290	58·40	10,795	58·97	7,459	59·00	7,545	59·14	7,553
30	57·38	17,300	58·23	10,270	58·40	10,795	58·99	7,508	59·00	7,515	59·10	7,504
31	57·38	17,300	58·23	10,270	....	....	59·01	7,515	....	....	59·10	7,504

Note.—Gauge heights read on forebay gauge at Norman dam.

MONTHLY DISCHARGE of Winnipeg River at Western Outlet Norman Traffic Bridge, Kenora, for the year 1913-14.

Month	Discharge in Second-feet			Run-off.
	Maximum	Minimum	Mean.	Total in acre feet.
May	18,000	13,[illegible]	16,000	983,800
June	17,848	16,000	17,400	1,035,400
July	17,000	10,100	13,000	799,300
August	13,600	13,000	13,300	817,800
September	13,243	5,567	11,100	660,500
October	5,565	4,950	5,500	338,200
November	5,595	5,500	5,550	327,300
December	5,565	5,450	5,500	338,200
The period	18,000	4,950	10,900	5,300,500
1914				
January	5,540	5,510	5,530	340,000
February	8,275	5,400	5,900	327,700
March	7,900	7,700	7,800	479,600
April	8,445	7,760	7,950	473,100
May	15,000	8,444	10,700	657,900
June	18,575	14,800	16,400	975,900
July	18,575	17,300	18,000	1,106,800
August	17,400	10,270	15,400	946,900
September	11,315	10,270	10,800	642,600
October	12,157	7,280	9,000	553,400
November	7,690	7,293	7,500	446,300
December	7,590	7,316	7,450	458,100
The year	18,575	5,510	10,200	7,408,300

MILL "A" HEAD-RACE, KEEWATIN.

History.—The station in the head-race, mill "A," was established by Mr. S. S. Scovil, December 23, 1912. This channel has formed one of the outlets of the lake of the Woods since the mill was built in 1887. A gauge in the tail-race was operated from May, 1896, until June, 1912, when it was discontinued.

Location of Section.—The section as first located in the head-race of mill "A" was on the downstream side of the foot-bridge across the channel. Later it was changed to a position just above the intake racks of the power-house in the head-race, mill "A," Lake of the Woods Milling Company, Keewatin, Ont.

Records Available.—Intermittent gauge readings in the tail-race from 1896-1912, and from 1913 daily discharge records based upon meterings, head and tail gauge readings and loads on the mill are available.

Drainage Area.—Total drainage area of all Lake of the Woods outlets is 26,400 square miles.

Gauge.—No gauge has been established, water levels are obtained by measuring down from a point of known elevation which is situated on the top of the head wall of the channel, near its intersection with the river retaining wall.

Channel.—The entrance to the racks is uniform and the section is well situated to avoid eddies of entrance, the stream line being generally perpendicular to the section.

Discharge Measurements.—A number of meterings have been made to determine the discharge for different gate openings and head, so that the daily discharge may be arrived at. They are made from the rack structure.

Accuracy.—The records are reliable owing to the conditions controlling the discharge, *i.e.*, gate opening, head, etc., being easily observed.

DISCHARGE MEASUREMENTS of Headrace, Mill "A," Lake of the Woods Milling Company, 1912-13.

Date.		Hydrographer	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.				Feet	Sq. ft.	Ft. per sec	Feet	Sec.-ft
Dec.	23	S. S. Scovil	1469	36	433	1·90	99·45	820
1913.								
Feb.	14	G. J. Lamb	1375	36	412	1·87	99·14	769
"	20	"	1375	36	420	1·81	99·27	760
Mar.	11	"	1375	36	420	1·83	99·25	769
"	12	"	1375	36	420	1·65	99·24	693
"	15	"	1375	36	420	1·79	99·31	749
"	21	"	1375	36	420	1·82	99·28	765
"	28	"	1375	36	426	1·75	99·43	747
April	9	"	1375	36	423	0·57	99·40	241
"	10	"	1375	36	426	0·57	99·43	242
"	10	"	1375	36	426	0·51	99·44	219
"	12	"	1375	36	426	0·48	99·50	206
"	12	"	1375	36	426	0·53	99·50	226
May	21	"	1375	36	444	1·99	99·93	885
June	26	"	1375	36	430	2·03	99·50	873
July	15	G. Emery	1375	36	440	1·76	99·80	774
Aug.	7	C. O. Allen	1375	36	444	1·63	99·98	724
Sept.	2	"	1435	36	426	1·86	99·40	792
"	2	"	1435	36	426	1·83	99·40	780
"	2	"	1435	36	426	1·78	99·40	757
"	2	"	1435	36	426	1·86	99·40	791
"	2	"	1434	36	423	1·81	99·38	763
"	2	"	1435	36	423	1·84	99·38	778
"	2	"	1435	36	423	1·82	99·37	767
"	4	"	1435	36	430	1·80	99·53	774
"	4	"	1435	36	430	1·73	99·50	743
"	4	"	1435	36	426	1·82	99·48	774
"	4	"	1435	36	426	1·90	99·48	811
"	4	"	1435	36	426	1·85	99·45	789
"	4	"	1435	36	426	1·84	99·43	784
"	4	"	1435	36	426	1·84	99·45	784
"	4	"	1435	36	426	1·84	99·45	785
"	6	"	1435	36	180	1·30	99·40	234
"	6	G. Emery	1435	36	180	1·29	99·37	232
"	6	"	1435	36	180	1·32	99·37	238
Dec	3	E. J. Budge	1186	36	404	1·77	99·10	713
"	4	"	1186	36	407	1·85	99·16	754

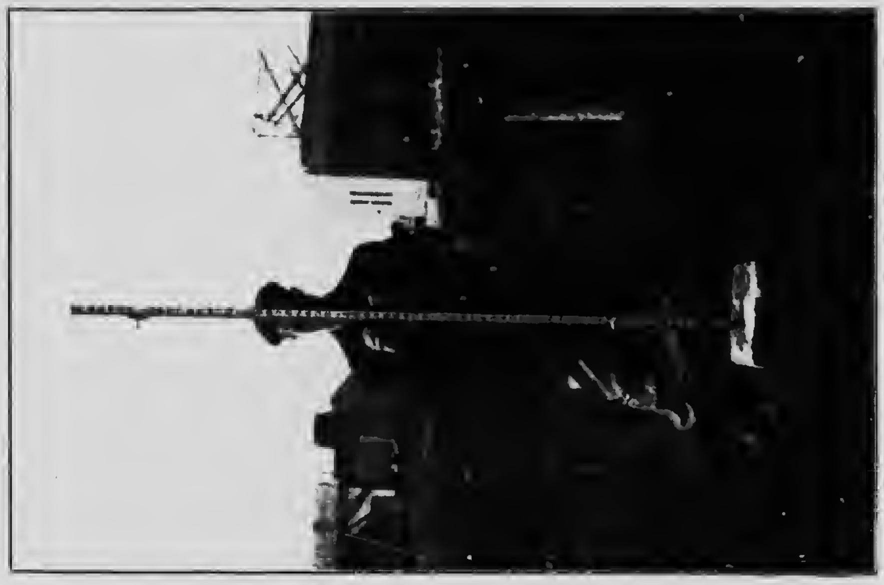
Discharge Measurements of Headrace, Mill "A," Flume No. 1, Lake of the Woods Milling Company, 1913-14.

Date.		Hydrographer.	Meter No	Width.	Area of Section	Mean Velocity	Gauge Height	Discharge	Remarks
1913				Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.	
Dec	10	S. C. O'Grady	1186	15	173	1·43	−3·98	248	Hydro-electric power-house
"	10	"	1186	15	173	1·35	−3·98	234	
"	23	E. J. Budge	1186	15	171	1·59	−4·10	273	
"	23	"	1186	15	171	1·62	−4·10	277	
"	26	S. C. O'Grady	1186	15	173	1·36	−3·99	235	
"	26	"	1186	15	173	1·33	−3·99	229	
"	27	"	1186	15	171	1·45	−4·06	248	
"	27	"	1186	15	171	1·35	−4·06	231	
"	31	E. J. Budge	1186	15	171	1·72	−4·10	295	
"	31	"	1186	15	171	1·76	−4·10	302	
1914.									
Jan	2	M. S. Madden	1186	15	173	0·95	−3·98	164	Hydro-electric power-house No. 2 generator off
"	2	"	1186	15	173	0·93	−3·98	161	No. 2 generator off
"	5	"	1186	15	173	1·47	−3·97	252	
"	5	"	1186	15	173	1·61	−3·96	278	
"	9	"	1186	15	171	1·62	−4·06	277	
"	9	"	1186	15	171	1·69	−4·06	290	
"	23	"	1186	15	170	1·29	−3·80	220	
"	23	S. C. O'Grady	1187	15	170	1·43	−3·80	241	
"	24	"	1196	15	169	1·20	−3·74	202	
"	24	"	1196	15	169	1·10	−3·70	178	
"	24	"	1196	15	177	1·04	−3·70	182	
"	24	"	1196	15	177	1·20	−3·70	211	
"	30	M. S. Madden	1196	15	173	1·69	−4·00	292	
"	30	"	1196	15	173	1·83	−4·00	316	
"	30	"	1196	15	171	1·52	−4·08	260	
"	30	"	1196	15	172	1·58	−4·08	270	
"	30	"	1196	15	171	1·51	−4·08	258	
"	30	"	1196	15	171	1·53	−4·07	262	
"	30	"	1196	15	171	1·54	−4·06	264	
"	30	"	1196	15	171	1·43	−4·06	244	
Feb	6	"	1196	15	173	0·88	−3·96	153	
"	6	"	1196	15	173	0·91	−3·96	158	
"	6	"	1196	15	173	1·20	−3·96	207	
"	6	"	1196	15	173	1·16	−3·96	200	
"	6	"	1196	15	173	1·18	−4·01	204	
"	7	"	1196	15	173	1·34	−4·00	231	
"	7	"	1196	15	173	1·34	−4·00	232	
"	7	"	1196	15	173	1·28	−4·00	222	
"	7	"	1196	15	173	1·26	−4·02	219	
"	7	"	1196	15	173	1·27	−4·02	220	
"	7	"	1196	15	173	1·11	−4·02	192	
"	7	"	1196	15	173	1·21	−4·02	210	
"	7	"	1196	15	173	1·15	−4·02	199	
"	7	"	1196	15	173	1·28	−4·02	221	Hydro-electric power house.
"	13	S. C. O'Grady	1196	15	173	0·89	−3·98	154	No. 2 generator off; pump on.
"	13	"	1196	15	173	0·98	−3·98	169	No. 2 generator off
"	13	"	1196	15	173	1·07	−3·98	186	"
"	13	M. S. Madden	1196	15	173	1·03	−4·00	178	"
"	13	"	1196	15	173	1·02	−4·00	176	"
"	13	"	1196	15	173	1·00	−4·00	173	"
"	13	"	1196	15	173	0·94	−4·00	162	"
"	13	"	1196	15	173	1·09	−4·00	188	"
"	13	"	1196	15	173	1·06	−4·02	184	"
"	14	S. C. O'Grady	1196	15	173	1·03	−3·98	179	"
"	14	"	1196	15	173	1·00	−3·98	173	"
"	14	"	1196	15	173	1·03	−3·98	179	"
"	14	"	1196	15	173	1·04	−3·98	181	"
"	14	"	1196	15	173	0·91	−3·98	158	"
"	14	"	1196	15	173	0·96	−3·98	166	"
"	20	"	1196	15	173	0·70	−3·98	122	" pump on
"	20	"	1196	15	173	0·62	−3·98	108	" "
"	20	"	1196	15	173	0·60	−3·98	105	" "
"	20	"	1196	15	173	0·63	−3·98	109	" "
"	21	"	1196	15	173	0·68	−3·95	117	"
"	21	"	1196	15	173	0·69	−3·98	119	"
"	21	"	1196	15	173	0·60	−3·98	104	"
"	21	"	1196	15	173	0·68	−3·97	119	"
April	3	"	1196	15	171·5	0·59	−4·03	102	"
"	3	"	1196	15	171·5	0·64	−4·03	110	"
"	3	"	1196	15	171·5	0·58	−4·03	100	"
"	3	"	1196	15	171·5	0·60	−4·03	102	"
"	7	"	1196	15	171·5	0·66	−4·06	112	"
"	7	"	1196	15	171·5	0·55	−4·06	96	"
"	7	"	1196	15	171·5	0·66	−4·06	114	"
"	7	"	1196	15	171·5	0·59	−4·06	101	"
"	7	C. C. Galloway	1196	15	168·5	1·48	−4·39	248	

DISCHARGE MEASUREMENTS of Head-race, Mill "A," Flume No. 1, Lake of the Woods Milling Company—*Concluded.*

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge	Remarks
1914				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.	
April	7	C. C. Galloway	1196	15	168·5	1·43	4·01	242	Hydro-electric power house
"	8	S. C. O'Grady	1196	15	171·5	0·69	−4·07	119	No. 2 generator off, pump on
"	8	"	1196	15	171·5	0·67	−4·06	116	"
"	8	"	1196	15	171·5	0·67	−4·06	115	"
"	8	"	1196	15	171·5	0·72	−4·06	123	"
"	9	"	1196	15	174·5	0·61	−3·88	107	"
"	9	"	1196	15	174·5	0·62	−3·88	109	
"	9	"	1196	15	174·5	0·62	−3·88	109	
"	9	"	1196	15	174·5	0·61	−3·88	107	"
"	10	"	1196	15	174·5	0·61	−3·92	106	"
"	10	C. C. Galloway	1196	15	174·5	0·60	−3·92	105	"
"	10	"	1196	15	173·2	1·31	−3·98	226	Pump on
"	10	"	1196	15	173·0	1·39	−3·98	241	
"	11	S. C. O'Grady	1196	15	174·5	0·54	−3·90	95	No. 2 generator off
"	11	"	1196	15	174·5	0·58	−3·90	101	
"	11	J. J. Moore	1196	15	174·5	0·57	−3·90	99	
"	11		1196	15	174·5	0·58	−3·90	102	
"	11		1196	15	174·5	0·56	−3·90	99	"
"	11		1196	15	174·5	0·58	−3·90	103	"
"	11		1196	15	174·5	0·57	−3·90	99	
"	15	S. C. O'Grady	1196	15	171·4	0·62	−4·12	107	
"	15	"	1196	15	171·4	0·60	−4·12	102	
"	15	"	1196	15	171·4	0·60	−4·12	104	
"	15	"	1196	15	171·4	0·63	−4·12	108	
"	16	"	1196	15	171·5	0·51	−4·12	88	
June	9	C. C. Galloway	1196	15	192·4	1·18	−2·70	228	
"	9	"	1196	15	192·4	1·19	−2·70	230	
July	14	"	1196	15	189·6	1·37	2·85	259	
"	14		1196	15	189·6	1·30	2·85	246	
"	20		1196	15	190·7	0·50	2·75	97	No. 2 generator off
"	20		1196	15	190·7	0·59	2·75	112	
"	20		1196	15	190·7	0·62	2·75	118	
"	20		1196	15	190·7	0·62	2·75	118	
"	20		1196	15	190·7	0·66	2·75	126	
"	20		1196	15	194·0	1·35	−2·60	263	
"	20		1196	15	194·0	1·30	−2·60	252	
"	21	J. J. Moore	1196	15	192·7	0·60	2·65	115	No. 2 generator off, pump on
"	21		1196	15	192·7	0·63	2·65	121	No. 2 generator off
"	21		1196	15	192·7	0·62	2·65	[illegible]	
"	21		1196	15	192·7	0·63	2·65	[illegible]	
"	21		1196	15	192·7	0·62	2·65	[illegible]	
"	22		1196	15	189·6	0·60	2·60	116	
"	22		1196	15	189·6	0·60	2·60	115	
"	29		1196	15	189·5	0·64	2·60	121	
"	29		1196	15	189·5	0·61	2·60	117	
"	29		1196	15	189·5	0·60	2·60	115	
Aug.	14	C. C. Galloway	1196	15	176·9	1·59	2·71	284	
"	14		1196	15	176·9	1·54	2·74	[illegible]	
Sept.	18		1196	15	176·0	1·26	2·59	[illegible]	
"	18		1196	15	[illegible]	1·26	2·59	[illegible]	
"	30		1196	15	176·2	1·34	[illegible]	[illegible]	

Assiniboine, Brandon. M. H. S. Bench-mark.



Whitemouth River at Whitemouth. M. H. S. Bench-mark.

DISCHARGE MEASUREMENTS of Head-race, Mill "A," Flume No. 2, (Mill drive), Lake of the Woods Milling Company, 1913-14.

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1913				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
Dec.	10	S. C. O'Grady	1186	38	568	1.15	-3.98	653
"	10	"	1186	38	568	1.15	-3.98	654
"	18	L. J. Budge	1186	38	568	1.11	-4.00	630
"	18	"	1186	38	568	1.12	-4.00	638
"	23	"	1186	38	565	1.16	-4.08	655
"	24	"	1186	38	563	1.21	-4.08	680
"	26	S. C. O'Grady	1186	38	577	1.10	-3.99	628
"	27	"	1186	38	563	1.11	-4.05	625
"	26	"	1186	38	567	1.10	-3.99	628
"	27	M. S. Madden	1186	38	567	1.10	-3.98	622
1914								
Jan.	2	M. S. Madden	1186	38	569	1.10	-3.98	622
"	5	"	1196	38	567	1.09	-3.97	620
"	8	"	1186	38	560	1.07	-4.16	601
"	8	"	1186	38	560	1.07	-4.16	601
"	26	"	1196	38	560	1.06	-4.12	578
Feb.	6	"	1196	38	567	1.03	-3.95	584
"	6	"	1196	38	571	1.10	-3.90	627
"	19	"	1196	38	563	1.16	-4.13	657
"	19	"	1196	38	563	1.16	-4.13	659
"	21	"	1196	38	563	1.14	-4.12	641
"	21	"	1196	38	563	1.16	-4.12	655
"	21	"	1196	38	563	1.20	-4.12	675
April	4	C. C. Galloway	1196	38	561	1.06	-4.20	592
"	[illegible]	"	1196	38	530	1.24	-4.30	601
"	[illegible]	"	1196	38	546	1.23	-4.30	687
"	[illegible]	"	1196	38	536	1.24	-4.30	691
"	[illegible]	"	1196	38	536	1.21	-4.30	672
June	5	"	1196	38	615	1.10	-2.70	735
"	9	"	1196	38	614	1.17	-2.70	722
"	11	"	1196	38	610	1.19	-2.82	726
"	11	"	1196	38	610	1.16	-2.83	712
"	15	"	1196	38	611	1.19	-2.81	727
"	15	"	1196	38	611	1.22	-2.82	745
"	20	T. J. Moore	1196	38	619	1.12	-2.60	694
"	20	C. C. Galloway	1196	38	619	1.14	-2.60	711
July	14	"	1196	38	609	1.02	-2.85	622
"	14	"	1196	38	609	0.98	-2.85	598
Aug.	14	"	1196	38	577	1.18	-3.72	680
"	14	"	1196	38	577	1.23	-3.74	707
"	14	"	1196	38	577	1.23	-3.74	708
Sept.	18	"	1196	38	582	1.13	-3.58	658
"	18	"	1196	38	582	1.18	-3.58	689
"	30	"	1196	38	583	1.09	-3.56	635

MILL "C" HEAD-RACE, KEEWATIN.

History.—The station was established on July 17, 1912, by Mr. S. S. Scovil, when the first metering was taken by this survey.

Location of Section.—The section is located about 5 feet upstream from the racks in the head-race of mill "C," Lake of the Woods Milling Company, leading from Portage bay, an arm of lake of the Woods at Keewatin, Ont. The initial point is marked on the east bank of the channel above the racks.

Records Available.—The records of discharge are based upon meterings and gauge heights in the head- and tail-race and also depend upon the load on the mill. The daily discharges through the mill are available for 1912-13-14.

Drainage Area.—This channel forms one of the outlets of the lake of the Woods, and in consequence the drainage area above has no particular significance. It is, however, 26,400 square miles.

Gauge.—The gauge is a vertical staff gauge placed on the east side of the channel, about 10 feet upstream from the racks, and reads direct to elevations.

The zero of the gauge is referred to W.P.S. datum, the reference bench-mark being a point on the top of the flume.

Channel.—The channel is rectangular, cut in solid rock, and has a normal depth of 12 feet. It is straight for about 15 feet above the section.

Discharge Measurements.—The meterings are made from a small bridge spanning the channel, and have been taken periodically from July 17, 1912, the range in stage covered being about 2½ feet.

Accuracy.—The station gives good records, but the daily discharge depends upon the gate openings on the turbines so that, after rating the station to these, the records are reliable.

Discharge Measurements of Head-race Mill "C," Lake of the Woods Milling Co., 1912-14.

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1912				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
July	17	S. S. Scovil	1,171	42	455	1·95	97·77	888
"	30	"	1,171	42	461	2·10	97·92	967
Aug	14	"	1,187	42	475	2·01	98·24	960
"	28	W. G. Worden	1,187	42	476	2·14	98·28	1,015
Oct	4	W. Richardson	1,142	42	525	1·80	99·40	946
Sept	26	"	1,162	42	504	1·86	99·10	938
Oct	11	A. Pirie	1,162	42	533	2·01	99·58	1,069
"	12	W. Richardson	1,162	42	530	1·95	99·56	1,035
"	16	"	1,162	42	527	1·88	99·74	991
"	18	"	1,162	42	532	2·09	99·60	1,112
Nov	26	G. J. Lamb	1,187	42	514	1·49	99·78	766
"	26	"	1,187	42	[illegible]	1·54	99·38	791
"	16	"	1,187	42	512	1·82	99·50	931
1913								
Feb	7	G. J. Lamb	1,175	42	513	1·39	99·30	715
"	14	"	1,175	42	506	1·39	99·14	706
"	20	"	1,175	42	513	0·27	99·27	138
Mar	11	"	1,175	42	512	1·35	99·25	693
"	12	"	1,175	42	512	1·36	99·25	698
"	15	"	1,175	42	512	1·30	99·30	666
"	21	"	1,175	42	512	1·31	99·28	672
"	28	"	1,175	42	519	0·31	99·43	174
April	8	"	1,175	42	523	1·34	99·48	703
"	10	"	1,175	42	519	1·36	99·14	704
June	25	"	1,175	42	531	1·34	99·75	710
July	2	G. Emery	1,175	42	527	1·38	99·65	730
Aug	7	"	1,175	42	538	1·29	99·98	696
Sept	6	C. O. Allen	1,135	42	515	1·44	99·31	739
"	6	"	1,135	42	515	1·40	99·32	722
"	6	"	1,135	42	515	1·40	99·31	719
Dec	3	E. J. Budge	1,186	42	502	1·18	99·02	593
"	4	"	1,186	42	505	1·28	99·08	646
"	9	S. C. O'Grady	1,186	42	502	1·34	98·99	670
"	11	E. J. Budge	1,186	42	501	1·41	98·96	708
"	11	S. C. O'Grady	1,186	42	490	1·38	98·98	677
"	22	E. J. Budge	1,186	42	499	1·33	98·92	667
"	22	"	1,186	42	499	1·35	98·92	675
"	27	S. C. O'Grady	1,186	42	496	1·50	98·89	744
"	27	"	1,186	42	496	1·51	98·89	749
"	31	E. J. Budge	1,186	42	505	1·37	98·87	694
"	31	"	1,186	42	505	1·44	98·88	732
1914								
Jan	3	M. S. Madden	1,186	42	496	1·40	98·87	694
"	3	"	1,186	42	495	1·43	98·87	702
"	8	"	1,186	42	494	1·31	98·85	647
"	8	"	1,186	42	495	1·31	98·87	648
"	9	"	1,186	42	495	1·37	98·88	679
"	9	"	1,186	42	495	1·35	98·88	667
"	24	S. C. O'Grady	1,196	42	493	1·32	98·90	650
"	24	"	1,196	42	493	1·46	98·90	721
"	23	M. S. Madden	1,196	42	499	1·38	98·92	689
"	26	"	1,196	42	490	1·38	98·82	679
Feb.	3	"	1,196	42	499	1·43	98·93	716
	3		1,196	42	499	1·35	98·92	675
"	3	"	1,196	42	499	1·38	98·92	688
"	14	"	1,196	42	498	1·72	98·92	861
"	14	"	1,196	42	498	1·74	98·94	868

DISCHARGE MEASUREMENTS of Head-race Mill "C," Lake of the Woods Milling Co., 1912–14—*Continued.*

Date.		Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914				Feet	Sq. ft	Ft. per sec	Feet	Sec.-ft
Mar.	4	T. J. Moore	1,196	42	495	1·27	98·85	630
"	4	"	1,196	42	495	1·26	98·85	625
"	5	"	1,196	42	495	1·23	98·85	607
"	5	"	1,196	42	495	1·25	98·85	617
April	20	S. C. O'Grady	1,196	42	494	1·32	98·90	653
"	20	"	1,196	42	494	1·36	98·90	671
"	21	"	1,196	42	491	1·33	98·85	658
"	21	"	1,196	42	491	1·36	98·85	671
"	21	"	1,196	42	191	1·34	98·85	661
"	28	C. Galloway	1,196	42	496	1·30	98·90	645
"	28	"	1,196	42	497	1·32	98·91	655
May	1	"	1,196	42	498	1·25	99·00	623
"	22	T. J. Moore	1,196	42	501	1·22	99·60	629
"	22	"	1,196	42	501	1·27	99·60	637
June	4	"	1,196	42	534	1·28	99·85	685
"	4	"	1,196	42	534	1·29	99·88	688
"	9	"	1,196	42	545	1·26	100·08	674
"	9	"	1,196	42	546	1·28	100·08	697
"	11	"	1,196	42	547	1·20	100·13	696
"	11	"	1,196	42	547	1·28	100·13	695
"	15	C. Galloway	1,196	42	545	1·20	100·15	710
"	15	"	1,196	42	558	1·34	100·20	745
"	24	"	1,196	42	545	1·30	[illegible]	707
"	24	"	1,196	42		1·29	100·09	706
"	24	T. J. Moore	1,196	42	538	1·31	100·00	707
"	24	"	1,196	42	538	1·32	100·00	711
July	14	C. Galloway	1,196	42	543	1·30	100·04	709
"	14	"	1,196	42	543	1·27	100·03	689
"	17	S. C. O'Grady	1,196	42	536	1·44	99·87	771
Aug.	14	C. Galloway	1,196	42	517	1·17	99·40	760
"	14	"	1,196	42	517	1·50	99·40	775
"	19	"	1,196	42	511	1·51	[illegible]	771
"	19	"	1,196	42	511	1·43	[illegible]	732
Sept	17	"	1,196	42	512	1·50	99·29	766
"	17	"	1,196	42	512	1·49	99·29	762
"	30	"	1,196	42	516	1·35	99·39	692
Nov	4	"	1,196	42	516	1·28	99·35	662
"	4	"	1,196	42	516	1·25	99·35	644

DISCHARGE MEASUREMENTS of Tail-race Mill "C," Lake of the Woods Milling Co., 1914.

Date.		Hydrographer	Meter No	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
				Feet	Sq. ft	Ft. per sec	Feet.	Sec.-ft.
Feb.	22	S. C. O'Grady	1,196	46·5	111	2·32	−15·04	258·00
	22	"	1,196	46·5	111	2·35	−15·04	260·00
	22	"	1,196	46·5	116	2·65	−14·90	308·00
	22	"	1,196	46·5	116	2·55	−14·90	297·00
Mar.	1	"	1,196	46·5	129	0·84	−14·50	108·00
"	1	"	1,196	16·5	130	0·80	−14·60	104·00
"	1	"	1,196	46·5	136	1·04	−14·50	111·00
"	1	"	1,196	46·5	136	1·02	−14·50	138·66
"	1	"	1,196	46·5	140	2·85	−14·50	397·3
"	1	"	1,196	46·5	140	2·85	−14·50	396·4

NOTE: Mill not running.

Keewatin Lumber and Manufacturing Company's Head-race, Keewatin, Ont.

History.—This channel forms one of the outlets of the Lake of the Woods. It was created and used in connection with the above company's mill, the discharge being controlled by the headgates. After the mill was burned in 1905 these fell into disrepair and leakage occurred; to ascertain this a station was established on December 13, 1913, by S. C. O'Grady, and has since been operated.

Location of Section.—The metering section is on the upstream side of the bridge crossing the channel 300 feet above the power-house and east of the headgates at the K. L. & M. Co.'s head-race. The initial point is a notch cut in the plank floor at the south end of the bridge and marked O+OO.

Records Available.—The daily discharge records are available at this point since the establishment of the station in December, 1913.

Gauge.—There is no gauge at this point, but the meterings are referred to the lake gauge at the Keewatin bridge, where daily records are available.

Channel.—The channel is fairly permanent, composed of clay and rock. It is straight for 150 feet above and 100 feet below the section. The current is not swift, and depends upon the leakage at the gates.

Discharge Measurements.—Discharge measurements are taken frequently to check the leakage through the headgates, and as this control is fairly permanent the discharge depends largely upon the lake stage. No curve has been plotted for the station, but the daily estimated discharge is based upon the meterings. The measurements are made from the bridge.

Accuracy.—The accuracy may be considered good.

Discharge Measurements of Winnipeg River at K. L. & M. Co. Head-race, 1913–14.

Date	Hydrographer.	Meter No	Width	Area of Section	Mean Velocity.	Gauge Height.	Discharge
1913			Feet	Sq. ft.	Ft. per sec	Feet.	Sec.-ft
Mar. 21	G. J. Lamb	1,375	15	44	2·39	−·79	106[1]
" 22	"	1,375	15	44	2·46	−·80	109[1]
April 9	"	1,375	29	[illegible]	0·89	−·00	121[2]
" 10	"	1,375	29	140	0·90	−·04	129[2]
1914.							
Feb 19	M. S. Madden	1,196	30	151	0·71	−8·00	107
Mar 25	S. C. O'Grady.	1,196	30	150	0·62	−8·00	94
" 25	"	1,196	30	150	0·60	−8·00	91
April 16	"	1,196	30	150	0·64	−8·00	96
" 16	"	1,196	30	150	0·62	−8·00	93
July 11	"	1,196	31	205	1·19	−5·60	243
" 11	"	1,196	31	205	1·22	−5·60	249
Aug 7	N. Galloway	1,196	32	196	1·19	−5·90	233
" 7	"	1,196	32	196	1·18	−5·90	231
Sept 17	"	1,196	31	177	1·05	−6·50	186
" 17	"	1,196	31	177	1·05	−6·50	186
" 30	"	1,196	31	171	1·21	−6·40	207
Nov 4	"	1,196	31	176	1·05	−6·55	185
" 4	"	1,196	3[illegible]	176	1·06	−6·55	187
Dec. 8	"	1,196		188	1·03	−6·40	192
" 8	"	1,196	30	188	0·97	−6·40	181

[1] Keewatin 1 mile west
[2] Keewatin school

Daily Gauge Height and Discharge of Head-race, K. L. & M. Co., at 2nd Bridge for 1913.

Day	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.
1	99.85	110	99.90	110
2	99.85	110	99.90	110
3	99.95	110	99.80	110
4	100.10	110	100.00	110
5	100.00	110	99.90	110
6	100.00	110	99.50	110
7	100.00	110	99.80	110
8	99.80	110	99.90	110
9	99.95	110	100.00	110
10	100.00	110	100.05	110
11	100.20	110	100.08	105
12	100.00	110	99.98	105
13	99.90	110	99.89	105
14	100.10	110	99.90	105
15	99.90	110	99.88	105
16	100.00	110	99.90	105
17	99.87	110	99.72	105
18	99.90	110	99.81	105
19	99.95	110	99.69	105
20	99.95	110	99.69	105
21	99.85	110	99.70	105
22	99.95	110	99.78	105
23	100.00	110	99.98	105
24	99.80	110	99.85	105
25	100.10	110	99.77	105
26	100.05	110	99.58	105
27	99.90	110	99.13	105
28	99.90	110	99.70	105
29	99.95	110	99.81	105
30	99.80	110	99.84	105
31	100.00	110		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1	99.51	105	99.89	110	99.55	110	98.94	110	99.16	110	99.06	110
2	99.62	105	99.87	110	99.45	110	98.90	110	99.20	110	99.02	110
3	99.78	105	99.77	110	99.10	110	99.00	110	98.92	110	99.10	110
4	99.19	105	99.79	110	99.15	110	98.79	110	99.10	110	99.18	110
5	99.58	105	99.63	110	99.40	110	98.41	110	99.26	110	99.03	110
6	99.62	105	99.71	110	99.32	105	98.82	110	99.03	110	99.13	110
7	99.62	105	99.97	110	99.35	105	99.07	110	98.88	110	98.78	110
8	99.63	105	99.83	110	99.30	105	98.81	110	98.88	110	98.80	110
9	99.23	105	99.71	110	99.64	105	98.88	110	98.90(1)	110	99.06	110
10	99.63	105	99.67	110	99.33	105	99.18	110	98.91	110	99.02	110
11	99.87	105	99.87	110	99.30	105	99.04	110	99.78	110	99.03	110
12	99.60	105	99.81	110	99.10	105	99.00	110	98.99	110	99.01	110
13	99.72	105	99.71	110	99.15	105	99.03	110	99.06	110	99.03	110
14	99.74	105	99.70	110	99.47	105	99.10	110	99.00	110	99.05	110
15	99.88	105	99.65	110	99.20	105	99.00	110	99.01	110	99.02	110
16	99.88	105	99.63	110	99.10	105	99.00	110	99.23	110	99.04	110
17	99.83	105	99.60	110	99.12	105	99.17	110	99.05	110	99.01	110
18	99.83	105	99.69	110	99.30	105	99.03	110	98.90	110	99.02	110
19	99.79	105	99.86	110	99.37	105	98.86	110	99.10	110	99.00	110
20	99.90	105	99.73	110	98.60	100	98.83	110	99.07	110	99.00	110
21	100.00	105	99.78	110	98.52	100	99.02	110	98.96	110	99.04	110
22	99.92	105	99.72	110	98.98	100	99.15	110	98.99	110	99.02	110
23	99.90	105	99.75	110	99.00	100	99.03	110	99.19	110	98.99	110
24	99.91	105	99.73	110	98.71	100	98.99	110	99.02	110	99.01	110
25	100.04	105	99.85	110	99.90	105	99.02	110	98.99	110	99.00	110
26	99.76	105	99.48	110	99.98	105	99.00	110	98.97	110	98.99	110
27	99.78	105	99.63	110	99.02	105	99.18	110	99.09	110	99.98	110
28	99.90	105	99.46	110	99.08	105	98.78	110	[illegible]	110	99.04	110
29	99.88	105	99.15	110	98.85	100	98.96	110	99.04	110	99.03	110
30	99.88	105	99.53	110	98.99	100	99.04	110	99.05	110	99.00	110
31	99.84	105	99.48	110			99.12	110	....		98.99	110

NOTE.—All gauge heights marked thus (1) interpolated. Gauge heights are readings on lake gauge at Keewatin bridge. Daily discharges are estimated from actual meterings.

SESSIONAL PAPER No. 25f

Daily Gauge Height and Discharge of Head-race, K. L. & M. Co., at 2nd Bridge for 1914.

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1	98.98	110	[illegible]	120	[illegible]	[illegible]	98.87	[illegible]	[illegible]	[illegible]	[illegible]	240
2	98.98	110	[illegible]	[illegible]	[illegible]	[illegible]	98.85	[illegible]	[illegible]	[illegible]	[illegible]	245
3	98.99	[illegible]	[illegible]	[illegible]	98.98	[illegible]	98.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	99.02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	98.87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	120	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	120	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	110	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	120	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245
19	[illegible]	110	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	295
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	285
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	287
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	[illegible]			[illegible]	[illegible]			[illegible]	[illegible]		

Day	July		August		September		October		November		December	
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	285	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	155	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99.74	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	257	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99.72	[illegible]
13	[illegible]	[illegible]	99.44	[illegible]	[illegible]	[illegible]	99.45	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99.45	[illegible]	[illegible]	[illegible]	99.7	[illegible]
16	[illegible]	320	99.46	175	99.31	177	[illegible]	[illegible]	99.71	[illegible]	99.72	200
17	99.82	255	99.41	17[illegible]	99.4	185	99.47	[illegible]	[illegible]	[illegible]	99.72	200
18	100.15	295	[illegible]	[illegible]	99.44	[illegible]	99.72	[illegible]	99.78	[illegible]	99.72	200
19	100.18	300	99.34	160	99.49	[illegible]	99.70	225	99.77	[illegible]	99.73	205
20	100.18	300	99.31	155	99.48	[illegible]	99.58	225	99.55	[illegible]	99.7	200
21	100.1	280	99.40	155	99.36	187	99.55	220	99.49	210	99.75	210
22	99.98	280	99.30	155	99.2	190	99.61	230	99.67	235	99.72	200
23	100.04	270	99.26	125	99.39	190	99.33	180	99.72	245	99.75	210
24	100.01	265	99.19	145	99.23	170	99.68	245	99.67	235	99.70	200
25	100.01	265	99.14	140	99.42	190	99.45	200	99.68	245	99.72	200
26	100.10	280	99.20	145	99.35	185	99.36	185	99.60	230	99.70	200
27	99.98	265	99.28	155	99.43	200	99.75	255	99.65	235	99.75	205
28	100.00	265	99.28	155	99.40	190	99.48	205	99.65	235	99.73	205
29	100.08	280	99.35	160	99.32	175	99.57	225	99.69	245	99.69	200
30	100.00	265	99.30	155	99.40	190	99.67	240	99.65	235	99.70	200
31	99.83	235	99.30	155			99.55	240			99.69	200

NOTE.—All gauge heights marked thus * interpolated. Gauge heights are readings on lake gauge at Keewatin bridge. Daily discharges up to April 30 are estimated from actual meterings.

MONTHLY DISCHARGE of Head-race, K. L. & M. Co., at 2nd Bridge, Keewatin 1913-14.

Month	Discharge in Second Feet		
	Maximum	Minimum	Mean
1913			
May	110	110	110
June	[illegible]	105	107
July	105	105	105
August	110	110	110
September	110	100	105
October	110	110	110
November	110	110	110
December	110	110	110
The period	110	100	108

NOTE.—Daily discharges are estimated from actual meterings.

Month	Maximum	Minimum	Mean
1914			
January	110	110	110
February	120	120	120
March	100	95	98
April	95	95	95
May	130	95	114
June	295	225	258
July	320	235	276
August	260	125	180
September	215	120	177
October	255	175	208
November	265	195	230
December	210	185	200
The year	320	91	172

NOTE.—Daily discharges to end of May, 1914, are estimated from actual measurements.

C.P.R. CULVERT AT MINK BAY.

History.—This channel is a tunnel excavated in solid rock under the C.P.R. embankment, and connects Mink bay and Darlington bay, the latter being an arm of the Winnipeg river. The station was established on July 29, 1912, by S. S. Scovil, and has since been continuously maintained.

Location of Section.—The section is about 25 feet above the entrance to the tunnel, which is about 2,000 feet west of the old K. L. & M. mill on Mink bay, and forms the outlet for that bay into Darlington bay. The initial point is a stake driven in the bank at the west side of the channel, 25 feet above the mouth of the tum

Records Av…—Meterings have been made at close intervals from July 29, 1912, but no g… ge heights are available, so no discharge curve has been constructed.

Drainage Area.—Not significant, as most of the water flowing past this station is leakage through the K. L. & M. Co.'s head gates from lake of the Woods.

Gauge.—No gauge has been installed, water levels at the time of meterings being obtained by measuring down from a point of rock which is referred to W.P.S. datum.

Channel.—The channel is a rock cut, and is constant in section above and below point of metering.

Discharge Measurements.—The meterings are taken from a plank bridged across the channel, by Price meter.

Accuracy.—The results obtained are good, as the governing conditions are constant. No attempt has been made to obtain the daily discharges from daily gauge heights.

DISCHARGE MEASUREMENTS of Winnipeg River at 1st Tunnel C.P.R. Culvert, Keewatin, 1912-14.

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1912				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
July	29	S. S. Scovil		13	30	1.62		48
1913								
April	7	G. J. Lamb	1,375	15	43	2.53	-0.90	109
"	7	"	1,375	15	43	2.25	-0.90	97
"	8	"	1,375	15	40	2.43	-0.90	98
"	10	"	1,375	15	42	2.43	-0.90	101
May	20	"	1,375	15	40	2.60	-0.70	104
June	26	"	1,375	15	51	2.10	-0.50	107
Sept	8	C. O. Allen	1,435	16	48	2.50	-0.82	121
"	8	"	1,435	16	48	2.52	-0.82	122
"	10	"	1,435	16	49	2.61	-0.82	127
"	10	"	1,435	16	49	2.55	-0.82	124
"	12	"	1,435	16	47	2.51	-0.90	118
"	12	"	1,435	16	47	2.57	-0.90	121
Dec	23	E. J. Bridge	1,186	16	49	2.25	-0.94	110
1914								
Feb	19	M. S. Madden	1,196	16	46	2.65	-0.94	122
"	19	"	1,196	16	46	2.63	-0.94	121
Mar	25	S. C. O'Grady	1,196	17	46	2.04	-1.33	94
"	25	"	1,196	17	44	2.21	-1.33	97
April	24	"	1,196	16	41	2.44	-2.15	101
"	24	"	1,196	16	41	2.39	-2.15	98
July	11	"	1,196	22	71	4.12	-0.65	292
"	11	"	1,196	22	71	4.20	-0.65	297
Aug	7	N. Galloway	1,196	16	61	4.20	-0.90	255
"	7	"	1,196	16	62	4.00	-0.90	247
Nov	13	"	1,196	17	54	3.32	-1.46	181
"	13	"	1,196	17	54	3.25	-1.46	178
Dec	8	"	1,196	17	56	[illegible]	-1.47	184

WAR EAGLE OUTLET.

History.—The station was established by Mr. S. S. Scovil on July 29, 1912.

Location of Section.—The station is situated at down-stream end of the culvert under the C.P.R. embankment on the outlet of War Eagle lake, about one-quarter mile below the lake and near Darlington bay, into which it empties. The initial point is marked on the rock forming the right side of the channel at the mouth of the tunnel.

Records Available.—A number of meterings have been made during the period 1912-13, but no gauge records have been kept.

Drainage Area.—The area tributary is about 59 square miles.

Gauge.—No gauge has been established, but the elevation of the water surface is obtained by measuring down from a fixed point marked on the rock near the section.

Channel.—The channel is straight for 20 feet above the section and 60 feet below. The section is fairly uniform, being an artificial rock-cut.

Discharge Measurements.—The meterings are made from a plank bridged from side to side of the channel.

Accuracy.—As only a few discharge measurements have been made covering a very narrow range in stage, no estimate has been made of daily discharge.

Discharge Measurements of Winnipeg River at War Eagle Lake Outlet, 1912-14.

Date	Hydrographer.	Meter No	Width.	Area of Section	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq ft.	Ft. per sec	Feet.	Sec.-ft
July 29	S. S Scovil	......	43	44	0·47	......	21[1]
1913.							
April 7	G J Lamb	1,375	3·7	26	3 84	......	98
May 20	"	1,375	8·1	11	3·93	......	10
Sept 8	R Emery	1,435	8·4	8·4	3·78	−0·46	6·6
" 8	C O Allen	1,435	8·4	8·4	3·75	−0·46	6·3
" 10	R. Emery	1,435	8·4	8·4	3·75	−0·42	6·3
" 10	"	1,435	8·4	8·4	3·74	−0·42	6·2
" 12	"	1,435	8·4	8·4	3·73	−0·43	6·2
" 12	"	1,435	8·4	8·4	3 76	−0·43	6·4
1914.							
Jan 10	M S Madden	1,186	8 5	7	0 14	−0·30	2

[1] Float measurement

North Tunnel Island.

History.—The station at North Tunnel island was established on June 28, 1912, by S. S. Scovil.

Location of Section.—The meter section is on the west branch of the Winnipeg river on the north side of Tunnel island about 1 mile below the Keewatin river bridge. The initial point of the section is chiselled in the rock on the south bank of the river, and is painted "I. P. W.P.S. El. 1039·88."

Records Available.—Frequent discharge measurements have been made since the establishment of the station, and daily discharges have been estimated for this section from the year 1907 to date.

Drainage Area.—The drainage area lying above this section is 26,400 square miles, but all of the water coming from this basin does not pass this section, as part of it goes through the east branch of the Winnipeg, the east and the west branch, joining a short distance below the section.

Gauge.—A vertical staff gauge, reading to tenths, was first located on a pile bent at the south end of the Keewatin River bridge, and to which all measurements at the station were referred. The zero of the gauge is referred to W.P.S. datum.

A vertical staff gauge read during metering is located on the north shore about 30 feet above the meter section, and is bolted to the rock. It is referred to W.P.S. datum.

Channel.—The river at this point is confined to a single channel at all stages, the bed of the stream is solid rock or boulders and of a very permanent nature, the banks are high and rocky, and the river is confined to its channel at all stages, and is straight for 100 feet above and below the station, the cross-section being approximately uniform throughout.

Discharge Measurements.—Numerous discharge measurements have been taken at this station and cover a range in stage of 6·3 feet. Owing to the fact that part of the water flowing past this section enters the river through the Lake of the Woods Milling Company's plants which discharge into Darlington bay, and part of the water is discharged through the Norman dam on the western outlet of the lake of the Woods, the conditions governing discharge at this point vary from time to time, and considerable difficulty is experienced in arriving at the daily discharge by means of a discharge curve, the ponding effect in Darlington bay being very noticeable. The measurements are made from a boat.

Accuracy.—Owing to the presence of the mills and the operation of the Norman dam, the accuracy of the records are considerably affected.

Discharge Measurements of W. Branch Winnipeg River at North Tunnel Island, 1912.

Date		Hydrographer	Meter No	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
				Feet.	Sq. ft	Fet per sec	Feet.	Sec ft
June	28	S S Scovil	1,374	156	4,115	1·05	32·62	4,340
July	17	"	1,374	155	4,080	0·94	32·60	3,851
"	27	"	1,374	155	4,054	0·97	32·72	3,952
"	28	"	1,374	155	4,017	0·83	32·58	3,330
"	30	"	1,374	155	4,033	1·02	32·72	4,126
Aug.	14	A G. Worden	1,187	158	4,149	1·12	32·97	4,647
"	29	"	1,187	159	4,171	1·13	33·04	4,714
Sept	26	W Richardson	1,462	159	4,190	1·22	33·43	5,131
Oct	5	"	1,462	160	4,346	1·79	34·42	7,798
"	11	A Pirie	1,462	161	4,480	1·81	35·18	8,510
"	12	"	1,462	161	4,480	1·84	35·23	8,230
"	16	"	1,462	163	4,508	1·99	35·38	8,993
"	18	"	1,462	163	4,558	2·20	35·74	10,048
Nov	20	G J Lamb	1,187	164	4,563	1·90	35·82	8,670
"	25	"	1,187	164	4,588	2·14	35·86	9,819
"	26	"	1,187	164	4,588	2·08	35·95	9,544

Discharge Measurements of W. Branch, Winnipeg River at North Tunnel Island, 1913.

Date		Hydrographer	Meter No	Width.	Area of Section.	Mean Velocity	Gauge Height	Discharge	Gauge at Meter Section
				Feet.	Sq. ft.	Ft. per sec	Feet	Sec.-ft.	Feet
Feb	21	G. J. Lamb	1,375	163	4,253	1·33	34·01	5,654	
"	23	"	1,375	163	4,232	1·19	33·76	5,033	
Mar.	12	"	1,375	163	4,240	1·39	33·91	5,909	
"	20	"	1,375	163	4,256	1·43	33·96	6,107	
"	21	"	1,375	163	4,256	1·10	33·99	5,978	..
"	22	"	1,375	163	4,256	1·41	33·98	6,052	
"	22	"	1,375	163	4,256	1·41	33·98	6,030	
"	27	"	1,375	162	4,224	1·32	33·73	5,562	
"	27	"	1,375	163	4,224	1·33	33·73	5,615	..
"	28	"	1,375	163	4,224	1·35	33·73	5,731	..
"	28	"	1,375	163	4,224	1·30	33·71	5,476	
"	31	"	1,375	163	4,177	1·21	33·41	5,197	
April	8	"	1,375	162	4,190	1·36	33·57	5,714	
"	12	"	1,375	161	4,206	1·39	33·64	5,835	
"	11	"	1,375	160	4,171	1·25	33·41	5,194	
"	16	"	1,375	162	4,2[illegible]6	1·42	33·67	5,963	
June	24	"	1,375	182	5,250	3·56	39·85	18,701	..
"	28	"	1,375	182	5,267	3·49	39·96	18,420	..
July	11	R. Emery	1,375	173	4,930	2·46	38·02	12,115	..
"	14	"	1,375	170	4,797	2·54	37·39	12,215	
"	15	"	1,375	179	4,798	2·48	37·50	11,880	
Aug	1	"	1,375	174	4,986	3·01	38·40	15,021	
"	5	"	1,375	171	4,982	2·80	38·33	13,917	..
"	6	"	1,375	171	4,983	2·85	38·34	14,216	..
"	21	G. J Lamb	1,375	173	4,915	2·85	38·13	14,039	
"	26	"	1,375	172	4,915	2·86	38·03	14,068	37·81
"	26	"	1,375	172	4,899	2·86	37·02	14,009	37·80
"	26	"	1,375	172	4,899	2·82	37·02	13,817	37·80
"	27	"	1,375	172	4,91	2·96	37·06	14,530	37·82
"	27	"	1,375	172	4,916	2·89	37·06	14,174	37·82
"	28	"	1,375	172	4,916	2·83	37·08	13,916	37·84
"	28	"	1,375	172	4,916	2·77	37·08	13,606	37·85
"	28	"	1,375	173	4,916	2·78	37·08	13,652	37·85

DISCHARGE MEASUREMENTS of W. Branch, Winnipeg River at North Tunnel Island, 1913.

Date 1913		Hydrographer	Meter No.	Width	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.	Gauge at Meter Section
				Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.	Feet
Aug.	28	G. J. Lamb	1,375	173	4,916	2·79	38·08	13,729	37·84
"	29	"	1,375	172	4,898	2·86	38·02	13,991	37·81
"	29	"	1,375	171	4,898	2·90	38·02	14,176	37·81
"	29	"	1,375	172	4,898	2·86	38·02	14,003	37·81
"	29	"	1,375	172	4,898	2·84	38·02	13,907	37·81
"	29	"	1,375	172	4,898	2·75	38·02	13,423	37·81
"	30	"	1,375	172	4,898	2·82	38·02	13,787	37·81
"	30	"	1,375	172	4,898	2·90	38·04	14,180	37·81
"	31	"	1,375	172	4,898	2·88	38·03	14,087	37·83
"	31	"	1,375	172	4,881	2·72	37·89	13,234	37·70
Sept.	1	"	1,375	172	4,881	2·76	37·87	13,501	37·65
"	1	"	1,375	172	4,881	2·83	37·89	13,820	37·70
"	2	"	1,375	172	4,881	2·85	37·93	13,956	37·72
"	2	"	1,375	172	4,881	2·79	37·90	13,644	37·72
"	3	"	1,375	172	4,881	2·81	37·90	13,736	37·71
"	3	"	1,375	172	4,883	2·74	37·90	13,382	37·69
"	4	"	1,375	172	4,881	2·77	37·90	13,501	37·69
"	5	"	1,375	172	4,850	2·87	37·91	13,901	37·73
"	5	"	1,375	172	4,850	2·78	37·90	13,488	37·68
"	5	"	1,375	172	4,850	2·82	37·90	13,719	37·70
"	6	"	1,375	172	4,850	2·77	37·90	13,416	37·70
"	6	"	1,375	172	4,850	2·72	37·90	13,208	37·70
"	7	"	1,375	172	4,850	2·76	37·90	13,376	37·70
"	7	"	1,375	172	4,833	2·76	37·77	13,300	37·58
"	8	"	1,375	172	4,833	2·71	37·73	13,066	37·57
"	8	"	1,375	172	4,816	2·73	37·77	13,125	37·55
"	21	"	1,375	172	4,833	2·64	37·77	12,766	37·57
"	21	"	1,375	171	4,799	2·38	37·60	11,427	37·43
"	22	"	1,375	171	4,782	2·39	37·49	11,411	37·35
"	22	"	1,375	171	4,782	2·65	37·66	12,637	37·33
"	23	"	1,375	171	4,782	2·50	37·53	11,917	37·37
"	23	"	1,375	166	4,725	2·21	37·07	10,414	36·98
"	24	"	1,375	166	4,709	2·09	37·07	9,838	36·95
"	24	"	1,776	166	4,660	1·98	36·69	9,215	36·58
"	25	"	1,375	165	4,660	2·00	36·70	9,302	36·60
"	25	"	1,776	165	4,627	2·00	36·50	9,249	36·42
"	26	"	1,776	165	4,627	2·00	36·50	9,249	36·41
"	26	"	1,776	165	4,631	1·98	36·41	9,173	36·31
"	27	"	1,776	165	4,631	2·00	36·41	9,294	36·31
"	27	"	1,776	165	4,586	1·98	36·19	9,054	36·13
"	28	"	1,776	165	4,582	1·86	36·19	8,465	36·11
"	28	"	1,776	163	4,480	1·45	35·60	6,494	35·52
"	29	"	1,776	163	4,526	1·46	35·53	6,603	35·50
"	29	"	1,776	162	4,432	1·62	35·29	7,188	35·22
"	30	"	1,776	162	4,432	1·60	35·31	7,108	35·24
Oct.	1	"	1,776	162	4,396	1·67	35·36	7,337	35·28
"	2	E. J. Budge	1,776	162	4,432	1·60	35·28	7,101	35·20
"	2	"	1,776	162	4,416	1·70	35·28	7,511	35·42
"	[illegible]	"	1,776	162	4,416	1·58	35·28	6,984	35·20
"	[illegible]	"	1,776	162	4,400	1·61	35·11	7,100	35·05
"	4	"	1,776	162	4,400	1·68	35·11	7,404	35·05
"	4	"	1,776	162	4,400	1·59	35·08	7,014	35·02
"	[illegible]	"	1,776	162	4,400	1·63	35·08	7,173	35·01
"	5	"	1,776	162	4,367	1·41	34·92	6,171	34·77
"	[illegible]	"	1,776	161	4,316	1·45	34·76	6,316	34·72
"	[illegible]	"	1,776	161	4,335	1·60	34·78	6,937	34·65
"	[illegible]	"	1,776	161	4,367	1·58	34·88	6,916	34·83
"	[illegible]	"	1,776	161	4,367	1·62	34·89	7,091	34·81
"	[illegible]	"	1,776	161	4,367	1·61	34·81	7,016	34·80
"	[illegible]	"	1,776	161	4,368	1·67	34·78	7,300	34·85
"	[illegible]	"	1,776	161	4,367	1·61	34·86	7,029	34·85
"	[illegible]	"	1,776	161	4,303	1·60	34·58	6,880	34·47
"	[illegible]	"	1,776	161	4,335	1·61	34·80	7,013	34·65
"	[illegible]	"	1,776	161	4,351	1·60	34·78	6,972	34·71
"	[illegible]	"	1,186	161	4,351	1·64	34·79	7,110	34·71
"	[illegible]	"	1,186	161	4,303	1·61	34·52	6,941	34·40
"	[illegible]	"	1,186	161	4,319	1·58	34·61	6,863	34·52
"	[illegible]	"	1,186	161	4,335	1·62	34·72	7,006	34·64
"	[illegible]	"	1,186	161	4,272	1·55	34·50	6,603	34·50
"	[illegible]	"	1,186	161	4,335	1·66	34·68	7,176	34·61
Nov.	[illegible]	"	1,186	161	4,335	1·65	34·68	7,126	34·65
"	[illegible]	"	1,186	160	4,319	1·63	34·63	7,026	34·55
"	[illegible]	"	1,186	161	4,335	1·50	34·66	6,771	34·67
"	[illegible]	"	1,186	161	4,319	1·61	34·62	6,962	34·51
"	[illegible]	"	1,186	161	4,335	1·60	34·63	6,933	34·60
"	[illegible]	"	1,186	161	4,335	1·56	34·68	6,769	34·61
"	[illegible]	"	1,186	161	4,319	1·57	34·82	6,765	[illegible]
"	[illegible]	"	1,186	161	4,334	1·67	34·63	7,242	34·61
"	[illegible]	"	1,186	161	4,335	1·65	34·70	7,151	34·65
"	[illegible]	"	1,186	159	4,319	1·61	34·61	7,090	34·51

Discharge Measurements of West Branch, Winnipeg River at North Tunnel Island, 1913—*Continued.*

Date.		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge	Gauge at Meter Section
1913				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.	
Dec.	1	M. S. Madden	1,186	160	4,323	1·61	34·46	7,064	34·44
"	6	E. J. Budge	1,186	160	4,315	1·55	34·55	6,668	34·64
"	12	S. C. O'Grady	1,186	161	4,335	1·58	34·68	6,868	34·60
"	20	"	1,186	161	4,365	1·65	34·57	7,218	34·45
"	24	E. J. Budge	1,186	160	4,372	1·60	34·57	7,008	34·50
"	30	M. S. Madden	1,186	161	4,365	1·67	34·54	7,288	34·19
"	30	E. J. Budge	1,186	161	4,365	1·63	34·54	7,124	34·19

Assiniboine River, Brandon. Gauge at Bridge.

Discharge Measurements of West Branch, Winnipeg River at North Tunnel Island, 1914.

Date.		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge	Gauge at Meter Section
1914				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.	
Jan	7	M. S. Madden	1,186	161	4,351	1·55	34·49	6,731	34·41
"	7	"	1,186	161	4,351	1·62	34·49	7,028	34·42
"	17	"	1,196-7	160	4,365	1·61	34·56	7,018	34·52
"	21	S. C. O'Grady	1,196-7	161	4,352	1·65	34·50	7,077	34·44
"	22	"	1,196-7	161	4,337	1·52	34·32	6,582	34·25
"	22	"	1,196-7	161	4,337	1·52	34·32	6,586	34·25
"	27	M. S. Madden	1,196-7	160	4,351	1·55	34·47	6,733	34·39
"	27	"	1,196-7	160	4,352	1·53	34·47	6,653	34·39
"	31	"	1,196-7	161	4,365	1·61	34·55	7,049	34·49
Feb	2	"	1,196-7	160	4,321	1·60	34·35	6,827	34·22
"	11	S. C. O'Grady	1,196-7	160	4,367	1·52	34·53	6,658	34·49
"	12	"	1,196-7	160	4,367	1·52	34·52	6,660	34·49
"	16	M. S. Madden	1,196-7	160	4,321	1·52	34·38	6,572	34·25
"	18	"	1,196-7	160	4,365	1·52	34·52	6,822	34·50
"	18	"	1,196-7	160	4,365	1·52	34·53	6,642	34·50
"	23	"	1,196-7	160	4,400	1·74	34·84	7,665	34·66
"	23	"	1,196-7	160	4,415	1·79	34·92	7,890	34·74
"	25	"	1,196-7	160	4,494	2·00	35·48	8,979	35·32
"	25	"	1,196-7	160	4,494	2·04	35·49	9,153	35·33

DISCHARGE MEASUREMENTS of West Branch, Winnipeg River at North Tunnel Island, 1914—*Continued.*

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge	Gauge at Meter Section
1914				Feet	Sq. ft.	Ft. per sec.	Feet.	Sec. ft.	
Mar.	2	S. C. O'Grady	1,196·7	162	4,520	2·07	35·58	9,406	35·45
"	2	"	1,196·7	162	4,541	2·06	35·68	9,386	35·55
"	4	T. J. Moore	1,196·7	162	4,576	2·04	35·80	9,313	35·80
"	4	"	1,196·7	162	4,576	2·05	35·80	9,399	35·80
"	6	S. C. O'Grady	1,196·7	162	4,576	2·06	35·84	9,441	35·80
"	18	"	1,196·7	162	4,592	2·06	36·00	9,436	35·84
"	18	"	1,196·7	162	4,592	2·02	36·00	9,277	35·84
"	23	"	1,196·7	162	4,544	1·96	35·76	8,906	35·59
"	23	"	1,196·7	162	4,560	2·00	35·76	9,160	35·65
"	28	T. J. Moore	1,196·7	162	4,576	2·02	35·92	9,256	35·79
"	28	"	1,196·7	162	4,576	2·06	35·92	9,428	35·79
"	30	"	1,196·7	162	4,529	1·98	35·67	8,977	35·50
"	30	"	1,196·7	162	4,529	1·96	35·67	8,885	35·55
April	1	"	1,196	162	4,560	2·00	35·81	9,147	35·67
"	1	"	1,196	162	4,560	2·07	35·81	9,459	35·67
"	3	S. C. O'Grady	1,196	162	4,560	2·04	35·87	9,314	35·70
"	3	"	1,196	162	4,560	2·04	35·87	9,323	35·70
"	6	"	1,196	162	4,529	1·86	35·70	8,520	35·51
"	6	"	1,196	162	4,513	1·86	35·70	8,380	35·42
"	8	"	1,196	162	4,560	2·04	35·82	9,270	35·71
"	8	"	1,196	162	4,560	2·03	35·82	9,137	35·71
"	11	T. J. Moore	1,196	162	4,527	1·85	35·64	8,359	35·50
"	14	S. C. O'Grady	1,196	162	4,529	1·99	35·61	9,017	35·50
"	16	"	1,196	162	4,544	1·87	35·70	8,512	35·59
"	16	"	1,196	162	4,544	1·83	35·70	8,330	35·59
"	18	"	1,196	162	4,529	1·90	35·68	8,615	35·55
"	20	T. J. Moore	1,196	162	4,544	2·06	35·73	9,343	35·58
"	20	"	1,196	162	4,514	2·02	35·73	9,220	35·62
"	22	S. C. O'Grady	1,196	162	4,576	2·12	35·90	9,694	35·80
"	22	"	1,196	162	4,576	2·15	35·90	9,823	35·80
"	23	"	1,196	162	4,560	2·00	35·81	9,117	35·70
"	23	"	1,196	162	4,560	2·02	35·81	9,235	35·70
"	24	"	1,196	162	4,544	2·05	35·77	9,336	35·65
"	24	"	1,196	162	4,544	2·00	35·77	9,103	35·65
"	27	"	1,196	162	4,529	1·80	35·61	8,133	35·50
"	27	"	1,196	162	4,529	1·85	35·61	8,353	35·52
"	29	T. J. Moore	1,196	162	4,592	2·18	35·95	10,001	35·85
"	29	"	1,196	162	4,592	2·11	35·95	9,689	35·85
"	30	"	1,196	162	4,592	2·15	35·97	9,879	35·87
"	30	"	1,196	162	4,592	2·11	35·97	9,682	35·87
May	1	"	1,196	162	4,592	2·13	36·00	9,762	35·87
"	1	"	1,196	162	4,592	2·14	36·00	9,819	35·87
"	2	"	1,196	162	4,592	2·11	36·02	9,851	35·90
"	2	"	1,196	162	4,592	2·08	36·02	9,552	35·90
"	8	"	1,462	162	4,656	2·19	36·42	10,181	36·20
"	8	"	1,462	162	4,656	2·19	36·40	10,217	36·29
"	11	"	1,462	162	4,624	1·87	36·22	8,662	36·07
"	11	"	1,462	162	4,624	2·09	36·22	9,638	36·13
"	12	C. C. Galloway	1,462	162	4,656	2·14	36·40	9,946	36·32
"	12	"	1,462	162	4,656	2·23	36·40	10,342	36·32
"	14	T. J. Moore	1,196	162	4,671	2·23	36·55	10,166	36·40
"	14	"	1,196	162	4,671	2·22	36·55	10,391	36·42
"	15	"	1,196	162	4,671	2·28	36·52	10,670	36·40
"	16	"	1,196	162	4,671	2·28	36·52	10,650	36·40
"	16	"	1,196	162	4,671	2·13	36·45	9,979	36·32
"	18	"	1,196	162	4,640	2·34	36·32	10,880	36·20
"	18	"	1,196	162	4,640	2·22	36·36	10,406	36·24
"	21	"	1,196	162	4,719	2·57	36·95	12,123	36·76
"	22	"	1,196	162	4,782	2·53	37·32	12,086	37·14
"	22	"	1,196	162	4,782	2·73	37·32	13,055	37·15
"	26	C. C. Galloway	1,462	162	4,830	2·77	37·60	13,352	37·4[illegible]
"	26	"	1,462	162	4,830	2·67	37·60	13,326	37·42
"	28	"	1,462	169	4,926	3·15	38·14	15,527	37·9[illegible]
"	28	"	1,462	169	4,926	3·14	38·14	15,459	37·94
"	30	S. C. O'Grady	1,196	171	5,022	3·21	38·70	16,111	38·42
"	30	"	1,196	174	5,022	3·23	38·70	16,227	38·4[illegible]
June	2	C. C. Galloway	1,462	174	5,041	3·16	38·75	15,945	38·5[illegible]
"	2	"	1,462	174	5,041	3·18	38·75	16,066	38·5[illegible]
"	4	"	1,462	174	5,081	3·22	38·95	16,379	38·8[illegible]
"	4	"	1,462	174	5,081	3·21	38·95	16,338	38·8[illegible]
"	10	T. J. Moore	1,196	171	5,161	3·40	39·50	17,665	39·2[illegible]
"	10	"	1,196	174	5,161	3·35	39·50	17,284	39·2[illegible]
"	16	"	1,196	179	5,166	3·30	39·50	17,071	39·[illegible]
"	16	"	1,196	179	5,166	3·30	39·50	17,181	39·[illegible]
"	18	C. C. Galloway	1,196	179	5,182	3·28	39·57	17,[illegible]25	39·[illegible]
"	18	"	1,196	179	5,182	3·18	39·57	16,499	39·2[illegible]
"	22	T. J. Moore	1,196	179	5,217	3·15	39·58	17,994	39·4[illegible]
"	22	"	1,196	179	5,217	3·35	39·58	17,504	39·4[illegible]
"	25	"	1,196	181	5,273	3·66	40·20	19,288	39·8[illegible]

Daily Gauge Height and Discharge of West Branch, Winnipeg River at North Tunnel Island for 1914.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge	Gauge at Meter Section
1914			Feet	Sq. ft.	Ft. per sec.	Feet	Sec. ft.	
June 25	"	1196	181	5,273	3.64	40.20	19,186	39.82
" 27	"	1196	181	5,273	3.56	40.18	18,764	39.82
" 27	"	1196	181	5,273	3.60	40.18	18,999	39.82
July 9	S. C. O'Grady	1196	179	5,365	3.42	40.14	18,356	39.80
" 9	"	1196	179	5,365	3.59	40.14	19,270	39.80
" 21	C. C. Galloway	1196	181	4,962	3.87	40.22	19,208	39.85
" 21	"	1196	181	4,962	3.78	40.22	18,765	39.85
" 30	"	1196	181	5,223	3.68	40.15	19,240	39.85
" 30	"	1196	181	5,223	3.78	40.15	19,714	39.85
Aug. 3	"	1196	180	5,231	3.67	39.88	19,192	39.61
" 3	"	1196	180	5,231	3.60	39.88	18,843	39.63
" 5	T. J. Moore	1196	181	5,264	3.73	40.00	19,644	39.75
" 13	S. C. O'Grady	1196	177	5,280	3.42	39.73	17,990	39.43
" 13	"	1196	177	5,280	3.42	39.73	18,069	39.41
" 18	"	1196	177	5,199	3.57	39.59	18,569	39.38
" 18	"	1196	177	5,199	3.71	39.59	19,372	39.38
" 22	C. C. Galloway	1196	177	5,199	3.48	39.70	18,078	39.42
Sept. 15	S. C. O'Grady	1196	171	4,827	2.67	37.41	12,887	37.24
" 15	"	1196	171	4,827	2.62	37.41	12,64[illegible]	37.24
" 22	"	1196	171	4,814	2.58	37.47	12,485	37.30
" 24	"	1196	171	4,843	2.60	37.49	12,545	37.33
" 24	"	1196	171	4,843	2.52	37.49	12,217	37.33
" 29	"	1196	172	4,817	2.58	37.32	12,437	37.18
Oct. 3	C. C. Galloway	1196	172	4,81[illegible]	2.60	37.42	12,530	37.22
Nov. 3	S. C. O'Grady	1196	163	4,529	1.94	35.62	8,797	35.51
" 11		1196	163	4,554	1.97	35.71	8,970	35.65
" 16		1196	163	4,530	1.93	35.58	8,648	35.52
" 16	"	1196	163	4,530	1.80	35.58	8,151	35.52
" 19	"	1196	163	4,554	1.98	35.73	9,024	35.65
" 19	"	1196	163	4,554	1.98	35.73	9,012	35.65
" 23	C. C. Galloway	1196	163	4,403	1.89	35.55	8,317	35.36
" 23	"	1196	163	4,506	1.96	[illegible]	8,830	35.36
" 27	"	1196	163	4,553	1.83		8,324	35.65
" 27	S. C. O'Grady	1196	163	4,553	1.91		8,701	35.65
" 30	C. C. Galloway	1196	163	4,582	2.00		9,040	35.46
Dec. 4	"	1196	163	4,561	2.02		9,203	35.69
" 9	S. C. O'Grady	1718	163	4,521	1.84	35.55	8,295	35.42
" 9	"	1718	163	4,521	1.89	35.55	8,540	35.42
" 14	"	1718	163	4,514	1.98	35.51	8,946	35.42
" 16	"	1718	163	4,530	1.95	35.62	8,847	35.50
" 16	"	1718	163	4,530	1.97	35.62	8,921	35.50
" 19	"	1718	163	4,547	1.93	35.64	8,778	35.50
" 22	"	1718	163	4,563	1.97	35.68	8,979	35.53
" 22	"	1718	163	4,563	1.95	35.60	8,901	35.53
" 24	C. C. Galloway	1718	163	4,571	1.95	35.61	8,919	35.57
" 24	"	1718	163	4,571	1.94	35.61	8,851	35.57
" 28	"	1718	163	4,531	1.93	35.51	8,759	35.37
" 28	"	1718	163	4,5[illegible]1	1.94	35.51	8,8[illegible]7	35.37
" 31	"	1718	163	4,563	1.94	35.64	8,854	35.56
" 31	"	1718	163	4,562	1.93	35.64	8,822	35.56

Daily Gauge Height and Discharge of West Branch, Winnipeg River at North Tunnel Island for 1912.

Drainage area, 26,400 square miles

Day.	January		February		March		April		May.		June	
	Gauge Height	Discharge.	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.
1	73·80	4,290	73·70	4,160	74·10	4,720	74·10	4,720	74·30	5,030	74·40	5,190
2	73·80	4,290	73·70	4,160	74·10	4,720	74·10	4,720	74·40	5,190	74·10	4,720
3	73·80	4,290	73·75	4,225	78·10	4,720	74·15	4,795	74·40	5,190	73·80	4,290
4	73·80	4,290	73·75	4,225	74·10	4,720	74·15	4,795	74·40	5,190	74·20	4,870
5	73·80	4,290	73·80	4,290	74·00	4,570	74·15	4,795	74·50	5,350	74·30	5,030
6	73·80	4,290	73·80	4,290	74·00	4,570	74·15	4,795	74·50	5,350	74·20	4,870
7	73·80	4,290	73·80	4,290	74·00	4,570	74·15	4,795	74·50	5,350	73·90	4,430
8	73·80	4,290	73·80	4,290	74·00	4,570	74·15	4,795	74·55	5,435	73·90	4,430
9	73·80	4,290	73·80	4,290	74·00	4,570	74·15	4,795	74·60	5,520	73·80	4,290
10	73·80	4,290	73·80	4,290	74·10	4,720	74·15	4,795	74·60	5,520	73·60	4,040
11	73·80	4,290	73·80	4,290	74·10	4,720	74·20	4,870	74·60	5,520	73·50	3,920
12	73·80	4,290	73·85	4,360	74·10	4,720	74·20	4,870	74·65	5,605	73·60	4,040
13	73·80	4,290	73·85	4,360	74·05	4,645	74·20	4,870	74·65	5,605	73·80	4,290
14	73·80	4,290	73·85	4,360	74·05	4,645	74·20	4,870	74·70	5,690	73·80	4,290
15	73·80	4,290	73·85	4,360	74·05	4,645	74·20	4,870	74·70	5,690	73·80	4,290
16	73·70	1,160	73·85	4,360	74·05	4,645	74·20	4,870	74·70	5,690	73·80	4,290
17	73·70	4,160	73·90	4,430	74·05	4,645	74·25	4,950	74·50	5,350	73·90	4,430
18	73·75	4,225	73·90	4,430	74·05	4,645	74·25	4,950	74·50	5,350	73·90	4,430
19	73·75	4,225	73·95	4,500	74·05	4,645	74·25	4,950	74·40	5,190	74·00	4,570
20	73·75	4,225	73·95	4,500	74·05	4,645	74·25	4,950	74·40	5,190	74·00	4,570
21	73·75	4,225	73·95	4,500	74·05	4,645	74·30	5,030	74·40	5,190	74·00	4,570
22	73·75	4,225	73·95	4,500	74·05	4,645	74·30	5,030	74·40	5,190	73·85	4,360
23	73·75	4,225	73·95	4,500	74·05	4,645	74·30	5,030	74·45	5,270	73·80	4,290
24	73·75	4,225	74·00	4,570	74·05	4,645	74·35	5,110	74·40	5,190	73·60	4,040
25	73·75	4,225	74·00	4,570	74·05	4,645	74·35	5,110	74·30	5,030	73·60	4,040
26	73·80	4,290	74·00	4,570	74·05	4,645	74·35	5,110	74·30	5,030	73·60	4,040
27	73·80	4,290	74·10	4,720	74·05	4,645	74·40	5,190	74·30	5,030	73·65	4,100
28	73·80	4,290	74·10	4,720	74·05	4,645	74·40	5,190	74·30	5,030	73·60	4,040
29	73·70	4,160	74·10	4,720	74·05	4,645	74·40	5,190	74·30	5,030	73·60	4,040
30	73·70	4,160			74·05	4,645	74·40	5,190	74·30	5,030	73·60	4,040
31	73·75	4,225			74·05	4,645			74·20	4,870		

	July.		August		September.		October		November.		December.	
1	73·50	3,920	73·60	4,040	73·70	4,160	74·40	5,190	76·95	10,430	76·90	10,320
2	73·15	3,540	73·55	3,980	73·80	4,290	74·40	5,190	77·00	10,540	76·70	9,880
3	73·40	3,810	73·60	4,040	74·00	4,570	74·45	5,270	76·75	9,990	76·80	10,100
4	73·40	3,810	73·60	4,040	74·00	4,570	75·00	6,240	76·85	10,210	76·80	10,100
5	73·45	3,865	73·65	4,100	74·20	4,870	75·35	6,915	76·95	10,430	76·80	10,100
6	73·45	3,865	73·70	4,160	74·00	4,570	75·30	6,840	76·95	10,430	76·80	10,100
7	73·50	3,920	73·75	4,225	74·05	4,645	75·70	7,680	76·90	10,320	76·80	10,100
8	73·50	3,920	73·80	4,290	73·85	4,360	75·85	8,010	76·20	8,780	76·90	10,320
9	73·50	3,920	73·80	4,290	73·95	4,500	75·85	8,010	76·10	8,560	76·90	10,320
10	73·50	3,920	73·85	4,360	74·00	4,570	76·00	8,340	75·80	7,900	76·95	10,430
11	73·40	3,810	73·85	4,360	74·05	4,645	76·10	8,560	75·70	7,680	77·00	10,540
12	73·50	3,920	73·80	4,290	74·05	4,645	76·10	8,560	75·95	8,230	77·00	10,540
13	73·40	3,810	73·80	4,290	74·10	4,720	75·95	8,230	76·50	9,140	77·00	10,540
14	73·50	3,920	73·85	4,360	74·10	4,720	76·05	8,450	76·70	9,880	77·00	10,540
15	73·30	3,700	73·90	4,430	74·10	4,720	76·15	8,670	76·75	9,990	77·00	10,540
16	73·50	3,920	73·90	4,430	74·08	4,570	76·30	9,000	76·70	9,880	77·00	10,540
17	73·50	3,920	73·90	4,430	74·05	4,6	76·55	9,550	76·65	9,770	77·00	10,540
18	73·50	3,920	73·90	4,430		4,6		9,880	76·70	9,880	77·00	10,540
19	73·35	3,755	73·65	4,100	74·00	4,570	76·80	10,100	76·75	9,990	77·00	10,540
20	73·30	3,700	73·90	4,430	74·05	4,645	76·60	9,660	76·80	10,100	77·00	10,540
21	73·35	3,755	73·95	4,500	74·10	4,720	76·65	9,770	76·80	10,100	77·00	10,540
22	73·30	3,700	73·95	4,500	74·00	4,570	76·80	10,100	76·85	10,210	76·90	10,320
23	73·35	3,755	74·00	4,570	74·10	4,720	77·00	10,540	76·90	10,320	76·80	10,100
24	73·50	3,920	74·05	4,645	74·20	4,870	76·95	10,430	76·80	10,100	76·90	10,320
25	73·50	3,920	73·85	4,360	74·30	5,030	76·95	10,430	76·85	10,210	76·90	10,320
26	73·55	3,980	73·80	4,290	74·35	5,110	76·80	10,100	76·90	10,320	76·95	10,430
27	73·60	4,040	73·95	4,500	74·35	5,110	76·65	9,770	77·00	10,540	76·95	10,430
28	73·60	4,040	73·95	4,500	74·40	5,190	76·70	9,880	77·10	10,760	76·95	10,430
29	73·60	4,040	74·00	4,570	74·20	4,870	76·75	9,990	77·00	10,540	76·85	10,210
30	73·55	3,980	74·05	4,645	74·30	5,030	76·85	10,210	77·00	10,540	76·90	10,320
31	73·55	3,980	74·00	4,570			76·95	10,430			76·90	10,320

Daily Gauge Height and Discharge of West Branch, Winnipeg River at North Tunnel Island for 1913.

Drainage area, 26,400 square miles

Day.	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1		10,320	35·94	10,320	33·96	6,050	33·61	5,435	38·09	15,050	39·80	18,790
2		10,320		10,200		6,050	33·66	5,520	38·15	15,160	39·79	18,790
3		10,430		10,200		6,050	33·64	5,520	38·23	15,270	39·95	19,120
4	36·01	10,430		10,100		6,050	33·58	5,350	38·14	15,160	40·02	19,230
5		10,430		10,100		5,960	33·58	5,350	38·10	15,050	40·08	19,340
6		10,320		10,000		5,960	33·46	5,190	38·30	15,490	40·11	19,450
7		10,320		10,000		5,960	33·54	5,350	38·42	15,710	40·08	19,340
8		10,210	35·76	9,880	33·91	5,960	33·56	5,350	38·42	15,710	39·95	19,120
9		10,210		9,730		5,960	33·66	5,520	38·45	15,820	39·88	18,900
10		10,100		9,580	33·56	5,350	33·70	5,605	38·50	15,930	40·02	19,230
11	35·86	10,100		9,430	33·86	5,870	33·68	5,520	38·31	15,490	40·08	19,340
12		10,100		9,230	33·91	5,960	33·66	5,520	38·28	15,390	40·15	19,560
13		10,100		9,080	33·94	6,050	33·55	5,270	38·60	16,200	40·14	19,560
14		10,100		8,930	33·96	6,050	33·51	5,270	39·00	17,030	40·05	19,340
15		10,100	35·28	8,780	33·96	6,050	33·61	5,435	39·42	17,910	39·84	18,900
16		10,100		8,400	33·76	5,690	33·67	5,520	39·56	18,240	39·83	18,790
17		10,100		8,100	33·58	5,350	33·79	5,780	39·60	18,350	39·96	19,120
18	35·86	10,100		7,700	33·81	5,870	33·91	5,960	39·55	18,240	39·99	19,230
19		10,100		7,400	33·88	5,870	33·97	6,050	39·58	18,240	40·01	19,230
20		10,100		7,000	33·96	6,050	33·81	5,780	39·65	18,460	40·01	19,230
21		10,100		6,700	33·98	6,050	33·80	5,780	39·70	18,570	39·97	19,120
22		10,100		6,300	33·98	6,050	34·94	8,120	39·79	18,790	39·88	18,900
23		[illegible]		6,000	33·76	5,690	35·70	9,770	40·12	19,450	39·72	18,570
24		10,210	35·76	5,690	33·59	5,435	36·51	11,580	39·76	18,680	39·84	18,700
25	35·91	10,210		5,780	33·76	5,690	37·14	12,960	39·66	18,460	39·94	18,820
26		10,210		[illegible]	33·74	5,690	37·46	13,620	39·68	18,460	39·95	18,700
27		10,210		5,870	33·74	5,690	37·41	13,510	39·78	18,680	39·93	18,450
28		10,210		5,960	33·73	5,605	37·52	13,730	39·80	18,790	39·94	18,420
29		10,210			33·70	5,605	37·85	14,500	39·85	18,900	39·82	18,100
30		10,210			33·58	5,350	38·00	14,830	39·90	19,010	39·78	18,100
31		10,210			33·48	5,190			39·94	19,120	...	...

Day.	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	39·73	17,950	38·46	15,020	37·91	13,880	35·28	7,100	34·70	7,100	34·38	7,050
2	39·64	17,850	38·49	14,850	37·90	13,690	35·18	7,250	34·45	6,600	34·59	7,300
3	39·81	18,100	38·31	14,250	37·90	13,440	35·12	7,250	34·37	6,480	34·65	7,450
4	39·84	18,250	38·28	14,000	37·91	13,500	35·07	7,100	34·57	6,900	34·68	7,450
5	39·80	17,750	38·38	13,950	37·89	13,540	34·83	6,240	34·61	7,020	34·70	7,100
6	39·60	17,000	38·37	14,220	37·90	13,290	34·64	6,930	34·63	7,060	34·69	6,670
7	39·50	16,400	38·41	14,280	37·80	13,180	34·84	6,910	34·67	7,050	34·43	6,000
8	39·31	15,750	38·47	14,480	37·76	12,850	34·87	7,090	34·70	6,770	34·41	6,050
9	38·80	14,300	38·45	14,430	37·87	13,150	34·86	7,010	34·48	6,350	34·57	6,400
10	38·13	12,600	38·24	13,980	37·90	13,170	34·89	7,300	34·40	6,200	34·61	6,550
11	38·00	12,100	38·24	13,980	37·93	13,270	34·86	7,030	34·58	6,960	34·67	6,650
12	37·87	12,100	38·35	14,250	37·90	13,200	34·64	6,900	34·65	7,000	34·68	6,870
13	37·59	11,820	38·36	14,300	37·90	13,230	34·54	6,880	34·68	6,930	34·68	6,850
14	37·40	12,210	38·34	14,250	37·82	13,050	34·74	7,010	34·70	6,850	34·40	6,400
15	37·48	11,880	38·43	14,500	37·81	13,000	34·77	6,970	34·70	6,770	34·35	6,350
16	37·50	11,970	38·45	14,550	37·89	13,180	34·78	7,000	34·48	6,300	34·55	6,850
17	37·50	12,000	38·27	14,150	37·90	13,200	34·78	7,050	34·58	6,300	34·56	6,950
18	37·49	12,000	38·13	13,850	37·95	13,300	34·80	7,140	34·61	6,760	34·58	7,050
19	37·45	12,000	38·14	13,960	38·02	13,450	34·57	6,550	34·67	6,900	34·58	7,180
20	37·20	11,600	38·17	13,950	37·91	12,600	34·31	6,050	34·70	7,240	34·57	7,220
21	37·17	11,600	38·20	14,040	37·62	11,120	34·41	6,940	34·70	7,200	34·35	6,700
22	37·27	11,850	38·18	14,390	37·43	12,280	34·62	6,800	34·70	7,150	34·34	6,700
23	37·35	12,050	38·16	14,250	37·02	10,130	34·67	6,900	34·47	6,700	34·55	6,900
24	37·84	13,250	38·04	14,000	36·65	9,200	34·68	7,000	34·37	6,550	34·58	7,000
25	38·25	14,200	37·99	13,900	36·51	9,250	34·72	7,050	34·58	7,040	34·36	6,500
26	38·31	14,300	38·02	13,960	36·38	9,230	34·47	6,780	34·65	7,190	34·34	6,600
27	38·15	[illegible]	[illegible]	[illegible]	36·12	[illegible]	[illegible]	[illegible]	34·66	[illegible]	34·55	[illegible]
28	38·13	14,100	38·06	13,730	35·57	6,550	34·61	7,000	34·67	7,250	34·30	6,650
29	38·30	14,550	38·01	[illegible]	35·28	7,330	34·67	7,175	34·70	7,300	34·35	6,700
30	38·40	14,800	38·03	14,130	35·36	7,390	34·68	7,200	34·45	6,850	34·51	7,200
31	38·46	15,000	37·91	13,350			34·69	7,125		... ...	34·60	7,300

Note.—Gauge heights are referred to gauge at Keewatin River Bridge

Daily Gauge Height and Discharge of West Branch, Winnipeg River at North Tunnel Island for 1914.

(Drainage area, 26,400 square miles).

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge.	Gauge Height	Discharge	Gauge Height	Discharge.	Gauge Height	Discharge.	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	34·62	7,260	34·31	6,870	35·68	9,660	35·79	9,300	35·96	9,790	38·55	15,725
2	34·65	7,370	34·25	6,860	35·65	9,400	35·84	9,300	36·00	9,700	38·72	16,025
3	34·67	7,370	34·43	7,150	35·79	9,400	35·88	9,320	35·86	9,670	39·05	16,225
4	34·48	7,050	34·51	7,170	35·80	9,380	35·90	9,320	35·86	9,630	39·07	16,375
5	34·36	6,740	34·56	7,150	35·82	9,410	35·73	9,000	36·04	9,600	39·10	16,450
6	34·45	6,590	34·41	6,850	35·84	9,440	35·70	8,450	36·15	9,650	39·06	16,425
7	34·47	6,950	34·38	6,750	35·88	9,480	35·79	9,200	36·32	9,980	38·89	16,400
8	34·51	7,050	34·30	6,640	35·74	9,170	35·82	9,200	36·40	10,200	38·99	16,500
9	34·58	7,260	34·33	6,460	35·72	8,940	35·77	9,200	36·38	9,890	39·33	16,925
10	34·65	7,370	34·50	6,650	35·90	9,400	35·64	8,650	36·23	9,300	39·48	17,400
11	34·47	6,950	34·55	6,650	35·96	9,420	35·64	8,600	36·22	9,150	39·48	17,425
12	34·40	6,840	34·58	6,650	36·01	9,520	35·53	8,560	36·40	10,144	39·50	17,425
13	34·52	7,050	34·59	6,770	36·03	9,640	35·50	8,100	36·47	10,300	39·54	17,500
14	34·62	7,260	34·60	6,850	36·03	9,570	35·64	8,360	36·50	10,278	39·39	17,275
15	34·63	7,370	34·43	6,750	35·82	9,000	35·77	8,620	36·52	10,670	39·35	17,125
16	34·64	7,370	34·34	6,550	35·76	8,880	33·73	8,420	36·45	10,289	39·50	17,100
17	34·58	7,260	34·49	6,750	35·92	9,100	35·58	8,400	36·21	10,125	39·52	16,900
18	34·35	6,740	34·53	6,760	35·98	9,350	35·61	8,635	36·31	10,643	39·55	17,200
19	34·24	6,530	34·58	7,070	35·98	9,470	35·55	8,870	36·47	11,050	39·68	17,650
20	34·42	6,840	34·59	7,170	36·00	9,470	35·61	9,280	36·57	11,500	39·83	17,900
21	34·48	7,050	34·69	7,450	36·00	9,560	35·83	9,600	36·79	12,110	39·73	17,900
22	34·41	6,560	34·69	7,470	35·79	9,180	35·91	9,760	37·25	12,580	39·59	18,100
23	34·35	6,460	34·81	7,680	35·72	8,950	35·83	9,180	37·33	12,700	39·79	18,800
24	34·34	6,460	35·31	8,780	35·86	9,200	35·74	9,220	37·20	12,600	39·90	19,150
25	34·19	6,150	35·44	9,110	35·92	9,240	35·72	9,200	37·30	12,900	40·02	19·250
26	34·21	6,180	35·58	9,440	35·95	9,350	35·64	9,170	37·53	13,440	40·15	19,325
27	34·45	6,690	35·73	9,770	35·95	9,400	35·65	8,240	37·87	14,400	40·13	19,300
28	34·50	6,820	35·85	9,990	35·92	9,400	35·80	9,510	38·25	15,493	40·02	19,050
29	34·53	6,970	......	......	35·78	9,100	35,87	9,845	38·48	16,000	39·98	19,050
30	34·54	7,050	......	......	35·67	8,940	35·95	9,780	38·66	16,168	40·05	19,150
31	34·55	7,050			35·77	9,100	.	....	38,66	16,210	.	

Day.	July.		August.		September.		October.		November		December.	
1	40·01	18,700	39·99	18,650	37·69	12,850	37·39	12,450	35·57	8,850	35·70	9,050
2	39·85	18,750	39·76	18,500	37·65	12,850	37·38	12,450	35·49	8,750	35·75	9,125
3	39·90	18,800	39·80	18,550	37·49	12,850	38·38	12,400	35·57	8,800	35·77	9,200
4	39·90	18,800	39·95	18,625	37·41	12,875	37·23	12,050	35·55	8,850	35·77	9,200
5	39·87	18,800	40·00	18,640	37·37	12,750	37·11	12,000	35·51	8,800	35·79	9,100
6	39·86	18,800	39·91	18,550	37·32	12,700	37·21	12,100	35·52	8,800	35·73	8,025
7	39·93	18,900	39·88	18,525	37·31	12,675	37·23	12,150	35·51	8,775	35·56	8,205
8	40·07	19,100	39·88	18,400	37·32	12,675	37·23	12,200	35·42	8,650	35·64	8,400
9	40·14	19,250	39·70	18,250	37·35	12,750	27·26	12,250	35·46	8,725	35·62	8,425
10	40·12	19,250	39·60	18,150	37·41	12,800	37·33	12,250	35·63	8,875	35·61	8,425
11	40·11	19,200	39·69	18,100	37·35	12,775	37 34	12,150	35·65	8,975	35·61	8,400
12	40·00	19,150	39·71	18,075	37·36	12,775	37·16	12,175	35·67	8,975	35·68	8,425
13	39·98	19,150	39·71	18,000	37·25	12,525	37·18	12,175	35·71	8,975	35·53	7,900
14	40·14	19,200	39·68	17,875	37·24	12,550	37·22	11,050	35·73	8,950	35·51	8,500
15	40·19	19,400	39·67	17,825	37·37	12,750	36·63	9,850	35·59	8,550	35·63	8,925
16	40·23	19,550	39·53	17,750	37·42	12,750	36·40	9,400	35·53	8,400	35·64	8,875
17	40·28	19,600	39 43	17,800	37 42	12,725	36·24	9,050	35·68	8,425	35·65	8,850
18	40·30	19,450	39·55	18,825	37·42	12,700	36·02	8,800	35·70	8,775	35·60	8,775
19	40 13	19,520	39·60	17,925	37·49	12,700	35·89	8,900	35·67	9,025	35·61	8,750
20	40·07	19,100	39·62	18,025	37·45	12,575	36 03	9,150	35·69	9,025	35·49	8,100
21	40·19	19,050	39·66	18,075	37·38	12,425	36·05	9,225	35 69	9,000	35 47	8,350
22	40 22	19,100	39·67	18,100	37·43	12,375	36 06	9,175	35·56	8,850	35·60	8,925
23	40·24	19,100	39·44	17,775	37·47	12,375	36·01	9,025	35·49	9,450	35·60	8,900
24	40·24	19,100	39·34	17,625	37·45	12,375	35·92	8,925	35·62	9,550	35·61	8,875
25	40·13	19,050	39·43	17,575	37·48	12,350	35·73	8,900	35·68	9,600	35·55	8,800
26	39·92	19,000	39·12	15,500	37·48	12,325	35·52	9,025	35·70	9,650	35·51	8,675
27	39·88	18,900	38·64	11,350	37·23	12,275	35·69	9,100	35·71	9,600	35·42	8,150
28	40·06	19,200	38·24	13,750	37·10	12,300	35·72	9,100	35·70	9,400	35·45	8,300
29	40·10	19,400	38·09	13,400	37 28	12,425	35·76	9,100	35·50	9,300	35 56	8,825
30	40·12	19,500	37·89	13,200	37·31	12,475	35·86	9,050	35·51	9,100	35·63	8,850
31	40·12	19,450	37·77	13,050			35·86	8,975			35·65	8,900

Note.—Gauge heights are referred to gauge at Keewatin River Bridge.

Monthly Discharge of West Branch, Winnipeg River at North Tunnel Island for the year 1912.

(Drainage area 26,400 square miles).

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	4,290	4,160	4,250	261,300
February	4,720	4,160	4,410	253,700
March	4,720	4,570	4,650	285,900
April	5,190	4,720	4,930	293,400
May	5,690	4,870	5,290	325,300
June	5,190	3,920	4,360	259,400
July	4,040	3,540	3,870	238,000
August	4,645	3,980	4,350	267,500
September	5,190	4,160	4,690	279,100
October	10,540	5,190	8,710	535,600
November	10,760	7,680	9,870	587,300
December	10,540	9,880	10,350	636,400
The year	10,760	3,540	5,810	4,222,900

Monthly Discharge of West Branch, Winnipeg River at North Tunnel Island for the year 1913.

(Drainage area 26,400 square miles).

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum.	Mean.	Total in acre-feet.
January	10,430	10,100	10,200	627,200
February	10,320	5,690	8,300	461,000
March	6,050	5,190	5,800	356,600
April	14,830	5,190	7,620	453,400
May	19,450	15,050	17,250	1,060,700
June	19,560	18,100	18,980	1,129,400
July	18,250	11,600	14,050	863,900
August	15,020	13,350	14,160	870,700
September	13,880	6,550	11,890	707,500
October	7,250	6,050	6,950	427,300
November	7,300	6,200	6,870	408,800
December	7,450	6,000	6,830	420,000
The year	19,560	5,190	10,740	7,786,500

Monthly Discharge of West Branch, Winnipeg River at North Tunnel Island for the year 1914.

(Drainage area, 26,400 square miles.)

Month.	Discharge in Second-Feet.			Run-Off.
	Maximum.	Minimum	Mean.	Total in acre-feet.
January	7,370	6,150	6,940	426,700
February	9,990	6,460	7,360	408,800
March	9,660	8,880	9,310	572,500
April	9,760	8,100	9,010	536,100
May	16,210	9,150	11,490	706,500
June	19,325	15,725	17,570	1,045,500
July	19,600	18,700	19,130	1,176,200
August	18,650	13,050	17,300	1,063,700
September	12,875	12,275	12,610	750,400
October	12,450	8,800	10,470	643,800
November	9,650	8,400	8,980	534,400
December	9,200	7,900	8,650	531,900
The year	19,600	6,150	11,570	8,396,500

COMBINED DISCHARGE OF LAKE OF THE WOODS OUTLETS.

Combined Discharge of Winnipeg River below Lake of the Woods Outlets for 1912.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft.	Feet.	Sec.-ft.
1		5,246		5,532		6,267		6,020		6,455	.....	6,466
2		5,592		5,485		6,252		6,189		6,611		5,478
3		5,726		5,698		5,767		6,296		6,571		4,978
4		5,698		5,171		6,074		6,289		5,956		5,942
5		5,533		5,574		6,066		6,287		6,754		6,282
6		5,362		5,656		6,019		6,305		6,422		6,137
7		5,275		5,722		6,097		6,106		6,670		5,568
8		5,637		5,744		6,070		6,120		6,804		5,121
9		5,855		5,748		6,109		6,291		6,833		4,962
10		5,816		5,717		5,731		6,194		6,843		4,761
11		5,812		5,219		5,920		6,321		6,878		4,831
12		5,787		5,481		6,212		6,330		6,382		4,913
13		5,766		5,750		6,129		6,382		6,640		5,507
14		5,301		5,702		6,136		5,722		7,006		5,584
15		5,431		5,793		6,152		6,090		7,045		5,603
16		5,633		5,856		6,085		6,286		6,968		5,603
17		5,576		5,978		5,619		6,396		6,716		5,516
18		5,690		5,458		5,985		6,315		6,747		5,710
19		5,647		5,830		6,180		6,338		5,980		5,842
20		5,551		6,083		6,184		6,373		6,280		5,853
21		5,153		6,121		6,137		5,851		6,548		5,826
22		5,422		5,945		6,088		6,089		6,568		5,565
23		5,612		6,238		5,883		6,438		6,635		4,975
24		5,618		6,102		5,646		6,496		6,527		5,015
25		5,551		5,596		6,001		6,495		6,370		5,274
26		5,703		5,954		6,161		6,557		5,806		5,296
27		5,684		6,275		5,809		6,649		5,783		5,306
28		5,266		6,321		6,131		6,006		6,345		5,238
29		5,272		6,261		6,140		6,314		6,035		5,197
30		5,522				5,847		6,607		6,330		4,674
31		5,531				5,464				6,174		....

	July.		August.		September		October		November.		December.	
1		4,475		5,262		4,756		5,825		11,675	...	11,034
2		4,436		5,208		5,299		5,904		11,782		10,881
3		4,959		5,287		5,804		5,901		10,657		11,397
4		4,893		4,726		5,723		6,899		11,154		11,378
5		4,956		5,114		5,804		8,102		11,669		11,385
6		5,025		5,401		5,207		7,461		11,674		11,411
7		4,591		5,454		5,283		8,647		11,550		11,416
8		4,665		5,021		4,955		9,240		9,906		11,228
9		4,555		5,518		5,136		9,239		9,761		11,375
10		5,061		5,521		5,283		9,574		8,552		11,752
11		5,002		5,018		5,470		9,746		8,648		11,848
12		5,106		5,306		5,466		9,773		9,467		11,856
13		5,017		5,523		5,550		8,883		10,670		11,831
14		4,580		5,602		5,577		9,444		11,122		11,796
15		4,562		5,664		5,330		9,881		11,208		11,429
16		5,111		5,665		5,451		10,197		11,117		11,648
17		4,969		5,673		5,481		10,744		10,452		11,808
18		5,122		5,106		5,285		11,086		10,787		11,842
19		4,904		5,138		5,205		11,308		11,233		11,846
20		4,875		5,599		5,289		10,321		11,043		11,851
21		4,425		5,747		5,351		10,618		11,258		11,861
22		4,605		5,752		5,169		10,776		11,398		11,232
23		4,907		5,815		5,361		11,747		11,618		11,250
24		5,111		5,890		5,525		11,628		10,822		11,543
25		5,097		5,230		5,660		11,605		11,175		11,193
26		5,072		5,314		5,753		11,294		11,620		11,558
27		5,197		5,279		5,995		10,412		11,840		[illegible]
28		4,672		5,554		5,828		10,771		12,010		11,709
29		4,970		5,815		5,447		11,218		11,960		11,068
30		5,079		5,677		5,660		11,496		11,795		11,437
31		4,980		5,431				11,660				11,594

COMBINED DISCHARGE of Winnipeg River below Lake of the Woods Outlets for 1913.

[Drainage area, 26,400 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Dis-charge.	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge.	Gauge Height	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	...	11,553		11,708	...	6,981		6,686		16,325		19,605
2		11,584		11,547		6,978		6,616		16,422	..	19,719
3		11,739		11,475		7,208		6,204		16,646		20,474
4		11,819		11,482		7,410		6,039		15,798		20,531
5		11,344		11,403		7,306		6,044		16,000		20,701
6		11,535		11,394		7,279		5,847		16,710		20,872
7		11,837		11,358		7,236		6,119		16,968		20,709
8		11,716		11,244		7,147		6,410		16,944		19,937
9		11,802		10,751		6,632		6,738		17,070		19,863
10		11,584		10,742		6,388		6,450		17,180		20,579
11		11,605		10,739		7,178		6,200		16,277		20,703
12		11,166		10,621		7,269		6,184		16,376		20,444
13		11,336		10,446		7,306		5,898		17,599		20,349
14		11,586		10,298		7,347		5,915		18,347		20,118
15		11,461		10,152		7,353		6,075		19,238		19,647
16		11,565		9,361		6,625		6,456		19,579		19,570
17		11,617		9,258		6,484		6,866		19,697		20,273
18		11,637		9,045		7,182		7,106		19,050		20,582
19		11,172		8,747		7,176		7,205		18,978		20,582
20		11,473		8,340		7,343		6,432		19,252		20,561
21		11,659		8,043		7,350		6,654		19,720		20,451
22		11,707		7,664		7,404		9,237		20,128		19,685
23		11,733		6,948		6,575		10,938		20,806		19,674
24		11,693		6,848		6,486		12,702		19,503		19,927
25		11,640		[illegible],138		7,072		14,132		19,223		20,136
26		11,225		7,250		6,955		14,827		19,232		20,042
27		11,358		7,081		7,002		14,1[illegible]		19,469		19,850
28		11,588		6,895		6,915		14,[illegible]		19,880		19,768
29		11,489				6,905		15,7[illegible]		20,223		18,882
30		11,508				6,090		16,0[illegible]		20,383		18,837
31		11,583		...		6,101				20,443		......

[Drainage area, 26,400 square miles.]

	July.		August		September		October.		November.		December.	
1		18,674		15,875		14,555		8,407		8,447	......	8,287
2		18,786		15,734		14,380		8,562		7,317		8,682
3		19,476		14,921		14,140		8,552		7,612		8,857
4		19,604		14,867		14,206		8,437		8,217		8,842
5		18,570		14,664		14,244		6,977		8,332		8,477
6		17,704		14,923		13,986		7,997		8,392		8,087
7		17,142		14,981		13,842		8,217		8,422		6,827
8		16,964		15,170		13,643		8,442		8,147		7,327
9		15,596		15,150		13,848		8,347		7,087		7,792
10		13,871		14,665		13,874		8,542		7,337		7,962
11		13,341		14,704		13,988		8,342		8,317		8,057
12		13,338		14,955		13,928		7,502		8,337		8,277
13		12,652		14,997		13,959		8,027		8,302		8,122
14		13,224		14,952		13,725		8,352		8,202		7,112
15		13,096		15,212		13,699		8,322		8,142		7,187
16		13,194		15,267		13,908		8,352		6,997		7,657
17		13,224		14,870		13,934		8,342		7,602		8,082
18		13,246		14,550		14,021		8,497		8,112		8,407
19		12,931		14,668		14,264		7,272		8,287		8,127
20		12,237		14,648		13,811		7,212		8,612		8,237
21		12,267		14,731		12,207		8,337		8,257		7,632
22		12,519		15,009		13,440		8,147		8,482		7,692
23		12,715		14,951		11,430		8,277		7,422		8,232
24		14,119		14,681		10,609		8,347		7,777		8,482
25		15,061		14,593		10,576		8,427		8,432		7,572
26		15,201		14,655		10,551		7,547		8,582		7,952
27		14,751		15,[illegible]		10,[illegible]		7,752		8,627		8,457
28		14,960		14,426		7,260		8,417		8,627		7,652
29		15,487		14,582		8,421		8,552		8,702		7,992
30		15,720		14,832		8,542		8,580		7,592		8,642
31		15,831		14,017				8,482		...		8,797

COMBINED DISCHARGE of Winnipeg River below Lake of the Woods Outlets for 1914.

[Drainage Area, 26,400 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft
1		8,692		7,817		10,602		10,017		10,463		16,594
2		8,792		7,747		10,607		10,042		10,363		16,944
3		8,767		8,112		10,547		10,097		10,323		17,149
4		7,987		8,157		10,497		10,127		10,278		17,262
5		7,667		8,182		10,542		9,737		10,273		17,394
6		7,832		7,857		10,542		9,242		10,493		17,334
7		7,792		7,812		10,622		10,057		10,828		17,039
8		8,277		7,417		9,982		10,032		11,008		17,379
9		8,657		7,507		10,172		9,967		10,743		17,821
10		8,752		7,727		10,657		9,352		9,948		18,304
11		8,032		7,752		10,682		9,372		10,070		18,356
12		8,172		7,737		10,752		9,297		11,109		18,371
13		8,567		7,842		10,822		8,852		11,260		18,481
14		8,647		7,897		10,707		9,087		11,223		17,959
15		8,687		7,712		9,702		9,512		11,365		18,011
16		8,417		7,547		9,712		9,342		11,209		17,979
17		8,172		7,752		10,282		9,337		10,760		17,782
18		7,557		7,717		10,482		9,607		11,403		18,094
19		7,327		8,082		10,532		9,557		11,925		18,551
20		7,737		8,207		10,597		10,217		12,370		18,792
21		7,997		8,467		10,597		10,457		13,005		18,576
22		7,532		8,472		9,982		10,447		13,480		19,044
23		7,407		8,732		10,037		9,872		13,625		19,867
24		7,467		9,777		10,277		9,907		13,235		20,166
25		7,077		10,047		10,222		9,887		13,555		20,259
26		7,147		10,332		10,232		9,812		14,345		20,352
27		7,657		10,657		10,267		8,927		15,300		20,302
28		7,787		11,172		10,217		10,222		16,363		19,737
29		7,967		...		9,812		10,537		16,880		19,786
30		8,077		...		9,662		10,462		17,078		19,891
31		8,077				9,812				16,875		....

Day.	July.	August.	September.	October.	November.	December.
1	19,421	19,419	13,842	13,324	9,506	10,015
2	19,482	19,201	13,562	13,325	9,626	10,131
3	19,541	19,317	13,562	13,313	9,736	10,210
4	19,582	19,591	13,577	12,658	9,795	10,179
5	19,619	19,625	13,742	13,092	9,739	10,081
6	19,584	19,545	13,367	13,397	9,751	8,739
7	19,671	19,280	13,617	13,447	9,735	9,150
8	20,059	19,159	13,857	13,517	9,361	9,413
9	19,964	18,943	13,732	13,557	9,476	9,444
10	20,229	18,897	13,892	13,612	9,864	9,554
11	20,019	18,860	13,497	12,850	9,937	9,433
12	19,834	18,836	13,667	12,822	9,950	9,441
13	19,881	18,765	13,181	13,179	9,935	8,687
14	19,939	18,633	13,732	12,386	9,917	9,605
15	20,149	18,583	13,742	11,115	9,306	10,049
16	20,311	18,457	13,903	10,671	9,343	10,115
17	20,371	18,567	13,667	10,333	9,445	9,944
18	20,176	18,612	13,864	9,487	9,824	9,844
19	19,944	18,917	13,565	9,866	10,065	9,825
20	20,019	19,272	14,215	10,421	10,065	8,926
21	19,811	19,332	14,329	10,260	9,989	9,573
22	[illegible]	19,112	13,492	10,436	9,601	10,056
23	19,85[illegible]	18,497	13,253	9,752	10,402	10,141
24	19,857	18,887	13,475	9,581	10,520	10,029
25	19,794	18,917	13,242	9,521	10,708	9,689
26	19,694	16,592	13,138	9,707	10,604	9,604
27	13,644	15,590	12,903	9,817	10,601	8,973
28	19,959	11,972	13,187	9,795	10,362	9,428
29	20,171	11,127	13,322	10,126	9,980	10,030
30	20,286	13,877	13,377	10,091	10,015	10,081
31	20,218	13,777		9,852		10,000

MONTHLY DISCHARGE of Winnipeg River at Outlets of the Lake of the Woods, for the years 1912–14.

Month.	Discharge in Second-feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area	Total in acre-feet.
1912						
January	5,855	5,153	5,555	0·210	0·242	341,600
February	6,321	5,171	5,795	0·220	0·229	333,300
March	6,267	5,464	6,010	0·228	0·263	369,500
April	6,649	5,722	6,270	0·237	0·264	373,100
May	7,045	5,783	6,505	0·246	0·284	400,000
June	6,466	4,674	5,435	0·206	0·230	323,400
July	5,197	4,425	4,870	0·184	0·212	299,400
August	5,890	4,726	5,430	0·206	0·238	333,900
September	5,828	4,756	5,425	0·205	0·229	322,800
October	11,747	5,825	9,720	0·368	0·424	597,700
November	12,010	8,552	10,990	0·416	0·464	654,000
December	11,861	10,881	11,520	0·436	0·503	708,300
The year	12,010	4,425	6,960	0·263	3·582	5,057,000
1913						
January	11,837	11,166	11,560	0·438	0·505	710,800
February	11,708	6,848	9,570	0·363	0·378	531,500
March	7,410	6,090	6,990	0·265	0·306	429,800
April	16,023	5,847	8,550	0·324	0·362	508,800
May	20,806	15,798	18,370	0·696	0·802	1,129,500
June	20,782	18,837	20,100	0·761	0·849	1,196,000
July	19,694	12,237	15,020	0·569	0·656	923,500
August	15,875	14,017	14,880	0·563	0·649	914,900
September	14,555	7,260	13,100	0·496	0·553	779,500
October	8,580	7,212	8,180	0·310	0·357	503,000
November	8,702	7,087	8,090	0·306	0·341	481,400
December	8,857	7,112	8,050	0·305	0·352	495,000
The year	20,806	5,847	11,870	0·449	6·110	8,603,700
1914						
January	8,792	7,077	8,020	0·304	0·351	493,100
February	11,172	7,417	8,360	0·317	0·330	464,300
March	10,822	9,662	10,320	0·391	0·451	634,500
April	10,537	8,852	9,780	0·370	0·413	582,000
May	17,078	9,948	12,300	0·466	0·537	756,300
June	20,352	16,594	18,450	0·699	0·780	1,097,900
July	20,476	19,421	19,910	0·754	0·869	1,224,200
August	19,625	13,777	18,200	0·689	0·794	1,119,100
September	13,903	12,903	13,520	0·512	0·571	804,500
October	13,612	9,487	11,460	0·434	0·500	704,600
November	10,708	9,306	9,900	0·375	0·418	589,100
December	10,210	8,687	9,850	0·373	0·430	605,700
The year	20,476	7,077	12,510	0·474	6·444	9,075,300

WINNIPEG RIVER AND TRIBUTARIES.

Winnipeg River.—The Winnipeg river is one of the most important in the province of Manitoba, forming the source of a power supply for the city of Winnipeg. It joins lake of the Woods to lake Winnipeg, flowing in a westerly direction from the former to the latter. The drainage area of this river is 53,500 square miles above the mouth. The basin has all the characteristics of of the Laurentian formation, being dotted with lakes, ponds, and muskegs. A considerable portion of the basin is composed of lake areas, the size of which range between a few square miles up to 1,500 miles, the latter being the size of the lake of the Woods. The country drained is rough and more or less timbered. The upper part of the area has been lumbered to a considerable extent, and still affords a field for such industry.

Assiniboine River, Headingly. Meter section at Bridge.

Souris River, Wawanesa. Meter section at Bridge.

The river itself is of considerable proportions, and is in the nature of lake-like expanses which are joined by short stretches of swift water or falls. On account of these features, splendid opportunity is offered for the development of water-power. At the present time advantage has been taken of these possibilities in two cases, and developments are to be found at Point du Bois, where the city of Winnipeg has a plant, and on the Pinawa channel, where the Winnipeg Street Railway plant is in operation. A number of other sites are capable of economic development, and it has been estimated that a total output of approximately 400,000 h.-p. is available from this river within the province of Manitoba.

In consequence of the importance of this river, a number of stations at which records of discharge have been obtained have been established. They are as follows:—

1.—The Dalles.[1]
2.—Throat Rapids.[1]
3.—Minaki.
4.—Whitedog Rapids.
5.—Slave Falls.
6.—Otter Falls.
7.—Pinawa Channel.
8.—Grand du Bonnet Falls.

At some of these points, continuous discharges are not available, the records being confined to a few isolated meterings.

Tributaries.—The tributaries of the Winnipeg river are, with one exception, of minor importance, having for the most part small drainage areas. The exception is, however, of the greatest importance, as nearly one-half of the total drainage area above the junction is tributary to it. This river is the English, which enters the Winnipeg from the north, just within the province of Ontario. The other tributaries of the Winnipeg river are: the Whiteshell river, which joins the main river in the lake-like expanse known as Jessie lake; the Whitemouth, which enters just below the Seven Sisters rapids; and the Bird river, which flows into Lac du Bonnet.

Of these tributaries the Whitemouth is the only one for which daily records of discharge are available.

Winnipeg River At Minaki.

History.—This station, established by C. O. Allen on September 23, 1913, was necessitated by the study of the early gauging records in the vicinity of the Lake of the Woods outlets.

Location of Section.—The section is located on the down-stream side of the Grand Trunk Pacific Railway bridge, three-quarters of a mile east of the Minaki station and one-quarter of a mile downstream from the Holst Point hotel. The initial point is marked by three spikes driven in the guard rail at the west end of the bridge on the downstream side.

Records available.—Daily gauge records, for which the station was primarily established, are available since September 24, 1913. Intermittent meterings in connection with the study of the upper river have been made at the section, but, on account of the physical conditions at the station, no attempt has been made to construct a discharge curve.

Drainage area.—The drainage area above Minaki is 27,000 square miles.

Gauge.—A vertical staff gauge, 6 feet long, is fastened to a plank which is spiked to the ice breaker at the east end of the bridge, and is 30 feet downstream from the section. It is referred to three bench-marks set to W. P. S. datum.

[1] See 'Miscellaneous Meterings.'

Channel.—It is straight for 50 feet above the station and 1,000 feet below. The channel is divided by a pier of the bridge which stands in the river about 65 feet from the east shore. The stream is moderately swift, but the bed of the stream is not liable to shift. It is confined to the two channels under all stages.

Discharge measurements.—They are made from the bridge deck, the intervals being marked on the guard rail.

Accuracy.—The channel forms a connecting link or strait between two lake-like expanses; on this account the discharge does not always bear the same relation to gauge heights, the ponding effect below being noticeable. A discharge curve for the station has not been constructed.

Discharge Measurements of Winnipeg River at G.T.R. Bridge, Minaki, 1912-13.

Date.	Hydrographer.	Meter No	Width.	Area of Section	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
June 15	A. Pirie	1374	346	9,456	0·50		4,740
1913.							
Sept. 23	C. O. Allen	1435	363	9,414	1·49	33·99	13,180
" 25	"	1435	363	9,368	1·38	33·88	12,927
Nov. 27	"	1375	357	8,967	1·02	32·26	9,126
" 28	"	1375	357	8,836	1·02	32·27	9,012

Winnipeg River—Whitedog Falls, North and South Channels.

History.—The meter section on the south channel at Whitedog was established on May 18, 1914, by S. C. O'Grady, and on the north channel on May 23, 1914, since which date it has been in operation.

Location of Section.—The section on the south channel is located about 150 feet above the second falls, reached from the portage at the Hudson's Bay store. The initial point is marked by a nail driven in a blazed tree on the north side of the river, about 150 feet above the second falls.

The section on the north channel is 50 feet above the head of the first falls. The initial point is a white arrow painted on the solid rock on the right bank of the channel. The discharge measurements are referred to the gauge at Minaki.

Records available.—The discharge measurements were taken since the establishment of the stations and are referred to the gauge at Minaki, which has been operated since September 24, 1913. Daily discharge records are available since that date. The discharges of these stations must be combined to give the total discharge of the Winnipeg river at that point.

Drainage area.—The drainage area above these sections is 27,500 square miles.

Gauge.—The gauge on the south channel is a vertical staff gauge, bolted to the rock on the left bank, 30 feet above the section; it reads direct.

On the north channel a vertical staff gauge is bolted to the rock on the right bank, 40 feet above the section; it also reads direct.

Owing to the absence of a gauge reader at these sections, all meterings are referred to the gauge at Minaki, which has been read daily since September, 1913.

Channel.—The south channel is approximately 400 feet wide, and is composed of rock and not subject to shifting, the control for the section being the crest of the falls, 150 feet below. The banks are high enough to ensure that under flood conditions no overflow will occur. The channel is straight and free from eddies under nearly all conditions.

The north channel is much narrower. It is also composed of clay and solid rock and free from likelihood of shifting, the control being only 50 feet below. The channel is straight both above and below the section for a sufficient distance to ensure freedom from eddies.

Discharge Measurements.—Sufficient meterings have been made to define the discharge curve over a range of 2.5 feet, forty-one in all being taken at the north channel, and twenty-nine at the south channel. They are made in the first case from a boat, and in the north channel by means of a cable carrier.

Accuracy.—The discharge curve is well defined between gauge heights 1,033 and 1,036 W.P.S. datum; above and below those heights the curve is only fairly well defined.

DISCHARGE MEASUREMENTS of Winnipeg River at Whitedog, North Channel, 1914.

Date		Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914.				Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May	23	S. C. O'Grady	1462	41	234	2·15	33·56	504
"	23	"	1462	41	234	2·12	33·56	495
July	7	T. J. Moore.	1196	41	293	3·51	35·56	1,028
"	7	"	1196	41	293	3·47	35·56	1,018
Aug.	26	C. C. Galloway	1196	40	295	3·16	34·96	929
"	27	"	1196	40	292	3·00	34·90	880
"	27	"	1196	40	292	3·04	34·90	889
"	28	S. C. O'Grady	1196	40	289	2·84	34·82	819
"	28	"	1196	40	289	2·81	34·82	812
"	29	"	1196	40	285	2·91	34·70	836
"	29	"	1196	40	278	2·85	34·61	794
Sept.	1	"	1196	40	269	2·72	34·46	733
"	1	"	1196	40	269	2·84	34·46	761
"	2	"	1196	40	262	2·65	34·41	695
Oct.	12	"	1196	40	252	2·35	34·11	594
"	14	"	1196	41	259	2·44	33·96	631
"	15	"	1196	41	255	2·37	33·97	602
"	15	"	1196	41	255	2·39	33·97	609
"	16	"	1196	41	253	2·40	33·84	607
"	16	"	1196	41	253	2·40	33·84	607
"	17	"	1196	41	246	2·22	33·74	546
"	17	"	1196	41	226	2·22	33·74	552
"	18	"	1196	41	247	2·12	33·63	521
"	18	"	1196	41	217	2·15	33·63	540
"	19	"	1196	41	239	2·18	33·50	21
"	19	"	1196	41	239	2·19	33·50	524
"	20	"	1196	41	235	2·06	33·46	481
"	20	"	1196	41	235	2·07	33·46	486
"	21	"	1196	41	233	1·99	33·38	462
"	21	"	1196	41	233	1·99	33·38	464
"	22	C. C. Galloway	1196	41	231	1·97	33·33	454
"	22	"	1196	41	231	1·98	33·33	456
"	23	S. C. O'Grady	1196	41	228	1·92	33·29	430
"	23	"	1196	1	228	1·88	33·29	428
"	25	"	1196	[illegible]	223	1·90	33·19	424
"	25	"	1196	41	223	1·90	33·19	423
"	26	"	1196	41	221	1·86	33·13	410
"	26	"	1196	41	221	1·85	33·13	408
"	27	"	1196	41	219	1·71	33·06	373
"	28	"	1196	38	218	1·70	33·61	369
"	28	"	1196	38	218	1·70	33·04	370

NOTE.—Gauge heights at Minaki employed.

DAILY GAUGE HEIGHT AND DISCHARGE of Winnipeg River at Whitedog, North Channel, for 1913.

[Drainage area 27,500 square miles.]

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
					Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft
1							33·14	397	32·22	181	32·22	181
2							33·09	385	32·22	181	32·27	192
3							32·99	360	32·22	181	32·32	204
4							32·84	324	32·12	158	32·22	181
5							32·79	312	32·22	181	32·27	192
6							32·79	312	32·22	181	32·22	181
7							32·67	284	32·32	204	32·27	192
8							32·52	249	32·32	204	32·32	204
9							32·62	272	32·22	181	32·22	181
10							32·52	249	32·12	158	32·27	192
11							32·52	249	32·22	181	32·32	204
12							32·52	249	32·32	204	32·32	204
13							32·57	261	32·32	204	32·32	204
14							32·42	226	32·22	181	32·32	204
15							32·37	215	32·22	181	32·27	192
16							32·32	204	32·22	181	32·22	181
17							32·27	192	32·22	181	32·22	181
18							32·22	181	32·32	204	32·32	204
19							32·37	215	32·22	181	32·22	181
20							32·22	181	32·27	192	32·27	192
21							32·22	181	32·22	181	32·22	181
22							32·22	181	32·17	169	32·22	181
23							32·22	181	32·22	181	32·22	181
24					33·64	529	32·22	181	32·27	192	32·22	181
25					33·54	502	32·22	181	32·22	181	32·22	181
26					33·59	515	32·22	181	32·27	192	32·22	181
27					33·49	488	32·17	169	32·22	181	32·17	169
28					33·44	475	32·22	181	32·22	181	32·22	181
29					33·34	448	32·22	181	32·22	181	32·27	192
30					33·29	435	32·22	181	32·22	181	32·22	181
31							32·22	181			32·22	181

NOTE.—Open-water conditions all the year round.
Below gauge height 3,033·00 the rating curve is not well defined.
Gauge heights refer to readings on the Minaki gauge.

Daily Gauge Height and Discharge of Winnipeg River, at Whitedog, North Channel, for 1914.

(Drainage area, 27,500 square miles.)

Day.	January.		February.		March.		April		May		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1	32·26	190	32·16	167	32·16	167	33·01	365	33·11	390	34·51	779
2	32·31	201	32·16	167	32·16	167	32·96	352	33·11	390	34·56	794
3	32·36	213	32·16	167	32·26	190	32·96	352	33·06	377	34·80	860
4	32·36	213	32·16	167	32·26	100	32·96	352	33·16	402	34·91	904
5	32·31	201	32·16	167	32·36	213	33·01	365	33·11	390	34·96	920
6	32·26	190	32·16	167	32·46	236	32·96	352	33·21	415	34·98	927
7	32·26	190	32·11	155	32·56	259	33·01	365	33·26	428	35·06	953
8	32·26	190	32·11	155	32·56	259	33·06	377	33·26	428	35·08	959
9	32·26	190	32·06	144	32·56	259	33·06	377	33·32	443	35·14	979
10	32·26	190	32·06	144	32·56	259	32·96	352	33·34	448	35·22	1,010
11	32·26	190	32·06	144	32·76	305	32·96	352	33·35	451	35·26	1,020
12	32·26	190	32·06	144	32·76	305	33·01	365	33·36	454	35·31	1,040
13	32·31	201	32·06	144	32·86	328	32·96	352	33·38	459	35·36	1,050
14	32·26	190	32·06	144	32·96	352	32·91	340	33·36	454	35·34	1,050
15	32·26	190	32·06	144	32·96	352	32·91	340	33·36	454	35·36	1,050
16	32·26	190	31·96	121	32·96	352	32·86	328	33·41	467	35·32	1,040
17	32·26	190	31·96	121	32·96	352	32·86	328	33·42	469	35·31	1,040
18	32·26	190	31·96	121	32·96	352	33·01	365	33·43	472	35·36	1,050
19	32·26	190	31·96	121	33·06	377	32·91	340	33·53	499	35·36	1,050
20	32·26	190	31·96	121	33·06	377	32·96	352	33·46	480	35·36	1,050
21	32·26	190	31·96	121	33·06	377	33·01	365	33·46	480	35·41	1,070
22	32·26	190	31·96	121	33·06	377	33·06	377	33·50	491	35·44	1,080
23	32·21	178	31·96	121	33·16	402	33·01	365	33·56	507	35·40	1,070
24	32·21	178	31·96	121	33·16	402	33·06	377	33·56	507	35·44	1,080
25	32·21	178	31·96	121	33·06	377	33·01	365	33·72	551	35·48	1,090
26	32·21	178	31·96	121	33·06	377	33·06	377	33·91	604	35·52	1,110
27	32·16	167	31·96	121	33·06	377	33·06	377	33·96	618	35·56	1,120
28	32·16	167	31·96	121	33·06	377	33·06	377	34·02	635	35·58	1,130
29	32·16	167	......	......	33·06	377	33·16	402	34·18	681	35·51	1,100
30	32·16	167	......	......	33·01	365	33·11	390	34·33	725	35·56	1,120
31	32·16	167		......	33·01	365	......	......	34·44	758		......

Day.	July.		August.		September.		October.		November.		December	
1	35·61	1,140	35·56	1,120	34·46	764	33·94	612	33·09	385	32·92	343
2	35·60	1,140	35·58	1,130	34·41	749	33·91	604	33·03	370	32·96	352
3	35·58	1,130	35·56	1,120	34·36	734	33·90	601	33·04	372	32·94	348
4	35·56	1,120	35·52	1,110	34·26	704	33·90	601	32·97	355	32·93	345
5	35·61	1,140	35·46	1,090	34·16	675	33·89	598	32·96	352	32·91	340
6	35·60	1,140	35·44	1,080	34·06	646	33·88	595	32·93	345		
7	35·56	1,120	35·46	1,090	34·01	632	33·86	590	32·89	336		
8	35·52	1,110	35·41	1,070	33·96	618	33·84	584	32·92	343		
9	35·56	1,120	35·50	1,100	34·04	641	33·86	590	32·86	328		
10	35·46	1,090	35·46	1,090	34·00	629	33·87	593	32·92	343		
11	35·56	1,120	35·41	1,070	33·94	612	34·04	641	32·90	338		
12	35·66	1,160	35·36	1,050	33·91	604	34·11	661	32·88	333		
13	35·66	1,160	35·32	1,040	33·94	612	34·02	635	32·89	336		
14	35·61	1,140	35·26	1,020	33·96	618	33·96	618	32·90	338		
15	35·61	1,140	35·21	1,000	33·94	612	33·97	621	32·96	352		
16	35·66	1,160	35·26	1,020	33·96	618	33·84	584	32·91	340		
17	35·70	1,170	35·25	1,020	33·94	612	33·74	556	32·94	348		
18	35·72	1,180	35·36	1,050	34·00	629	33·63	526	32·86	328		
19	35·61	1,140	35·30	1,030	34·01	632	33·50	491	32·95	350		
20	35·66	1,160	35·26	1,020	34·02	635	33·46	480	32·91	340		
21	35·66	1,160	35·26	1,020	34·01	632	33·38	459	32·95	350		
22	35·71	1,170	35·21	1,000	34·06	646	33·33	446	32·92	343		
23	35·70	1,170	35·16	986	34·06	646	33·29	435	32·91	340		
24	35·68	1,160	35·10	966	34·01	632	33·24	422	32·92	343		
25	35·66	1,160	35·02	940	34·00	629	33·19	409	32·96	352		
26	35·66	1,160	34·96	920	33·98	623	33·13	395	33·00	362		
27	35·61	1,140	34·90	901	33·96	618	33·06	377	32·95	350		
28	35·56	1,120	34·82	875	33·96	618	33·04	372	32·93	345		
29	35·46	1,090	34·76	837	33·97	621	33·03	370	32·91	340		
30	35·60	1,140	34·61	809	33·96	618	33·04	372	32·94	348		
31	35·60	1,140	34·56	794	......	......	33·06	377	......	......		

Note.—Open water conditions all the year round. Below gauge height 1,033·00 the rating curve is not well defined. Gauge heights refer to readings on the Minaki gauge.

Monthly Discharge of Winnipeg River at North Channel, Whitedog, for the year 1913-14.

[Drainage area, 27,500 square miles.]

Month.	Discharge in Second-feet.			Run-off
	Maximum.	Minimum.	Mean	Total in acre-feet.
1913				
September			[1]550	32,700
October	397	169	235	14,500
November	204	158	184	10,900
December	204	169	188	11,600
The period	397	158	289	69,700
1914				
January	213	167	187	11,500
February	167	121	139	7,700
March	402	167	317	19,500
April	402	328	362	21,500
May	758	377	494	30,400
June	1,130	779	1,020	60,700
July	1,180	1,090	1,140	70,100
August	1,130	794	1,010	62,100
September	764	604	643	38,300
October	661	370	523	32,200
November	385	328	347	20,600
December	.	....	[1]325	20,000
The year	1,180	121	542	394,600

Note.—Discharges marked thus ([1]) estimated.

Monthly Discharge of Winnipeg River at Whitedog Falls, for the year 1913-14.

[Drainage area, 27,500 square miles.]

Month	Discharge in Second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area	Total in acre-feet.
1913						
September	....	.....	[1]12,600	0·458	0·511	749,800
October	10,500	7,300	8,250	0·300	0·346	507,300
November	7,800	7,150	7,550	0·274	0·306	449,300
December	7,800	7,300	7,600	0·276	0·318	467,300
The period	10,500	7,150	9,000	0·327	1·481	2,173,700
1914						
January	7,900	7,300	7,600	0·276	0·318	467,300
February	7,300	6,700	6,950	0·253	0·264	386,000
March	10,500	7,300	9,400	0·342	0·394	578,000
April	10,500	9,600	10,000	0·363	0·405	595,000
May	15,600	10,200	11,800	0·429	0·495	725,600
June	21,400	15,900	19,600	0·713	0·796	1,166,300
July	22,200	20,800	21,600	0·786	0·906	1,328,100
August	21,400	16,400	19,600	0·713	0·822	1,205,200
September	15,700	13,300	13,800	0·502	0·560	821,200
October	14,200	10,100	12,200	0·444	0·512	750,100
November	10,300	9,600	9,800	0·356	0·397	583,100
December	....	....	[1]9,700	0·353	0·407	596,400
The year	22,200	6,700	12,700	0·461	6·276	9,202,300

Note.—Discharges marked thus ([1]) estimated. This table gives the total combined discharges, run-off, etc., for the North and South channels of Whitedog falls.

Discharge Measurements of Winnipeg River at Whitedog, South Channel, for 1914.

Date.		Hydrographer.	Meter No.	Width.	Area of Section	Mean Velocity.	Gauge Height	Discharge.
1914				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
May	18	S. C. O'Grady	1,196	330	6,665	1·74	33·43	11,589
July	6	T. J. Moore	1,196	350	7,469	2·50	35·60	18,705
"	6	"	1,196	350	7,469	2·27	35·60	16,991
Aug.	26	S. C. O'Grady	1,196	358	7,387	2·31	34·96	17,041
"	27	"	1,196	358	7,332	2·32	34·90	17,032
"	28	"	1,196	348	7,322	2·29	34·82	16,769
"	29	"	1,196	357	7,285	2·33	34·70	16,917
"	30	"	1,196	357	7,211	2·18	34·61	15,667
"	31	"	1,196	356	7,158	2·15	34·56	15,420
Sept.	1	"	1,196	356	7,088	2·08	34·46	14,766
"	2	"	1,196	356	7,042	2·01	34·41	14,137
"	3	"	1,196	344	6,982	2·03	34·36	14,175
Oct.	13	"	1,196	339	6,818	1·95	34·02	13,287
"	13	"	1,196	339	6,818	1·91	34·02	13,031
"	14	"	1,196	339	6,830	1·90	33·96	13,046
"	15	"	1,196	339	6,778	1·89	33·97	12,827
"	16	"	1,196	339	6,745	1·85	33·84	12,502
"	17	"	1,196	333	6,682	1·85	33·74	12,325
"	18	"	1,196	333	6,644	1·79	33·63	11,887
"	19	"	1,196	331	6,558	1·78	33·50	11,649
"	20	"	1,196	330	6,540	1·69	33·46	11,061
"	21	"	1,196	330	6,477	1·66	33·38	10,775
"	23	"	1,196	329	6,443	1·64	33·29	10,578
"	24	"	1,196	329	6,443	1·62	33·24	10,413
"	25	"	1,196	329	6,414	1·55	33·19	9,921
"	26	"	1,196	328	6,362	1·61	33·13	10,256
"	27	"	1,196	328	6,346	1·58	33·06	10,052
"	28	"	1,196	328	6,329	1·51	33·04	9,544
"	29	"	1,196	328	6,313	1·52	33·03	9,585

NOTE.—Gauge heights at Minaki employed.

Daily Gauge Height and Discharge of Winnipeg River at Whitedog, South Channel, for 1913.

[Drainage area, 27,500 square miles.]

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1							33·14	10,100	32·22	7,300	32·22	7,300
2							33·09	9,900	32·22	7,300	32·27	7,450
3							32·99	9,600	32·22	7,300	32·32	7,600
4							32·84	9,150	32·12	7,000	32·22	7,300
5							32·79	9,000	32·22	7,300	32·27	7,450
6							32·79	9,000	32·22	7,300	32·22	7,300
7							32·67	8,650	32·32	7,600	32·27	7,450
8							32·52	8,200	32·32	7,600	32·32	7,600
9							32·62	8,500	32·22	7,300	32·22	7,300
10							32·52	8,200	32·12	7,000	32·27	7,450
11							32·52	8,200	32·22	7,300	32·32	7,600
12							32·52	8,200	32·32	7,600	32·32	7,600
13							32·57	8,350	32·32	7,600	32·32	7,600
14							32·42	7,900	32·22	7,300	32·32	7,600
15							32·37	7,750	32·22	7,300	32·27	7,450
16							32·32	7,600	32·22	7,300	32·22	7,300
17							32·27	7,450	32·22	7,300	32·22	7,300
18							32·22	7,300	32·32	7,600	32·32	7,600
19							32·37	7,750	32·22	7,300	32·22	7,300
20							32·22	7,300	32·27	7,450	32·27	7,450
21							32·22	7,300	32·22	7,300	32·22	7,300
22							32·22	7,300	32·17	7,150	32·22	7,300
23							32·22	7,300	32·22	7,300	32·22	7,300
24					33·64	11,700	32·22	7,300	32·27	7,450	32·22	7,300
25					33·54	11,400	32·22	7,300	32·22	7,300	32·22	7,300
26					33·59	11,600	32·22	7,300	32·27	7,450	32·22	7,300
27					33·49	11,200	32·17	7,150	32·22	7,300	32·17	7,150
28					33·14	11,300	32·22	7,300	32·22	7,300	32·22	7,300
29					33·34	10,700	32·22	7,300	32·22	[illegible]	32·27	7,450
30					33·29	10,600	32·22	7,300	32·22	[illegible]	32·22	7,300
31							32·22	7,300			32·22	7,300

NOTE.—Discharge curve is only defined between gauge heights 1,033·00 and 1,035·00. Gauge heights refer to readings on the Minaki gauge.

Daily Gauge Height and Discharge of Winnipeg River at Whitedog, South Channel, for 1914.

[Drainage area, 27,500 square miles.]

Day.	January.		February.		March.		April.		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	32·26	7,450	32·16	7,150	32·16	7,150	33·01	9,700	33·11	10,000	34·51	15,100
2	32·31	7,600	32·16	7,150	32·16	7,150	32·96	9,550	33·11	10,000	34·56	15,300
3	32·36	7,750	32·16	7,150	32·26	7,450	32·96	9,550	33·06	9,850	34·80	16,400
4	32·36	7,750	32·16	7,150	32·26	7,450	32·96	9,550	33·16	10,100	34·91	16,900
5	32·31	7,600	32·16	7,150	32·36	7,750	33·01	9,700	33·11	10,000	34·96	17,200
6	32·26	7,450	32·16	7,150	32·46	8,050	32·96	9,550	33·21	10,300	34·98	17,300
7	32·26	7,450	32·11	7,000	32·56	8,350	33·01	9,700	33·26	10,500	35·06	17,700
8	32·26	7,450	32·11	7,000	32·56	8,350	33·06	9,850	33·26	10,500	35·08	17,800
9	32·26	7,450	32·06	6,850	32·56	8,350	33·06	9,850	33·32	10,700	35·14	18,100
10	32·26	7,450	32·06	6,850	32·56	8,350	32·96	9,550	33·34	10,700	35·22	18,500
11	32·26	7,450	32·06	6,850	32·76	8·950	32·96	9,550	33·35	10,800	35·26	18,700
12.	32·26	7,450	32·06	6,850	32·76	8,950	33·01	9,700	33·36	10,800	35·31	18,900
13	32·31	7,600	32·06	6,850	32·86	9,250	32·96	9,550	33·38	10,900	35·36	19,200
14	32·26	7,450	32·06	6,850	32·96	9,550	32·91	9,400	33·36	10,800	35·34	19,100
15	32·26	7,450	32·06	6·850	32·96	9,550	32·91	9,400	33·36	10,800	35·36	19,200
16	32·26	7,450	31·96	6,550	32·96	9,550	32·86	9,250	33·41	11,000	35·32	19,000
17	32·26	7,450	31·96	6,550	32·96	9,550	32·86	9,250	33·42	11,000	35·31	18,900
18	32·26	7,450	31·96	6,550	32·96	9,550	33·01	9,700	33·43	11,000	35·36	19,200
19	32·26	7,450	31·96	6,550	33·06	9,850	32·91	9,400	33·53	11,400	35·36	19,200
20	32·26	7,450	31·96	6,550	33·06	9,850	32·96	9,550	33·46	11,100	35·36	19,200
21	32·26	7,450	31·96	6,550	33·06	9,850	33·01	9,700	33·46	11,100	35·41	19,400
22	32·26	7,450	31·96	6,550	33·06	9,850	33·06	9,850	33·50	11,300	35·44	19,600
23	32·21	7,300	31·96	6,550	33·16	10,100	33·01	9,700	33·56	11,500	35·40	19,400
24	32·21	7,300	31·96	6,550	33·16	10,100	33·06	9,850	33·56	11,500	35·44	19,600
25	32·21	7,300	31·96	6,550	33·06	9,850	33·01	9,700	33·72	12,000	35·48	19,800
26	32·21	7,300	31·96	6,550	33·06	9,850	33·06	9,850	33·91	12,700	35·52	20,000
27	32·16	7,150	31·96	6,550	33·06	9,850	33·06	9,850	33·96	12,900	35·56	20,200
28	32·16	7,150	31·96	6,550	33·06	9,850	33·06	9,850	34·02	13,100	35·58	20,300
29	32·16	7,150	......	......	33·06	9,850	33·16	10,100	34·18	13,700	35·51	19,900
30	32·16	7,150	......	......	33·01	9,700	33·11	10,000	34·33	14,300	35·56	20,200
31	32·16	7,150	......	......	33·01	9,700	......	......	33·44	14,800	......	......

Day.	July		August.		September.		October.		November.		December.	
1	35·61	20,400	35·56	20,200	34·46	14,900	33·94	12,800	33·09	9,900	32·92	9,400
2	35·60	20,400	35·58	20,300	34·41	14,700	33·91	12,700	33·03	9,750	32·96	9,550
3	35·58	20,300	35·56	20,200	34·36	14,500	33·90	12,700	33·04	9,750	32·94	9,450
4	35·56	20,200	35·52	20,000	34·26	14,100	33·90	12,700	32·97	9,550	32·93	9,450
5	35·61	20,400	35·46	19,700	34·16	13,700	33·89	12,600	32·96	9,550	32·91	9,400
6	35·60	20,400	35·44	19,600	34·06	13,300	33·88	12,600	32·93	9,450		
7	35·56	20,200	35·46	19,700	34·01	13,100	33·86	12,500	32·89	9,300		
8	35·52	20,000	35·41	19,400	33·96	12,900	33·84	12,500	32·92	9,400		
9	35·56	20,200	35·50	19,900	34·04	13,200	33·86	12,500	32·86	9,250		
10	35·46	19,700	35·46	19,700	34·00	13,100	33·87	12,600	32·92	9,400		
11	35·56	20,200	35·41	19,400	33·94	12,800	34·04	13,200	32·90	9,350		
12	35·66	20,700	35·36	19,200	33·91	12,700	34·11	13,500	32·88	9,300		
13	35·66	20,700	35·32	19,000	33·94	12,800	34·02	13,100	32·89	9,300		
14	35·61	20,400	35·26	18,700	33·96	12,900	33·96	12,900	32·90	9,350		
15	35·61	20,400	35·21	18,400	33·94	12,800	33·97	12,900	32·96	9,550		
16	35·66	20,700	35·26	18,700	33·96	12,900	33·84	12,500	32·91	9,400		
17	35·70	20,900	35·25	18,600	33·94	12,800	33·74	12,100	32·94	9,450		
18	35·72	21,000	35·36	19,200	34·00	13,100	33·63	11,700	32·86	9,250		
19	35·61	20,400	35·30	18,900	34·01	13,100	33·50	11,300	32·95	9,500		
20	35·66	20,700	35·26	18,700	34·02	12,100	33·46	11,100	32·91	9,400		
21	35·66	20,700	35·26	18,700	34·01	13,100	33·38	10,900	32·95	9,500		
22	35·71	20,900	35·21	18,400	34·06	13,300	33·33	10,700	32·92	9,400		
23	35·70	20,900	35·16	18,200	34·06	13,300	33·29	10,600	32·91	9,400		
24	35·68	20,800	35·10	17,900	34·01	13,100	33·24	10,400	32·92	9,400		
25	35·66	20,700	35·02	17,500	34·00	13,100	33·19	10,200	32·96	9,550		
26	35·66	20,700	34·96	17,200	33·98	13,000	33·13	10,000	33·00	9,650		
27	35·61	20,400	34·90	16,900	33·96	12,900	33·06	9,850	32·95	9,500		
28	35·56	20,200	34·82	16,500	33·96	12,900	33·04	[illegible]	32·93	9,450		
29	35·46	19,700	34·70	15,900	33·97	12,900	33·03	[illegible]	32·91	[illegible]		
30	35·60	20,400	34·61	15,500	33·96	12,900	33·04	[illegible]	32·94	9,450		
31	35·60	20,400	34·56	15,300	......	......	33·06	[illegible]	......			

Note.—Discharge curve is only defined between gauge heights 1033·00 and 1035·00.
Gauge heights refer to readings on the Minaki gauge.

MONTHLY DISCHARGE of Winnipeg River at South Channel, Whitedog, for the years 1913-14.

(Drainage area, 27,500 square miles.)

Month	Discharge in Second-Feet			Run-Off
	Maximum.	Minimum.	Mean.	Total in acre-feet.
1913				
September	....	....	[1]12,000	714,000
October	10,100	7,150	8,000	491,900
November	7,600	7,000	7,350	437,400
December	7,600	7,150	7,400	455,000
The period	10,100	7,000	8,690	2,098,300
1914				
January	7,750	7,150	7,400	455,000
February	7,150	6,550	6,800	377,700
March	10,100	7,150	9,100	559,500
April	10,100	9,250	9,650	574,200
May	14,800	9,850	11,300	694,800
June	20,300	15,100	18,600	1,106,800
July	21,000	19,700	20,500	1,260,500
August	20,300	15,300	18,600	1,143,700
September	14,900	12,700	13,200	785,500
October	13,500	9,750	11,700	719,400
November	9,900	9,250	9,450	562,300
December			[1]9,400	578,000
The year	21,000	6,550	12,200	8,817,400

NOTE.—Discharges marked thus (1) estimated.

Fairford River at Fairford. Meter Section at Bridge, 1912.

WINNIPEG RIVER AT SLAVE FALLS.

History.—A number of meterings of the Winnipeg river were made by various interested parties between March, 1906, and October, 1911. These have all been referred to gauge heights in the tail-race of the plant at Point du Bois, though they were taken at various points in the river. The majority were taken at Otter falls. On October 1, 1911, D. L. McLean established a metering station at Slave falls, and this has been operated from that date. All meterings are referred to the gauge at the Point du Bois tail-race.

Location of section.—The metering section is located about 250 feet above the crest of the Slave falls, which is about 4 miles below the city of Winnipeg's plant at Point du Bois. The initial point is a chisel mark on the rock marked by paint, on the right bank near the cable tower.

Records available.—By referring the meterings made to the Point du Bois gauge, records of daily discharge have been computed from January, 1907, to October, 1911. Since that date daily discharges based upon records of discharge at Slave falls, referred to the Point du Bois gauge made by the Manitoba Hydrographic Survey, are available.

Drainage area.—The drainage area above Otter falls is 50,500 square miles, and above Slave falls the area is 49,700 square miles.

Gauge.—A vertical staff gauge nailed to a 4-inch by 6-inch timber braced in a crevice of the rock about 75 feet downstream from the section on the right bank. It is referred to B.-M. No. 189, W.P.S. 200 feet above the initial point.

Channel.—The channel is straight for 100 feet above and 350 feet below the gauge at nearly all stages. The bed is of solid rock with a few large boulders at the left side of the section. It is permanent and all the water at all stages is confined to the section.

Discharge Measurements.—Meterings are made from a cable car running on a cable stretched across the section. Meterings covering practically the complete range in stage have been taken.

Accuracy.—The discharge curve is well defined over the range in gauge height, both when plotted to the Slave Falls and Point du Bois gauges. On account of the drop at the falls below the station there is no possibility of backwater effect. Also the section is an open-water one at all seasons, so that the open-water rating applies the year round. The section is a very favourable one, and the accuracy of the records is high.

DISCHARGE MEASUREMENTS of Winnipeg River at Slave Falls, 1911–14.

Date.	Hydrographer.	Meter. No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 13	A. M. Beale	285	....	7,266	3·59	161·90	26,115
" 29	"	1,137	269	7,230	3·65	161·50	26,391
1912							
May 8	A. M. Beale	1,197	260	6,761	2·91	160·52	19,675
" 14	G. H. Burnham	1,197	264	7,014	3·26	161·20	22,865
" 28	A. M. Beale	1,197	273	7,366	3·65	161·88	26,886
June 4	E. B. Patterson	1,196	264	7,542	3·85	162·15	28,037
" 6	G. H. Burnham	1,187	277	7,565	3·95	162·50	29,882
" 10	E. B. Patterson	1,197	277	7,537	3·92	162·25	29,545
" 17	W. H. Richardson	1,197	273	7,449	3·80	162·09	28,306
" 24	"	1,197	272	7,396	3·67	161·90	27,143
July 6	"	1,197	272	7,238	3·56	161·75	25,767
" 8	"	1,197	271	7,237	3·55	161·78	25,691
" 11	"	1,197	271	7,446	3·54	161·76	26,358
" 15	"	1,197	271	7,446	3·58	161·77	26,657
" 16	"	1,197	272	7,473	3·60	161·79	26,903
" 17	"	1,197	271	7,473	3·54	161·80	26,454
" 18	"	1,197	271	7,446	3·52	161·78	26,210
" 19	"	1,197	271	7,473	3·55	161·75	26,529
" 20	"	1,197	271	7,473	3·55	161·76	26,529
Aug. 20	Alex. Pirie	1,197	272	7,369	3·74	161·98	27,560
Oct 23	"	1,197	293	7,935	4·43	163·28	35,152
Nov. 21	"	1,462	291	7,785	3·95	162·85	30,761
Dec. 31	"	1,462	274	7,430	3·64	162·10	27,095
1913							
Mar. 5	A. Pirie	1,469	268	6,717	2·85	160·65	19,110
May 1	"	1,186	266	6,943	3·30	160·89	22,912
June 24	S. C. O'Grady	285	281	7,850	4·46	162·96	34,998
July 18	A. Hannington	285	277	7,522	4·03	162·11	30,290
Oct. 1	C. O. Allen	1,435	264	7,268	2·96	161·03	21,513
Nov. 5	"	1,435	256	6,535	2·54	159·92	16,600

NOTE.—Gauge heights referred to tail-race gauge at Point du Bois.
Partial ice Cover.

DISCHARGE MEASUREMENTS of Winnipeg River at Slave Falls, 1911-14—*Con.*

Date		Hydrographer.	Meter No.	Width.	Area of Section	Mean Velocity.	Gauge Height.	Discharge.
1914				Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan.	13	E. B. Patterson	1,497	255	6,119	2·17	159·4	13,268
Feb.	11	C. O. Allen	1,497	254	5,954	2·00	159·53	11,922
April	8	"	1,497	255	6,169	2·36	159·60	14,584
May	6	G. J. Lamb	1,375	257	6,517	2·59	159·85	16,876
"	18	"	1,375	260	6,681	2·81	160·45	18,774
"	24	"	1,375	262	6,781	2·95	160·60	20,004
June	4	A. Pirie	1,939	274	7,481	3·85	162·12	28,829
"	5	"	1,939	274	7,480	3·85	162·12	28,839
"	9	"	1,939	280	7,775	4·18	162·62	32,500
"	10	"	1,939	280	7,775	4·24	162·72	32,938
"	11	"	1,939	280	7,788	4·27	162·77	33,306
"	13	"	1,939	281	7,820	4·29	162·82	33,615
"	15	"	1,939	281	7,820	4·30	162·95	33,638
"	22	"	1,939	290	7,917	4·38	163·10	34,713
"	23	"	1,939	282	7,877	4·32	163·12	34,310
"	24	"	1,939	284	7,896	4·36	163·12	34,428
"	26	"	1,939	293	7,951	4·45	163·12	35,394
"	29	"	1,939	293	7,964	4·45	163·27	35,459
"	30	"	1,939	294	7,994	4·46	163·32	35,683
July	3	"	1,939	294	8,023	4·52	163·35	36,366
"	7	"	1,939	293	7,965	4·49	163·32	35,672
"	13	"	1,939	295	8,063	4·53	163·38	36,561
"	14	"	1,939	295	8,063	4·55	163·40	36,759
"	15	"	1,939	295	8,063	4·55	163·36	36,690
"	18	"	1,939	295	8,063	4·50	163·35	36,310
"	20	"	1,939	294	8,048	4·50	163·35	36,173
"	22	"	1,939	294	8,048	4·55	163·40	36,606
"	23	"	1,939	294	8,048	4·57	163·32	36,381
"	24	"	1,939	294	8,033	4·55	163·30	36,592
"	25	"	1,939	293	8,004	4·23	163·36	33,855
"	28	"	1,939	293	8,004	4·44	163·28	35,529
"	29	"	1,939	293	7,989	4·52	163·30	36,116
"	30	"	1,939	292	7,960	4·45	163·28	35,429
"	31	"	1,939	292	7,932	4·41	163·15	34,957
Aug.	1	"	1,939	292	7,932	4·38	163·14	34,744
"	3	"	1,939	292	7,932	4·34	163·08	34,468
"	4	"	1,939	291	7,896	4·32	163·14	34,115
"	5	"	1,939	281	7,834	4·30	163·06	33,689
"	6	"	1,939	281	7,834	4·27	163·01	33,416
Sept.	10	"	1,939	272	7,322	3·58	161·77	26,282
"	11	"	1,939	271	7,292	3·55	161·67	25,942
"	14	"	1,939	271	7,292	3·57	161·70	26,019
"	15	"	1,939	271	7,292	[illegible]	161·62	25,834
"	16	"	1,939	269	7,260	3·[illegible]	161·62	24,606
"	17	"	1,939	269	7,234	3·[illegible]	161·65	25,446
"	18	"	1,939	269	7,234	3·47	161·57	25,105
"	19	"	1,939	269	7,208	3·45	161·52	24,938
"	22	"	1,939	269	7,234	3·49	161·67	25,223
"	23	"	1,939	269	7,260	3·53	161·67	25,597
"	24	"	1,939	269	7,234	3·51	161·65	25,376
"	25	"	1,939	269	7,234	[illegible]·50	161·62	25,301
"	28	"	1,939	269	7,260	3·50	161·62	25,388
"	29	"	1,939	269	7,234	3·44	161·66	24,911
"	30	"	1,939	269	7,234	3·46	161·57	25,048
Oct.	1	"	1,939	269	7,207	3·44	161·60	24,801
"	2	"	1,939	269	7,207	3·43	161·50	24,705
"	7	"	1,939	269	7,207	3·43	161·57	24,639
"	8	"	1,939	269	7,207	3·41	161·55	24,574
"	26	"	1,760	265	7,068	3·32	161·32	23,533
"	28	"	1,760	264	7,061	3·24	161·12	22,877
"	29	"	1,760	263	7,031	3·21	161·07	22,570
"	30	"	1,760	263	7,031	3·21	161·12	22,570
"	31	"	1,760	262	7,001	3·19	161·07	22,333
Nov.	2	"	1,760	262	7,001	3·21	161·12	22,472
"	3	"	1,760	261	6,974	3·15	160·95	21,967
"	5	"	1,760	261	6,948	3·14	160·92	21,817
"	6	"	1,760	261	6,948	3·14	160·87	21,817
"	7	"	1,760	261	6,921	3·05	160·85	21,109
"	9	"	1,760	261	6,974	3·20	161·05	22,317
"	10	"	1,760	260	6,893	3·03	160·80	20,886
"	11	"	1,760	260	6,893	3·02	160·77	20,817
"	13	"	1,760	259	6,892	3·01	160·95	20,745
"	19	"	1,760	259	6,865	2·98	160·77	20,458
"	20	"	1,760	259	6,865	2·98	160·77	20,458
"	21	"	1,760	258	6,813	2·98	160·72	20,303
"	23	"	1,760	259	6,865	3·01	160·77	20,664
"	24	"	1,760	259	6,639	2·96	160·80	20,243
"	25	"	1,760	259	6,839	2·98	160·77	20,380
"	27	"	1,760	258	6,813	2·97	160·72	20,235
"	28	"	1,760	258	6,813	2·96	160·70	20,166
"	30	"	1,760	259	6,839	2·98	160·75	20,380
Dec.	2	"	1,760	259	6,839	2·98	160·77	20,380
"	4	"	1,760	259	6,813	2·97	160·80	20,235
"	5	"	1,760	259	6,813	2·96	160·75	20,166
"	9	"	1,760	258	6,787	2·89	160·65	19,614
"	10	"	1,760	259	6,787	2·89	160·67	19,614

NOTE.—Gauge heights referred to tail-race gauge at Point du Bois.

Daily Gauge Height and Discharge of Winnipeg River at Slave Falls, for 1911.

[Drainage area, 49,700 square miles.]

Day.	January.		February		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft	Sec.-ft	Feet.	Feet.	Sec.-ft.
1	59·50	13,900	59·50	13,900	59·42	13,500	59·00	11,300	59·25	12,600	60·10	17,000
2	59·58	14,300	59·54	14,100	59·30	12,900	58·90	10,800	59·30	12,900	60·15	17,200
3	59·66	14,700	59·58	14,300	59·30	12,900	59·00	11,300	59·30	12,900	60·20	17,500
4	59·78	15,300	59·46	13,700	59·30	12,900	59·10	11,800	59·30	12,900	60·20	17,500
5	59·72	15,000	59·55	14,100	59·35	13,100	59·08	11,700	59·35	13,100	60·20	17,500
6	59·70	14,900	59·65	14,600	59·38	13,300	59·02	11,400	59·40	13,400	60·20	17,500
7	59·70	14,900	59·54	14,100	59·42	13,500	59·02	11,400	59·45	13,600	60·20	17,500
8	59·70	14,900	59·42	13,500	59·20	12,300	59·02	11,400	59·40	13,400	60·20	17,500
9	59·71	15,000	59·48	13,800	59·15	12,100	59·02	11,400	59·45	13,600	60·25	17,800
10	59·75	15,200	59·50	13,900	59·18	12,200	59·00	11,300	59·47	13,700	60·25	17,800
11	59·80	15,400	59·48	13,800	59·00	11,400	59·00	11,300	59·48	13,800	60·30	18,000
12	59·95	16,200	59·40	13,400	59·40	13,400	59·05	11,600	59·50	13,900	60·35	18,300
13	60·00	16,500	59·32	13,000	59·12	11,900	59·05	11,600	59·50	13,900	60·35	18,300
14	60·05	16,700	59·23	12,500	59·18	12,200	59·05	11,600	59·60	14,400	60·35	18,300
15	60·10	17,000	59·23	12,500	59·14	12,000	59·12	11,900	59·70	14,900	60·35	18,300
16	60·15	17,200	59·23	12,500	59·14	12,000	59·15	12,100	59·77	15,300	60·35	18,300
17	60·00	16,500	59·23	12,500	59·14	12,000	59·15	12,100	59·79	15,400	60·38	18,500
18	59·78	15,300	59·25	12,600	59·12	11,900	59·17	12,200	59·85	15,700	60·36	18,300
19	59·76	15,200	59·28	12,700	59·10	11,800	59·17	12,200	59·87	15,800	60·40	18·600
20	59·72	15,000	59·30	12,900	59·08	11,700	58·17	12,200	59·90	15,900	60·40	18,600
21	59·68	14,800	59·30	12,900	59·05	11,600	59·25	12,600	59·90	15,900	60·39	18,500
22	59·64	14,600	59·27	12,700	59·10	11,800	59·25	12,600	59·88	15,800	60·43	18,700
23	59·62	14,500	59·25	12,600	59·12	11,900	59·25	12,600	59·90	15,900	60·46	18,900
24	59·60	14,400	59·22	12,400	59·15	12,100	59·25	12,600	59·90	15,900	60·50	19,100
25	59·60	14,400	59·22	12,400	59·13	12,000	59·25	12,600	59·90	15,900	60·58	19,500
26	59·40	13,400	59·25	12,600	59·00	11,400	59·27	12,700	59·95	16,200	60·60	19,600
27	59·40	13,400	59·30	12,900	58·90	10,800	59·32	13,000	59·98	16,400	60·60	19,600
28	59·40	13,400	59·35	13,100	59·10	11,800	59·31	12,900	60·02	16,600	60·60	19,600
29	59·45	13,600	......	......	59·07	11,700	59·30	12,900	60·05	16,700	60·62	19,800
30	59·45	13,600	......	......	59·15	12,100	59·25	12,600	60·10	17,000	60·62	19,800
31	59·50	13,900	......	......	59·05	11,600	......	......	60·10	17,000	......	......

Day.	July.		August.		September.		October.		November.		December.	
1	60·62	19,800	61·62	25,300	61·68	25,700	61·47	24,500	61·60	25,200	60·75	20,400
2	60·62	19,800	61·61	25,300	61·65	25,500	61·50	24,700	61·57	25,000	60·72	20,300
3	60·64	19,900	61·60	25,200	61·62	25,300	61·50	24,700	61·55	24,900	60·68	20,100
4	60·66	20,000	61·63	25,400	61·65	25,500	61·56	25,000	61·50	24,700	60·65	19,900
5	60·66	20,000	61·65	25,500	61·65	25,500	61·64	25,400	61·45	24,400	60·65	19,900
6	60·66	20,000	61·68	25,700	61·64	25,500	61·75	26,100	16·42	24,200	60·62	19,800
7	60·66	20,000	61·72	25,900	61·60	25,200	61·79	26,300	61·37	23,900	60·60	19,600
8	60·78	20,600	61·78	26,200	61·55	24,900	61·85	26,700	61·36	23,800	60·60	19,600
9	60·90	21,300	61·84	26,600	61·48	24,500	61·85	26,700	61·34	23,700	60·56	19,400
10	60·90	21,300	61·90	27,000	61·45	24,400	61·85	26,700	61·33	23,700	60·56	19,400
11	60·95	21,500	61·87	26,800	61·46	24,400	61·90	27,000	61·33	23,700	60·60	19,600
12	61·05	22,100	61·85	26,700	61·40	24,100	61·93	27,100	61·30	23,500	60·60	19,600
13	61·10	22,400	61·85	26,700	61·38	24,000	61·80	26,400	61·25	23,200	60·60	19,600
14	61·15	22,700	61·85	26,700	61·40	24,100	61·80	26,400	61·20	22,900	60·55	19,400
15	61·18	22,800	61·85	26,700	61·43	24,800	61·80	26,400	61·15	22,600	60·55	19,400
16	61·25	23,200	61·83	26,500	61·43	24,300	61·80	26,400	61·15	22,600	60·56	19,400
17	61·34	23,700	61·81	26,400	61·45	24,400	61·65	25,500	61·10	22,400	60·66	20,000
18	61·42	24,200	61·81	26,400	61·47	500	61·70	25,800	61·10	22,400	60·55	19,400
19	61·48	24,500	61·80	26·400	61·50	,700	61·75	26,100	61·10	22,400	60·54	19,300
20	61·48	24,500	61·78	26,200	61·53	24,800	61·75	26,100	61·05	22,100	60·53	19,300
21	61·52	24,800	61·77	26,200	61·56	25,000	61·78	26,200	61·05	22,100	60·52	19,200
22	61·52	24,800	61·75	26,100	61·57	25,000	61·80	26,400	61·05	22,100	60·59	19,100
23	61·52	24,800	61·76	26,100	61·57	25,000	61·75	26,100	61·00	21,800	60·50	19,100
24	61·52	24,800	61·76	26,100	61·54	24,900	81·75	26,100	61·00	21,800	60·48	19,000
25	61·52	24,800	61·75	26,100	61·51	24,700	61·70	25,800	60·95	21,500	60·50	19,100
26	61·55	24,900	61·75	26,100	61·48	24,500	61·70	25,800	60·90	21,300	60·46	18,900
27	61·60	25,200	61·73	26,000	61·45	24,400	61·70	25,800	60·90	21,300	60·42	18,700
28	61·62	25,300	61·70	25,800	61·48	24,500	61·70	25,800	60·88	21,200	60·40	18,600
29	61·62	25,300	61·70	25,800	61·45	24,400	61·68	25,700	60·85	21,000	60·35	18,200
30	61·62	25,300	61·68	25,700	61·48	24,500	61·65	25,500	60·80	20,700	60·30	18,000
31	61·62	25,300	61·68	25,700	....	...	61·60	25,200	......	......	60·30	18,000

NOTE.—Daily discharges are taken from rating curve plotted for Slave Falls. Gauge heights are referred to tail-race gauge at Point du Bois.

Daily Discharge and Gauge Height of Winnipeg River at Slave Falls, for 1912.

[Drainage Area, 49,700 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft
1	60·30	18,000	60·40	18,600	59·85	15,700	[1]59·19	12,300	[1]60·01	16,500	62·05	27,900
2	60·30	18,000	60·40	18,600	59·84	15,600	[1]59·20	12,300	60·07	16,800	62·15	28,500
3	60·30	18,000	60·35	18,300	59·83	15,600	[1]59·21	12,400	60·10	17,000	62·15	28,500
4	60·35	18,300	60·30	18,000	59·82	15,500	59·23	12,500	60·45	18,808	[1]62·27	29,200
5	60·40	18,600	60·28	17,900	59·80	15,400	59·23	12,500	60·50	19,100	[1]62·39	29,900
6	60·65	19,900	60·28	17,900	59·77	15,300	[1]59·24	12,500	60·40	18,600	62·50	30,600
7	61·00	21,800	60·28	17,900	59·75	15,200	[1]59·25	12,600	60·48	19,000	62·50	30,600
8	61·05	22,100	60·25	17,800	59·72	15,000	[1]59·26	12,600	60·52	19,200	62·55	30,900
9	61·10	22,400	60·23	17,700	59·68	14,800	[1]59·27	12,700	60·65	19,900	62·30	29,400
10	61·10	22,400	60·20	17,500	59·66	14,700	[1]59·28	12,700	[1]60·75	20,400	62·25	29,100
11	61·10	22,400	60·15	17,200	59·64	14,600	[1]59·29	12,800	60·85	21,000	[1]62·21	28,800
12	61·10	22,400	60·12	17,100	59·62	14,500	59·29	12,800	[1]60·92	21,400	[1]62·17	28,600
13	61·05	22,100	60·10	17,000	59·59	14,300	[1]59·30	12,900	61·00	21,800	[1]62·13	28,300
14	61·05	22,100	60·05	16,700	[1]59·56	14,200	[1]59·31	12,900	61·20	22,900	[1]62·19	28,700
15	61·00	21,800	60·02	16,600	[1]59·53	14,000	[1]59·32	13,000	61·35	23,800	62·05	27,900
16	60·95	21,500	60·00	16,500	[1]59·50	13,900	[1]59·33	13,000	[1]61·37	23,900	62·05	27,900
17	60·70	20,200	60·00	16,500	[1]59·47	13,700	[1]59·34	13,100	61·40	24,100	62·03	27,700
18	60·70	20,200	60·00	16,500	[1]59·44	13,600	[1]59·35	13,100	61·43	24,300	62·15	28,500
19	60·70	20,200	59·98	16,400	[1]59·40	13,400	59·35	13,100	[1]61·47	24,500	62·01	27,600
20	60·65	19,900	59·97	16,300	[1]59·38	13,300	[1]59·40	13,400	61·50	24,700	62·03	27,700
21	60·60	19,600	59·96	16,300	[1]59·33	13,000	[1]59·45	13,600	61·51	24,700	62·03	27,700
22	60·55	19,400	59·95	16,200	59·30	12,900	[1]59·50	13,900	61·55	24,900	62·00	27,600
23	60·55	19,400	59·94	16,100	[1]59·24	12,500	[1]59·55	14,100	61·62	25,300	61·95	27,300
24	60·55	19,400	59·93	16,100	[1]59·18	12,200	[1]59·60	14,400	61·70	25,800	61·90	27,000
25	60·56	19,100	59·92	16,000	59·12	11,900	[1]59·65	14,600	61·74	26,000	61·80	26,400
26	60·45	18,800	59·91	16,000	[1]59·13	12,000	[1]59·71	15,000	[1]61·79	26,300	61·89	26,900
27	60·45	18,800	59·89	15,900	[1]59·14	12,000	[1]59·77	15,300	61·85	26·700	61·88	26,800
28	60·45	18,800	59·89	15,900	[1]59·15	12,100	[1]59·83	15,600	61·88	26,800	[1]61·88	26,800
29	60·43	18,700	59·88	15,800	[1]59·16	12,100	[1]59·89	15,900	61·91	27,000	61·89	26,900
30	60·41	18,600	....	...	[1]59·17	12,200	[1]59·95	16,200	61·95	27,300	61·87	26,800
31	60·40	18,600			[1]59·18	12,200			61·98	27,400	.....	..

Day.	July.		August.		September.		October.		November		December	
1	61·96	27,300	62·05	27,900	61·99	27,500	[1]62·52	30,700	63·25	35,800	62·60	31,300
2	61·89	26,900	62·05	27,900	61·99	27,500	[1]62·55	30,900	63·25	35,800	62·60	31,300
3	61·87	26,800	62·01	27,600	62·00	27,600	[1]62·58	31,100	63·25	35,800	62·60	31,300
4	61·84	26,600	62·05	27,900	62·47	30,400	[1]62·61	31,300	63·25	35,800	62·60	31,300
5	61·79	26,300	62·09	28,100	62·35	29,700	[1]62·64	31,500	63·20	35,400	62·60	31,300
6	61·75	26,100	62·07	28,000	62·16	28,500	[1]62·67	31,700	63·15	35,100	62·60	31,300
7	61·76	26,100	62·10	28,200	62·25	29,100	62·70	31,900	63·15	35,100	62·50	30,600
8	61·78	26,200	63·05	27,900	62·25	29,100	62·70	31,900	63·15	35,100	62·50	30,600
9	61·76	26,100	62·05	27,900	62·26	29,100	62·74	32,200	63·15	35,100	62·50	30,600
10	61·76	26,100	62·06	27,900	62·25	29,100	62·80	32,600	63·15	35,100	62·50	30,600
11	61·75	26,100	62·07	28,000	62·23	28,900	62·91	33,400	63·15	35,100	62·40	30,000
12	61·76	26,100	62·08	28,000	62·25	29,100	62·96	33,700	63·10	34,700	62·40	30,000
13	61·76	26,100	62·09	28,100	62·25	29,100	62·98	33,800	63·10	34,700	62·40	30,000
14	61·75	26,100	[1]62·03	27,700	62·27	29,200	63·03	34,200	63·00	34,000	62·30	29,400
15	61·77	26,300	[1]62·03	27,700	62·30	29,400	63·05	34,300	62·90	33,300	62·30	29,400
16	61·79	26,300	62·03	27,700	[1]62·32	29,500	63·06	34,400	62·85	32,900	62·30	29,400
17	61·80	26,400	62·02	27,700	[1]62·35	29,700	63·10	34,700	62·85	32,900	62·20	28,800
18	61·78	26,200	62·04	27,800	[1]62·37	29,800	63·10	34,700	62·85	32,900	62·20	28,800
19	61·75	26,100	62·05	27,900	[1]62·40	30,000	63·15	35,100	62·85	32,900	62·20	28,800
20	61·76	26,100	61·98	27,400	[1]62·42	30,100	63·20	35,400	62·85	32,900	62·20	28,800
21	61·74	26,000	62·00	27,600	62·45	30,300	63·28	36,000	62·80	32,600	62·20	28,800
22	61·70	25,800	62·05	27,900	63·46	30,400	63·28	36,000	62·80	32,600	62·20	28,800
23	61·75	26,100	62·03	27,700	62·48	30,500	63·28	36,000	62·80	32,600	62·20	28,800
24	61·77	26,200	61·98	27,400	62·51	30,700	63·25	35,800	62·80	32,600	62·20	28,800
25	61·79	26,300	62·00	27,600	62·58	31,100	63·25	35,800	62·75	32,200	62·20	28,800
26	61·80	26,400	62·00	27,600	62·57	31,100	63·20	35,400	62·75	32,200	62·20	28,800
27	61·84	26,600	62·00	27,600	62·56	31,000	63·20	35,400	62·75	32,200	67·20	28,800
28	61·85	26,700	62·00	27,600	62·56	31,000	63·20	35,400	62·75	32,200	62·20	28,800
29	61·89	26,900	61·99	27,500	62·45	29,400	63·25	35,800	62·75	32,200	62·20	28,800
30	61·90	27,000	62·00	27,600	[1]62·49	30,600	63·25	35,800	62·75	32,200	62·10	28,200
31	61·94	27,200	62·00	27,600	...	.....	63·30	36,200	..	.. ..	62·10	28,200

Note.—Daily discharges are taken from rating curve plotted for Slave falls. Gauge heights are referred to tail-race gauge at Point du Bois. Gauge heights marked thus ([1]) interpolated.

Daily Gauge Height and Discharge of Winnipeg River at Slave Falls, for 1913.

[Drainage area, 49,700 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.
1	62·10	28,200	62·10	28,200	60·90	21,300	59·90	15,900	60·89	21,200	62·81	32,600
2	62·00	27,600	62·10	28,200	60·90	21,300	59·95	16,200	61·11	22,400	62·94	33,600
3	62·00	27,600	62·10	28,200	60·90	21,300	59·95	16,200	61·18	22,800	62·89	33,200
4	62·00	27,600	62·10	28,200	60·80	20,700	60·00	16,500	61·27	23,300	62·96	33,700
5	62·00	27,600	62·10	28,200	60·80	20,700	60·00	16,500	61·51	24,700	63·00	34,000
6	62·00	27,600	62·10	28,200	60·80	20,700	60·00	16,500	61·61	25,300	62·93	33,500
7	62·00	27,600	62·10	28,200	60·80	20,700	60·00	16,500	61·72	25,900	62·96	33,700
8	62·00	27,600	62·00	27,600	60·70	20,200	60·00	16,500	61·70	25,800	62·92	33,400
9	62·00	27,600	62·00	27,600	60·70	20,200	60·00	16,500	61·82	26,500	63·03	34,200
10	62·00	27,600	62·00	27,600	60·60	19,500	60·00	16,500	61·89	26,900	63·02	34,100
11	62·00	27,600	62·00	27,600	60·60	19,600	60·05	16,700	61·98	27,400	63·06	34,300
12	62·10	28,200	62·00	27,600	60·50	19,100	60·05	16,700	62·03	27,700	63·05	34,300
13	62·10	28,200	62·00	27,600	60·50	19,100	60·05	16,700	62·03	27,700	63·11	34,800
14	62·10	28,200	62·00	27,600	60·50	19,100	60·05	16,700	62·10	28,200	63·05	34,300
15	62·10	28,200	61·90	27,000	60·40	18,600	60·05	16,700	62·11	28,200	62·94	33,600
16	62·10	28,200	61·90	27,000	60·40	18,600	60·10	17,000	62·14	28,400	63·01	34,100
17	62·10	28,200	61·80	26,400	60·40	18,600	60·10	17,000	62·12	28,300	63·02	34,100
18	62·10	28,200	61·80	26,400	60·30	18,000	60·15	17,200	62·15	28,500	62·99	33,900
19	62·10	28,200	61·60	25,200	60·30	18,000	60·15	17,200	62·37	29,800	62·94	33,600
20	62·10	28,200	61·60	25,200	60·30	18,000	60·20	17,500	62·43	30,200	62·90	33,300
21	62·10	28,200	61·30	23,500	60·20	17,500	60·20	17,500	62·43	30,200	62·88	33,100
22	62·10	28,200	61·30	23,500	60·20	17,500	60·30	18,000	62·43	30,200	62·87	33,100
23	62·10	28,200	61·20	22,900	60·10	17,000	60·30	18,000	62·68	31,800	62·95	33,600
24	62·10	28,200	61·10	22,400	60·10	17,000	60·40	18,600	62·70	31,900	62·96	33,700
25	62·10	28,200	61·10	22,400	60·10	17,000	60·50	19,100	62·78	32,400	62·85	32,900
26	62·10	28,200	61·00	21,800	60·10	17,000	60·50	19,100	62·80	32,600	62·86	33,000
27	62·10	28,200	61·00	21,800	60·10	17,000	60·60	19,600	62·76	32,300	62·85	32,900
28	62·10	28,200	61·00	21,800	60·10	17,000	60·70	20,200	62·88	33,100	62·92	33,400
29	62·10	28,200	......	......	60·00	16,500	60·70	20,200	62·86	33,000	62·85	32,900
30	62·10	28,200	......	......	60·00	16,500	60·70	20,200	62·83	32,800	62·91	33,400
31	62·10	28,200	...	......	59·90	15,900	......	...	62·86	33,000	...	......

Day.	July.		August.		September.		October.		November.		December.	
1	62·89	33,200	61·90	27,000	61·84	26,600	61·03	22,000	59·80	15,400	59·89	15,900
2	62·93	33,500	61·90	27,000	61·80	26,400	60·93	21,400	59·60	14,400	59·82	15,500
3	62·91	33,300	61·87	26,800	61·81	26,400	60·75	20,500	59·70	14,900	59·82	15,500
4	62·91	33,300	62·00	27,600	61·80	26,400	60·59	19,600	59·70	14,900	59·77	15,300
5	62·82	32,700	61·94	27,300	61·77	26,200	60·62	19,800	59·91	16,000	59·79	15,400
6	62·75	32,300	61·98	27,400	61·70	25,800	60·70	20,200	59·87	15,800	59·77	15,300
7	62·81	32,600	62·0[illegible]	27,700	61·60	25,200	60·42	18,700	59·84	15,600	59·54	14,100
8	62·72	32,000	62·01	27,600	61·77	26,200	60·45	18,800	59·84	15,600	59·82	15,500
9	62·71	32,000	62·02	27,700	61·76	26,100	60·46	18,900	59·84	15,600	59·76	15,200
10	62·73	32,100	61·97	27,400	61·70	25,800	60·45	18,800	[1]59·83	15,600	59·79	15,400
11	62·80	32,600	62·07	28,000	61·62	25,300	60·32	18,100	[1]59·83	15,600	69·74	15,100
12	62·68	31,800	62·09	28,100	61·66	25,600	60·16	17,300	[1]59·82	15,500	59·69	14,800
13	62·52	30,700	62·12	28,300	61·62	25,300	60·32	18,100	[1]59·82	15,500	59·72	15,000
14	62·52	30,700	62·07	28,000	61·54	24,900	60·27	17,900	[1]59·81	15,500	59·56	14,200
15	62·51	30,700	62·16	28,500	61·81	26,400	60·19	17,400	[1]59·80	15,400	59·59	14,300
16	62·37	29,800	62·13	28,300	61·59	25,200	60·19	17,400	59·79	15,400	69·59	14,300
17	62·24	29,000	62·09	28,100	61·58	25,100	60·16	17,300	[1]59·78	15,300	59·64	14,600
18	62·11	28,200	62·20	28,800	61·63	25,400	60·06	16,800	[1]59·77	15,300	59·58	14,300
19	62·07	28,000	62·19	28,700	61·48	24,500	69·65	14,600	[1]59·76	15,200	59·56	14,200
20	61·99	27,500	62·14	28,400	61·43	24,300	60·02	16,600	[1]59·75	15,200	59·49	13,800
21	61·98	27,400	62·06	27,900	61·36	23,900	60·07	16,800	[1]59·73	15,100	59·42	13,500
22	62·00	27,600	62·05	27,900	61·58	25,100	60·02	16,600	[1]59·71	15,000	59·46	13,700
23	61·94	27,200	61·98	27,400	61·53	24,800	60·02	16,600	59·69	14,800	59·49	13,800
24	61·90	27,000	61·96	27,300	61·48	24,500	60·00	16,500	[1]59·73	15,100	59·59	14,300
25	61·93	27,100	61·95	27,300	61·40	24,100	59·78	15,300	[1]59·77	15,300	59·44	13,600
26	61·82	26,500	61·92	27,100	61·35	23,800	59·99	16,400	[1]59·81	15,500	59·39	13,300
27	61·72	25,900	61·92	27,100	61·25	23,200	60·60	19,600	59·84	15,600	59·32	13,000
28	61·85	26,700	61·88	26,800	61·16	22,700	60·10	17,000	59·86	15,700	59·38	13,300
29	61·89	26,900	61·85	26,700	61·24	23,200	60·10	17,000	59·82	15,500	59·51	[illegible]
30	61·88	26,800	61·85	26,700	61·13	22,500	60·00	16,500	59·64	14,600	59·54	14,100
31	61·89	26,900	61·78	26,200	......	...	60·00	16,500	......	......	59·51	13,900

NOTES.—Daily discharges are taken from rating curve plotted for Slave falls. Gauge heights are referred to tail-race gauge at Point du Bois. Gauge heights marked thus ([1]) interpolated.

DAILY GAUGE HEIGHT AND DISCHARGE of Winnipeg River at Slave Falls, for 1914.

[Drainage area, 49,700 square miles.]

Day.	January.		February.		March		April.		May.		June	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	59·37	13,200	59·17	12,200	59·10	11,800	59·57	14,200	59·80	15,400	61·55	24,900
2	59·47	13,700	59·35	13,100	59·32	13,000	59·52	14,000	59·72	15,000	61·50	24,700
3	59·50	13,900	59·27	12,700	59·32	13,000	59·52	14,000	59·62	14,500	61·95	26,300
4	59·37	13,200	59·37	13,200	59·32	13,000	59·50	13,900	59·85	15,700	62·12	28,300
5	59·55	14,100	59·35	13,100	59·27	12,700	59·42	13,500	59·92	16,000	62·12	28,300
6	59·50	13,900	59·35	13,100	59·42	13,500	59·57	14,200	59·85	15,700	62·27	29,200
7	59·50	13,900	59·25	12,600	59·46	13,400	59·52	14,000	60·05	16,700	62·32	29,500
8	59·55	14,100	59·30	12,900	59·30	12,900	59·60	14,400	59·95	16,200	62·42	30,100
9	59·50	13,900	59·50	13,900	59·55	14,100	59·57	14,200	60·10	17,000	62·62	31,400
10	59·42	13,500	59·37	13,200	59·57	14,200	59·42	13,500	59·95	16,200	62·72	32,000
11	59·37	13,200	59·45	13,600	59·47	13,700	59·47	13,700	60·25	17,800	62·77	32,400
12	59·42	13,500	59·47	13,700	59·47	13,700	59·42	13,500	60·15	17,200	62·82	32,700
13	59·40	13,400	59·45	13,600	59·47	13,700	59·60	14,400	60·20	17,500	62·82	32,700
14	59·42	13,500	59·55	14,100	59·52	14,000	59·57	14,200	60·25	17,800	62·82	32,700
15	59·52	14,000	59·22	12,400	59·42	13,500	59·62	14,500	60·30	18,000	62·95	33,600
16	59·47	13,700	59·45	13,600	59·57	14,200	59·57	14,200	60·25	17,800	62·87	33,100
17	59·37	13,200	59·47	13,700	59·52	14,000	59·57	14,200	60·25	17,800	62·92	33,400
18	59·27	12,700	59·37	13,200	59·62	14,500	59·57	14,200	60·45	18,800	63·02	34,100
19	59·57	14,200	59·32	13,000	59·52	14,000	59·57	14,200	60·45	18,800	63·05	34,300
20	59·45	13,600	59·37	13,200	59·57	14,200	59·67	14,700	60·50	19,100	62·92	33,400
21	59·60	14,400	59·32	12,900	59·50	13,900	59·67	14,700	60·55	19,400	62·92	33,400
22	59·57	14,200	59·07	11,700	59·40	13,400	59·70	14,900	60·55	19,400	63·10	34,700
23	59·47	13,700	59·40	13,400	59·52	14,000	59·72	15,000	60·55	19,400	63·12	34,800
24	59·50	13,900	59·42	13,500	59·57	14,200	59·72	15,000	60·60	19,600	63·12	34,800
25	59·22	12,400	59·37	13,200	59·50	13,900	59·62	14,500	60·65	19,900	63·12	34,800
26	59·47	13,700	59·32	12,900	59·57	14,200	59·60	14,400	60·85	21,000	63·12	34,800
27	59·40	13,400	59·22	12,400	59·52	14,000	59·77	15,300	61·00	21,800	63·12	34,800
28	59·27	12,700	59·27	12,700	59·50	13,900	59·82	15,500	61·00	21,800	63·10	34,700
29	59·37	13,200	......	......	59·42	13,500	59·80	15,400	61·10	22,400	63·27	35,900
30	59·32	13,000	......	......	59·57	14,200	59·77	15,300	61·20	22,900	63·32	36,300
31	59·25	12,600	......	......	59·52	14,000	......	......	61·20	22,900	......	......

Day.	July.		August.		September.		October.		November.		December.	
1	63·27	35,900	63·07	34,500	62·42	30,100	61·60	25,200	60·92	21,400	60·82	20,800
2	63·37	36,700	63·05	34,300	62·27	29,200	61·50	24,700	61·12	22,500	60·77	20,600
3	63·32	36,300	63·02	34,100	62·20	28,800	61·45	24,400	60·95	21,500	60·77	20,600
4	63·32	36,300	63·05	34,300	62·12	28,300	61·37	23,900	61·02	21,900	60·80	20,700
5	63·20	35,400	63·02	34,100	62·07	28,000	61·57	25,000	60·92	21,400	60·75	20,500
6	63·42	37,100	62·92	33,400	61·82	26,500	61·57	25,000	60·87	21,100	60·57	19,500
7	63·32	36,300	62·82	32,700	61·82	26,500	61·57	25,000	60·85	21,000	60·72	20,300
8	63·35	36,500	62·82	32,700	61·82	26,500	61·55	24,900	60·75	20,500	60·70	20,200
9	63·32	36,300	62·72	32,000	[illegible]	26,400	61·47	24,500	61·05	22,100	60·65	19,900
10	63·30	36,100	62·80	32,600	[illegible]	26,200	61·52	24,800	60·80	20,700	60·67	20,000
11	63·27	35,900	62·82	32,700	61·67	25,600	61·57	25,000	60·77	20,600	60·67	20,000
12	63·27	35,900	62·77	32,400	61·72	25,900	61·67	25,600	60·75	20,500	60·65	19,900
13	63·37	36,700	62·80	32,600	61·62	25,300	61·77	26,200	60·95	21,500	60·52	19,200
14	63·40	36,900	62·77	32,400	61·70	25,800	61·82	26,500	60·87	21,100	60·67	20,000
15	63·42	37,100	62·70	31,900	61·62	25,300	61·77	26,200	60·72	20,300	60·62	19,700
16	63·45	37,300	62·62	31,400	61·62	25,300	61·75	26,100	60·92	21,400	60·60	19,600
17	63·37	36,700	62·77	32,400	61·65	25,500	61·67	25,600	60·87	21,100	60·57	19,500
18	63·32	36,300	62·77	32,400	61·57	25,000	61·65	25,500	60·80	20,700	60·50	19,100
19	63·27	35,900	62·67	31,700	61·52	24,800	61·62	25,300	60·77	20,600	60·47	18,900
20	63·40	36,900	62·62	31,400	61·45	24,400	61·62	25,300	60·77	20,600	60·35	18,300
21	63·45	37,300	62·60	31,300	61·67	25,600	61·60	25,200	60·72	20,300	60·62	19,700
22	63·37	36,700	62·57	31,100	61·67	25,600	61·52	24,800	60·70	20,200	60·50	19,100
23	63·42	37,100	62·57	31,100	61·67	25,600	61·37	23,900	60·77	20,600	60·42	18,700
24	63·37	36,700	62·67	31,700	61·65	25,500	61·32	23,600	60·80	20,700	60·42	18,700
25	63·40	36,900	62·62	31,400	61·62	25,300	61·30	23,500	60·77	20,600	60·35	18,300
26	63·27	35,900	62·62	31,400	61·57	25,000	61·32	23,600	60·72	20,300	60·32	18,100
27	63·37	36,700	62·62	31,400	61·45	24,400	61·37	23,900	60·72	20,300	60·40	18,600
28	63·30	36,100	62·60	31,300	61·62	25,300	61·12	22,500	60·70	20,200	60·47	18,900
29	63·27	35,900	62·57	31,100	61·60	25,200	61·07	22,200	60·70	20,200	60·47	18,900
30	63·22	35,600	62·40	30,000	61·57	25,000	61·12	22,500	60·75	20,500	60·45	18,800
31	63·07	34,500	62·52	30,700	......	......	61·07	22,200	......	......	60·42	18,700

NOTE.—Daily discharges are taken from rating curve plotted for Slave falls. Gauge heights are referred to tail-race gauge at Point du Bois.

MONTHLY DISCHARGE of Winnipeg River at Slave Falls, for the years 1911–14.

[Drainage Area, 49,700 square miles.]

Month.	Discharge in Second-feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
1911.						
January	17,200	13,400	14,900	0·300	0·346	916,200
February	14,600	12,400	13,200	0·266	0·277	733,100
March	13,500	10,800	12,200	0·245	0·283	750,100
April	13,000	10,800	12,000	0·241	0·269	714,000
May	17,000	12,600	14,900	0·300	0·346	916,200
June	19,800	17,000	18,400	0·370	0·413	1,094,900
July	25,300	19,800	22,900	0·461	0·532	1,408,100
August	27,000	25,200	26,100	0·525	0·605	1,604,800
September	25,700	24,000	24,800	0·499	0·557	1,475,700
October	27,100	24,500	25,900	0·521	0·601	1,592,600
November	25,200	20,700	22,900	0·461	0·514	1,362,600
December	20,400	18,000	19,300	0·388	0·447	1,186,700
The year	27,100	10,800	18,900	0·381	5·190	13,754,900
1912.						
January	22,400	18,000	20,000	0·402	0·464	1,229,800
February	18,600	15,800	16,900	0·340	0·367	972,100
March	15,700	11,900	13,800	0·278	0·321	848,500
April	16,200	12,300	13,500	0·272	0·304	803,300
May	27,400	16,500	22,800	0,459	0·529	1,401,900
June	30,900	26,800	28,200	0·567	0·633	1,678,000
July	27,300	25,800	26,400	0·531	0·612	1,623,300
August	28,100	27,400	27,800	0·559	0·645	1,709,400
September	31,100	27,500	29,700	0·598	0·667	1,767,300
October	36,200	30,700	34,000	0·684	0·789	2,090,600
November	35,800	32,200	33,800	0·680	0·759	2,011,200
December	31,300	28,200	29,700	0·598	0·689	1,826,200
The year	36,200	11,900	24,700	0·497	6·779	17,961,600
1913.						
January	28,200	27,600	28,000	0·563	0·649	1,721,700
February	28,200	21,800	26,000	0·523	0·545	1,444,000
March	21,300	15,900	18,700	0·376	0·434	1,149,800
April	20,200	15,900	17,500	0·352	0·393	1,041,300
May	33,100	21,200	28,500	0·573	0·661	1,752,400
June	34,800	32,600	33,600	0·676	0·754	1,999,300
July	33,500	25,900	29,700	0·598	0·689	1,826,200
August	28,800	26,200	27,600	0·555	0·640	1,697,100
September	26,600	22,500	25,000	0·503	0·561	1,487,600
October	22,000	14,600	17,900	0·360	0·415	1,100,600
November	16,000	14,400	15,300	0·308	0·344	910,400
December	15,900	13,000	14,500	0·292	0·337	891,600
The year	34,800	13,000	23,500	0·473	6·422	17,022,000
1914.						
January	14,400	12,400	13,500	0·272	0·314	830,100
February	14,100	11,700	13,100	0·264	0·275	727,500
March	14,500	11,800	13,700	0·276	0·318	842,400
April	15,300	13,500	14,400	0·290	0·324	856,900
May	22,900	14,500	18,400	0·370	0·427	1,131,400
June	36,300	24,700	32,200	0·648	0·723	1,916,000
July	37,300	34,500	36,400	0·732	0·844	2,238,100
August	34,500	30,000	32,200	0·648	0·747	1,979,900
September	30,100	24,400	26,100	0·525	0·586	1,553,100
October	26,500	22,200	24,600	0·495	0·571	1,512,600
November	22,500	20,200	20,900	0·421	0·470	1,242,600
December	20,800	18,100	19.500	0·392	0·452	1,199,000
The year	37,300	11,700	22,100	0·444	6·051	16,030,600

DISCHARGE MEASUREMENTS of Winnipeg River near Otter Falls. 1903, 1907-11.

Date.	Hydrographer.	Meter No	Width.	Area of Section	Mean Velocity	Gauge Height.	Discharge.
1903.			Feet	Sq. ft.	Ft. per sec	Feet	Sec.-ft
Nov. 11	W. E. S. R. Co ...					101·45	40,240[1]
1907.							
Aug. 2	"					101 45	31,028
Oct. 8	"					102 1	39,800
1908.							
July 12 & 14	"					104 2	42,979
Nov. 7 & 8	"					104 6	29,980
1909							
May 24	"					104 25	26,365
July 17	"					105 0	26,000
Oct 7	"					105 3	22,500
1910.							
July 28	"					105·04	29,324
1911.							
May 19	"				..	102 6	15,807

[1] Float measurement.
NOTE.—Gauge heights refer to upper gauge at control dam.

Daily Gauge Height and Discharge of Winnipeg River at Otter Falls, for 1907.

[Drainage area, 53,000 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			61·80	27,860	60·4	19,180	60·0	16,700	59·6	14,400	60·6	21,660
2			61·72	27,550	60·4	19,180	59·9	16,100	59·7	14,950	60·8	21,660
3			...	27,550	......	18,560	59·8	15,500	59·6	14,400	60·8	21,660
4			61·80	27,860	60·2	17,940	59·7	14,950	59·6	14,400	60·8	21,660
5			62·0	29,100	60·3	18,560	59·6	14,400	59·6	14,400	60·9	22,280
6			62·0	29,100	60·4	9,180	59·6	14,400	59·6	14,400	61·0	22,900
7			61·8	27,860	60·3	18,560	59·6	14,400	59·7	14,950	61·2	24,140
8			61·6	26,620	60·4	19,180	59·6	14,400	59·8	15,500	61·2	24.140
9			61·2	24,140	60·2	17,940	59·6	14,400	59·7	14,950	61·2	24,140
10			......	24,140	......	17,320	59·6	14,400	59·7	14,950	61·2	24,140
11			61·2	24,140	60·0	16,700	59·6	14,400	59·7	14,950	61·4	25,380
12			61·2	24,140	60·2	17,940	59·6	14,400	59·7	14,950	61·6	26,620
13			60·6	20,420	60·2	17,940	59·6	14,400	59·7	14,950	61·8	27,860
14			60·8	21,660	60·2	17,940	59·6	14,400	59·7	14,950	61·8	27,860
15			60·4	19,180	60·3	18,560	59·6	14,400	59·7	14,950	62·0	29,100
16			60·4	19,180	60·1	17,320	59·6	14,400	59·7	14,950	62·0	29,100
17			..	19,180	60·1	17,320	59·6	14,400	59·7	14,950	62·0	29,100
18			60·3	18,560	60·1	17,320	59·6	14,400	59·8	15,500	62·2	30,340
19			60·6	20,420	60·1	17,320	59·6	14,400	60·0	16,700	62·2	30,340
20			60·5	19,800	60·1	17,320	59·6	14,400	60·1	17,320	62·2	30,340
21			60·6	20,420	60·0	16,700	59·6	14,400	60·1	17,320	62·3	30,960
22			60·4	19,180	59·9	16,100	59·6	14,400	60·2	17,940	62·4	31,580
23	61·5	26,000	60·4	19,180	59·9	16,100	59·6	14,400	60·2	17,940	62·5	32,200
24		26,000		19,800	59·8	15,500	59·6	14,400	60·1	17,320	62·6	32,820
25		26,000	60·6	20,420	59·8	15,500	59·6	14,400	60·1	17,320	62·6	32,820
26	61·5	26,000	60·8	21,660	59·8	15,500	59·6	14,400	60·2	17,940	62·6	32,820
27		26,700	60·7	21,040	59·8	15,500	59·6	14,400	60·3	18,560	62·6	32,820
28		27,400	60·6	20,420	59·8	15,500	59·6	14,400	60·4	19,180	62·7	33,440
29	61·85	28,170	.....	...	59·9	16,100	59·6	14,400	60·5	19,800	62·7	33,440
30		28,170	......	......	60·0	16,700	59·6	14,400	60·5	19,800	62·7	33,440
31	61·85	28,170			60·0	16,700			60·6	20,420		

Day.	July.		August.		September.		October.		November.		December.	
1	62·7	33,440	62·2	30,340	62·9	34,680	63·6	39,020	64·2	42,740	64·2	42,740
2	62·8	34,060	62·3	30,960	63·0	25,300	63·6	39,020	64·2	42,740	64·2	42,740
3	62·8	34,060	62·2	30,340	63·0	35,300	63·8	40,260	64·2	42,740	64·2	42,740
4	62·7	33,440	62·2	30,340	63·0	35,300	63·8	40,260	64·2	42,740	64·2	42,740
5	62·8	34,060	62·2	30,340	63·0	35,300	64·0	41,500	64·2	42,740	64·1	42,120
6	62·7	33,440	62·2	30,340	63·1	35,920	64·2	42,740	64·2	42,740	64·1	42,120
7	62·8	34,060	62·2	30,340	63·2	36,540	64·2	42,740	64·2	42,740	64·0	41,500
8	62·7	33,440	62·2	30,340	63·2	36,540	64·2	42,740	64·2	42,740	64·0	41,500
9	62·6	32,820	62·2	30,340	63·2	36,540	64·2	42,740	64·2	42,740	64·0	41,500
10	62·5	32,200	62·2	30,340	63·2	36,540	64·2	42,740	64·2	42,740	64·0	41,500
11	62·5	32,200	62·2	30,340	63·2	36,540	64·2	42,740	64·2	42,740	63·8	40,260
12	62·5	32,200	62·2	30,340	63·2	36,540	64·2	42,740	64·2	42,740	63·8	40,260
13	62·4	31,580	62·2	30,340	63·2	36,540	64·3	43,360	64·2	42,740	63·8	40,260
14	62·4	31,580	62·2	30,340	63·3	37,160	64·2	42,740	64·2	42,740	63·7	39,640
15	62·4	31,580	62·2	30,340	63·4	37,780	64·2	42,740	64·2	42,740	63·6	39,020
16	62·4	31,580	62·2	30,340	63·4	37,780	64·2	42,740	64·2	42,740	63·6	39,020
17	62·4	31,580	62·2	30,340	63·4	37,780	64·2	42,740	64·2	42,740	63·6	39,020
18	62·4	31,580	62·2	30,340	63·4	37,780	64·2	42,740	64·2	42,740	63·6	39,020
19	62·4	31,580	62·2	30,340	63·4	37,780	64·2	42,740	64·2	42,740	61·6	39,020
20	62·4	31,580	62·4	31,580	63·4	37,780	64·2	42,740	64·2	42,740	63·5	38,400
21	62·4	31,580	62·6	32,820	63·4	37,780	64·3	43,360	64·2	42,740	63·4	37,780
22	62·4	31,580	62·6	32,820	63·4	37,780	64·4	43,980	64·2	42,740	63·4	37,780
23	62·4	31,580	62·6	32,820	63·4	37,780	64·3	43,360	64·2	42,740	63·4	37,780
24	62·4	31,580	62·6	32,820	63·4	37,780	64·3	43,360	64·2	42,740	63·3	37,160
25	62·4	31,580	62·6	32,820	63·4	37,780	64·4	43,360	64·2	42,740	63·4	37,780
26	62·3	30,960	62·6	32,820	63·4	37,780	64·3	43,360	64·2	42,740	63·4	37,780
27	62·2	30,340	62·6	32,820	63·6	39,020	64·3	43,360	64·2	42,740	63·3	37,160
28	62·2	30,340	62·6	32,820	63·6	39,020	64·3	43,360	64·1	42,120	63·2	36,540
29	62·2	30,340	62·6	32,820	63·6	39,020	64·3	43,360	64·1	42,120	63·2	36,540
30	62·2	30,340	62·7	33,440	63·6	39,020	64·2	42,740	64·1	42,120	61·2	36,540
31	62·2	30,340	62·8	34,060	....	..	64·2	42,740	....	....	63·2	36,540

Notes —Daily discharges are taken from rating curve plotted for Otter falls. The gauge heights are referred to tail-race gauge at Point du Bois.

Daily Gauge Height and Discharge of Winnipeg River at Otter Falls, for 1908.

[Drainage area, 50,550 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft.
1	63·2	36,540	63·6	40,260	62·7	33,440	61·8	27,860	62·0	29,100	63·5	38,400
2	63·2	36,540	63·9	40,880	62·6	32,820	62·0	29,100	62·1	29,720	63·5	38,400
3	63·3	37,160	63·8	40,260	62·6	32,820	61·9	28,480	62·1	29,720	63·5	38,400
4	63·3	37,160	63·6	39,020	62·5	32,200	61·8	27,860	62·1	29,720	63·5	38,400
5	63·2	36,540	63·8	40,260	62·5	32,200	62·0	29,100	62·1	29,720	63·5	38,400
6	63·2	36,540	63·8	40,260	62·5	32,200	62·0	29,100	62·2	30,340	63·5	38,400
7	63·3	37,160	63·8	40,260	62·5	32,200	62·0	29,100	62·1	29,720	63·5	38,400
8	63·2	36,540	63·8	40,260	62·6	32,820	61·9	28,480	62·2	30,340	63·5	38,400
9	63·3	36,540	63·6	39,020	62·7	33,440	61·9	28,480	62·2	30,340	63·6	39,020
19	63·3	37,160	63·4	37,780	62·7	33,440	61·9	28,480	62·2	30,340	63·8	40,260
11	63·2	36,540	63·2	36,540	62·6	32,620	61·9	28,480	62·2	30,340	64·0	41,500
12	63·2	36,540	63·0	35,300	62·4	31,580	61·9	28,480	62·3	30,960	64·2	42,740
13	63·2	36,540	62·8	34,060	62·4	31,580	61·9	28,480	62·4	31,580	64·2	42,740
14	63·2	36,540	62·8	34,060	62·4	11,580	61·9	28,480	62·4	31,580	64·2	42,740
15	63·2	36,540	62·8	34,060	62·3	30,960	61·9	28,480	62·4	31,580	64·2	42,740
16	63·2	36,540	62·8	34,060	62·6	32,820	61·9	28,480	62·4	31,580	64·2	42,740
17	63·2	36,540	62·8	34,060	62·4	31,580	61·9	28,480	62·4	31,580	64·2	42,740
18	63·2	36,540	62·8	34,060	62·4	31.580	61·7	27,240	62·5	32,200	64·2	42,740
19	63·2	36,540	62·8	34.060	62·4	31,580	61·7	27,240	62·5	32,200	64·2	42,740
20	63·2	36,540	62·8	34,060	62·2	30,340	61·8	27,860	62·5	32,200	64·3	43,360
21	63·2	36,540	62·6	34,060	62·4	31,580	61·8	27,860	62·8	34,060	64·3	43,360
22	63·2	36,540	62·6	32,820	62·4	31.580	61·8	27,860	62·9	34,680	64·3	43,360
23	61·2	36,540	62·8	34.060	62·2	30,340	61·8	27,860	63·0	35,300	64·3	43,360
24	63·2	36,540	63·1	35,920	62·1	29,720	62·0	29,100	63·0	35,300	64·3	43,360
25	63·2	35,920	63·3	37,160	62·1	29,720	62·0	29,100	63·0	35,300	64·3	43,360
26	63·0	35,300	63·3	37,160	62·1	29,720	62·0	29,100	63·2	36,540	64·3	43,360
27	63·0	35,300	63·3	37,160	62·1	29,720	62·0	29,100	63·2	36,540	64·4	43,980
28	63·4	37,780	63·2	36,540	62·1	29,720	62·0	29,100	63·2	36,540	64·4	43,980
29	63·6	39,020	63·0	35,300	62·0	29.100	62·0	29,100	63·2	36,540	64·4	43,980
30	63·8	40,260	....	......	62·0	29,100	62·0	29,100	63·3	37,160	64·4	43,980
31	63·8	40,260	.	.....	61·9	28,480	.....		63·4	37,780	.....	.....

Day.	July.		August.		September.		October.		November.		December.	
1	64·3	43,360	64·0	41,500	63·4	37,780	62·8	34,060	62·1	29,720	61·3	24,760
2	64·4	43,980	64·0	41,500	63·6	39,020	62·8	34,060	62·0	29,100	61·3	24,760
3	64·4	43,980	64·0	41,500	63·6	39,020	62·9	34,680	62·1	29,720	61·2	24,140
4	64·4	43,980	63·9	40,880	63·5	38,400	62·8	34,060	62·1	29,720	61·2	24,140
5	64·4	43,980	63·8	40,260	63·5	38,400	62·7	33,440	62·1	29,720	61·2	24,140
6	64·4	43,980	63·8	40,260	63·5	38,400	62·6	32,820	62·2	30,340	61·2	24,140
7	64·4	43,980	63·8	40,260	63·5	38,400	62·7	33,440	62·1	29,720	61·2	24,140
8	64·4	43,980	63·8	40,260	63·5	38,400	62·7	33,440	62·0	29,100	61·2	24,140
9	64·4	43,980	63·8	40,260	63·4	37,780	62·7	33,440	62·0	29,100	61·3	24,760
10	64·4	43,980	63·8	40,260	63·4	37,780	62·7	33,440	62·0	29,100	61·2	24,140
11	64·3	43,360	63·8	40,260	63·3	37,160	62·7	33,440	62·0	29,100	61·2	24,140
12	64·3	43,360	63·8	40,260	63·2	36,540	62·7	33,440	62·0	29,100	61·2	24,140
13	64·3	43,360	63·8	40,260	63·1	35,920	62·7	33,440	62·1	29,720	61·2	24,140
14	64·3	43,360	63·8	40,260	63·0	35,300	62·7	33,440	62·1	29,720	61·2	24,140
15	64·3	43,360	63·7	39,640	62·9	34,680	62·6	32,820	62·0	29,100	61·0	22,900
16	64·3	43,360	63·7	39,640	62·9	34,680	62·6	32,820	62·0	29,100	61·0	22,900
17	64·3	43,360	63·6	39,020	62·9	34,680	62·8	34,060	62·0	29,100	61·1	23,520
18	64·3	43,360	63·6	39,020	62·9	34,680	62·7	33,440	62·0	29,100	61·1	23,520
19	64·3	43,360	63·6	39,020	62·9	34,680	62·7	33,440	62·0	29,100	61·1	23,520
20	64·2	42,740	63·6	39,020	62·9	34,680	62·7	33,440	61·8	27,860	61·1	23,520
21	64·1	42,120	63·6	39,020	62·9	34,680	62·7	33,440	61·8	27,860	61·0	22,900
22	64·1	42,120	63·6	39,020	62·8	34,060	62·6	32,820	61·8	27,860	61·0	22,900
23	64·1	42,120	63·6	39,020	62·8	34,060	62·6	32,820	61·7	27,240	61·0	22,900
24	64·1	42,120	63·6	39,020	62·8	34,060	62·5	32,200	61·7	27,240	60·9	22,280
25	64·1	42,120	63·6	39,020	62·8	34,060	62·5	32,200	61·6	26,620	60·9	22,280
26	64·1	42,120	63·5	38,400	62·8	34,060	62·5	32,200	61·6	26,620	60·9	22,280
27	64·0	41,500	63·5	38,400	62·8	34.060	62·5	32,200	61·5	26,000	60·8	21,660
28	64·0	41,500	63·4	37,780	62·8	34.060	62·5	32,200	61·4	25,380	60·8	21,660
29	64·0	41,500	63·4	37,780	62·8	34.060	62·4	31,580	61·4	25,380	60·8	21,660
30	64·0	41,500	63·4	37,780	62·7	33,440	62·4	31,580	61·4	25,380	60·8	21,660
31	....	....	63·4	37,780	....	...	62·2	30,340	....	......	60·8	21,660

Notes.—Daily discharges are taken from rating curve plotted for Otter falls. The gauge heights are referred to tail-race gauge at Point du Bois.

Daily Gauge Height and Discharge of Winnipeg River at Otter Falls, for 1909.

[Drainage Area, 50,550 square miles.]

Day.	January.		February.		March		April		May		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	60·89	22,280	60·99	22,900	60·89	22,280	60·10	17,320	60·00	16,700	61·20	24,140
2	60·89	22,280	60·99	22,900	60·79	21,660	60·10	17,320	59·90	16,100	61·20	24,140
3	60·89	22,280	60·99	22,900	60·69	21,040	60·10	17,320	59·90	16,100	61·25	24,450
4	60·89	22,280	60·99	22,900	60·59	20,420	60·00	16,700	59·90	16,100	61·20	24,140
5	60·89	22,280	60·99	22,900	60·59	20,420	60·00	16,700	59·90	16,100	61·30	24,760
6	60·89	22,280	60·99	22,900	60·49	19,800	60·10	17,320	59·90	16,100	61·30	24,760
7	60·99	22,900	60·19	24,140	60·49	19,800	60·10	17,320	60·00	16,700	61·30	24,760
8	61·29	24,760	60·29	24,760	60·49	19,800	60·00	16,700	60·10	17,320	61·25	24,450
9	61·69	27,240	60·39	25,380	60·49	19,800	60·00	16,700	60·20	17,940	61·30	24,760
10	61·79	27,860	60·39	25,380	60·49	19,800	60·00	16,700	60·20	17,940	61·30	24,760
11	61·69	27·240	61·39	25·380	60·49	19·800	60·00	16,700	60·30	18,560	61·25	24,450
12	61·69	27,240	61·49	26,000	60·49	19,800	60·00	16,700	60·40	19,180	61·30	24,760
13	61·89	28,480	61·59	26,620	60·39	19,180	60·00	16,700	60·50	19,800	61·30	24,760
14	61·89	28,480	61·59	26,620	60·39	19,180	60·00	16,700	60·60	20,420	61·30	24,760
15	61·79	27,860	61·59	26,620	60·39	19,180	60·00	16,700	60·70	21,040	61·25	24,450
16	61·79	27,860	61·59	26,620	60·39	19,180	60·00	16,700	60·70	21,040	61·30	24,760
17	61·79	27,860	61·59	26,620	60·29	18,560	59·90	16,100	60·70	21,040	61·25	24,450
18	61·69	27,240	61·39	25,380	60·09	17,320	59·90	16,100	60·80	21,660	61·30	24,760
19	61·59	26,620	61·19	24,140	60·19	17,940	59·90	16,100	60·80	21,660	61·20	24,140
20	61·59	26,620	60·99	22,900	......	17,940	59·90	16,100	60·80	21,660	61·20	24,140
21	61·49	26,000	60·89	22,280	......	17,940	60·00	16,700	60·90	22,280	61·30	24,760
22	61·09	23,520	60·89	22,280	....	17,320	59·90	16,100	60·90	22,280	61·25	24,450
23		23,210	60·99	22,900	....	17,320	60·00	16,700	61·00	22,900	61·25	24,450
24	60·99	22,900	60·99	22,900	60·09	17,320	60·00	16,700	61·00	22,900	61·30	24,760
25	..	22,900	61·09	23,520	60·09	17,320	60·00	16,700	61·10	23,520	61·30	24,760
26		22,900	61·09	23,520	60·09	17,320	60·00	16,700	61·10	23,520	61·30	24,760
27		22,900	60·99	22,900	60·09	17,320	60·00	16,700	61·10	23,520	61·25	24,450
28		22,900	60·99	22,900	60·09	17,320	60·00	16,700	61·10	23,520	61·25	24,450
29		22,900			60·09	17,320	60·00	16,700	61·10	23·520	61·30	24,760
30		22,900			60·09	17,320	60·00	16,700	61·20	24,140	61·30	24,760
31		22,900	.	...	59·99	16,700	....	... .	61·20	24,140	..	

Day.	July.		August.		September.		October.		November.		December.	
1	61·25	24,450	61·25	24·450	61·10	23·520	60·80	21,660	60·50	19,800	60·70	21,040
2	61·25	24,450	61·25	24,450	61·00	22,900	60·75	21,350	60·45	19,490	60·75	21,350
3	61·30	24,760	61·20	24,140	61·00	22,900	60·75	21,350	60·50	19,800	60·75	21,350
4	61·30	24,760	61·20	24,140	61·00	22,900	60·75	21,350	60·55	20,110	60·75	21,350
5	61·30	24,760	61·20	24,140	61·05	23,210	60·75	21,350	60·55	20,110	60·75	21,350
6	61·30	24,760	61·30	24,760	61·00	22,900	60·75	21,350	60·55	20,110	60·75	21,350
7	61·35	25,070	61·30	24,760	60·90	22,280	60·75	21,350	60·55	20,110	60·75	21,350
8	61·35	25,070	61·30	24,760	60·95	22,590	60·70	21,040	60·55	20,110	60·80	21,660
9	61·35	25,070	61·30	24,760	60·85	21,970	60·65	20,730	60·55	20,110	60·85	21,970
10	61·35	25,070	61·30	24,760	60·90	22,280	60·60	20,420	60·55	20,110	60·95	22,590
11	61·30	24,760	61·25	24,450	60·90	22,280	60·55	20,110	60·55	20,110	60·95	22,590
12	61·30	24,760	61·25	24,450	60·90	22,280	60·55	20,110	60·55	20,110	60·95	22,590
13	61·30	24,760	61·30	24,760	60·95	22,590	60·50	19,800	60·60	20,420	60·95	22,590
14	61·30	24,760	61·35	25,070	60·95	22,590	60·50	19,800	60·60	20,420	60·95	22,590
15	61·30	24,760	61·35	25,070	60·90	22,280	60·50	19,800	60·60	20,420	60·95	22,590
16	61·30	24,760	61·35	25,070	60·90	22,280	60·50	19,800	60·60	20,420	60·95	22,590
17	61·30	24,760	61·30	24,760	60·90	22,280	60·45	19,490	60·60	20,420	60·95	22,590
18	61·30	24,760	61·30	24,760	60·95	22,590	60·50	19,800	60·65	20,730	60·95	22,590
19	61·30	24,760	61·30	24,760	60·90	22,280	60·55	20,110	60·65	20,730	60·95	22,590
20	61·30	24,760	61·20	24,140	60·90	22,280	60·55	20,110	60·65	20,730	60·95	22,590
21	61·30	24,760	61·25	24,450	60·85	21,970	60·50	19·800	60·65	20,730	60·95	22,590
22	61·30	24,760	61·25	24,450	60·85	21,970	60·55	20,110	60·65	20,730	[illegible]	[illegible]
23	61·30	24,760	61·25	24,450	60·85	21,970	60·55	20,110	60·70	21,040	[illegible]	[illegible]
24	61·30	24,760	61·25	24,450	60·80	21,660	60·55	20,110	60·70	21,040	[illegible]	[illegible]
25	61·25	24,450	61·25	24,450	60·80	21,660	60·55	20,110	60·70	21,040	[illegible]	[illegible]
26	61·20	24,140	61·25	24,450	60·80	21,660	60·50	19,800	60·70	21,040	61·[illegible]	[illegible]
27	61·25	24,450	61·30	24,760	60·80	21,660	60·45	19,490	60·70	21,040	61·[illegible]	[illegible]
28	61·20	24,140	61·30	24,760	60·80	21,660	60·55	20,110	60·70	21,040	61·[illegible]	[illegible]
29	61·20	24,140	61·25	24,450	60·80	21,660	60·55	20,110	60·70	[illegible]	[illegible]	[illegible]
30	61·15	23,830	61·15	23,830	60·80	21,660	60·50	19,800	60·70	21,040	61·20	24,140
31	61·20	24,140	61·10	23,520	......	......	60·50	19,800	...		61·20	24,140

Note.—Daily discharges are taken from rating curve plotted for Otter falls. Gauge heights are referre[illegible] gauge at Point du Bois.

DAILY GAUGE HEIGHT AND DISCHARGE of Winnipeg River at Otter Falls, for 1910.

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Feet	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1	61·20	24,140	61·30	24,760	61·20	24,140	61·40	25,380	65·50	50,880	65·70	52,160
2	61·20	24,140	61·30	24,760	61·20	24,140	61·50	26,000	65·55	51,200	65·65	51,840
3	61·20	24,140	61·30	24,760	61·20	24,140	61·60	26,620	65·70	52,160	65·60	51,520
4	61·50	26,000	61·30	24,760	61·20	24,140	61·70	27,240	65·75	52,480	65·55	51,200
5	61·35	25,070	61·30	24,760	61·20	24,140	61·90	28,480	65·80	52,800	65·60	51,520
6	61·40	25,380	61·30	24,760	61·20	24,140	62·20	30,340	65·85	53,120	65·65	51,840
7	61·40	25,380	61·25	24,450	61·20	24,140	62·40	31,580	65·90	53,440	65·65	51,840
8	61·50	26,000	61·20	24,140	61·20	24,140	62·60	32,820	65·85	53,120	65·65	51,840
9	61·70	27,240	61·20	24,140	61·20	24,140	62·80	34,060	65·80	52,800	65·65	51,840
10	61·50	26,000	61·20	24,140	61·20	24,140	63·10	35,920	65·80	52,800	65·65	51,840
11	61·50	26,000	61·20	24,140	61·20	24,140	63·30	37,160	65·80	52,800	65·60	51,520
12	61·50	26,000	61·20	24,140	61·20	24,140	63·50	38,400	65·80	52,800	65·50	50,880
13	61·50	26,000	61·20	24,140	61·15	23,830	63·60	39,020	65·80	52,800	65·45	50,560
14	61·50	26,000	61·20	24,140	61·15	23,830	63·75	39,950	65·80	52,800	65·35	49,920
15	61·50	26,000	61·20	24,140	61·15	23,830	63·90	40,880	65·85	53,120	65·25	49,280
16	61·45	25,690	61·20	24,140	61·15	23,830	64·00	41,500	65·90	53,440	65·15	48,650
17	61·40	25,380	61·20	24,140	61·15	23,830	64·15	42,430	65·85	53,120	65·05	48,020
18	61·40	25,380	61·20	24,140	61·15	23,830	64·40	43,980	65·85	53,120	64·95	47,390
19	61·35	25,070	61·20	24,140	61·15	23,830	64·55	44,910	65·85	53,120	64·85	46,770
20	61·35	25,070	61·20	24,140	61·15	23,830	64·75	46,150	65·85	53,120	64·85	46,770
21	61·35	25,070	61·20	24,140	61·15	23,830	64·75	46,150	65·85	53,120	64·80	46,460
22	61·30	24,760	61·20	24,140	61·15	23,830	64·75	46,150	65·85	53,120	64·80	46,460
23	61·35	25,070	61·20	24,140	61·15	23,830	64·85	46,770	65·85	53,120	64·75	46,150
24	61·35	25,070	61·20	24,140	61·15	23,830	65·00	47,700	65·85	53,120	64·75	46,150
25	61·35	25,070	61·20	24,140	61·10	23,520	65·20	[illegible]	65·80	52,800	64·70	45,840
26	61·30	24,760	61·20	24,140	61·05	23,210	65·25	49,280	65·80	52,800	64·65	45,530
27	61·30	24,760	61·20	24,140	61·00	22,900	65·30	49,600	65·80	52,800	64·55	44,910
28	61·30	24,760	61·20	24,140	61·00	22,900	65·30	49,600	65·85	53,120	64·50	44,600
29	61·30	24,760			61·05	23,210	65·30	49,600	65·85	53,120	64·40	43,980
30	61·30	24,760			61·05	23,210	65·40	50,240	65·80	52,800	64·30	43,360
31	61·20	24,140			61·20	24,140			65·75	52,480		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	64·25	43,050	61·80	27,860	60·80	21,660	60·25	18,250	59·78	15,[illegible]	59·38	13,150
2	64·20	42,740	61·90	28,480	60·80	21,660	60·20	17,940	59·74	15,180	59·35	13,250
3	64·20	42,740	61·50	26,930	60·70	21,040	60·20	17,940	59·74	15,480	59·35	13,250
4	64·15	42,430	61·65	26,620	60·70	21,040	60·25	18,250	59·70	14,950	59·37	13,250
5	64·10	42,120	61·55	26,310	60·70	21,040	60·15	17,630	59·70	14,950	59·30	13,050
6	64·00	41,500	61·60	26,620	60·70	21,040	60·20	17,940	59·70	14,950	59·30	13,050
7	64·00	41,500	61·55	26,310	60·65	20,730	60·20	17,940	59·70	14,950	59·30	13,050
8	63·90	40,880	61·50	26,000	60·50	19,800	60·20	17,940	59·70	14,950	59·30	13,050
9	63·90	40,880	61·45	25,690	60·45	19,490	60·20	17,940	59·65	14,630	59·30	13,050
10	63·90	40,880	61·50	26,000	60·45	19,490	60·20	17,940	59·60	14,400	59·30	13,050
11	63·85	40,570	61·45	25,690	60·50	19,800	60·15	17,630	59·60	14,400	59·30	13,050
12	63·75	39,950	61·40	25,380	60·40	19,180	60·15	17,630	59·65	14,630	59·30	13,050
13	63·70	39,640	61·35	25,070	60·45	19,490	60·05	17,010	59·65	14,630	59·30	13,050
14	63·70	39,640	61·35	25,070	60·40	19,180	60·00	16,700	59·60	14,400	59·30	13,050
15	63·60	39,020	61·35	25,070	60·40	19,180	60·00	16,700	59·50	13,900	59·20	12,700
16	63·55	38,710	61·35	25,070	60·40	19,180	60·05	17,010	59·44	13,680	59·20	12,700
17	63·40	37,780	61·40	25,380	60·35	18,870	60·00	16,700	59·50	13,900	59·20	12,700
18	63·25	36,850	61·15	23,830	60·40	19,180	60·00	16,700	59·40	13,450	59·20	12,700
19	63·10	35,920	61·30	24,760	60·45	19,490	60·05	17,010	59·50	13,900	59·20	12,700
20	63·00	35,300	61·00	22,900	60·40	19,180	60·05	17,010	59·55	14,150	59·25	12,880
21	62·85	34,370	61·15	23,830	60·30	18,560	60·10	17,320	59·50	13,900	59·25	12,880
22	62·65	33,130	61·00	22,900	60·35	18,870	60·00	16,700	59·45	13,680	59·18	12,700
23	62·55	32,510	61·15	23,830	60·35	18,870	59·95	16,400	59·40	13,450	59·14	12,550
24	62·50	32,200	61·10	23,520	60·40	19,180	59·90	16,100	59·50	13,900	59·12	12,400
25	62·50	32,200	61·00	22,900	60·40	19,180	59·90	16,100	59·50	13,900	59·10	12,400
26	62·45	31,890	60·95	22,590	60·40	19,180	59·90	16,100	59·50	13,900	59·10	12,400
27	62·35	31,270	60·90	22,280	60·40	19,180	59·87	15,800	59·50	13,900	59·20	12,700
28	62·25	30,650	60·90	22,280	60·30	18,560	59·85	15,800	59·50	13,900	59·15	12,550
29	62·05	29,410	60·90	22,280	60·35	18,870	59·85	15,800	59·45	13,680	59·30	13,050
30	61·85	28,170	60·90	22,280	60·35	18,870	59·82	15,500	59·42	13,450	59·35	13,250
31	61·75	27,550	60·85	21,970			59·80	15,500	..		59·40	13,450

ote.—Daily discharges are taken from rating curve plotted for Otter Falls. Gauge heights are referred to tail-race auge at Point du Bois.

MONTHLY DISCHARGE of Winnipeg River at Otter Falls, for the years 1907-10.

[Drainage Area, 50,550 square miles.]

Month.	Discharge in Second-Feet.				Run-Off	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
1907.						
January	28,170	26,000	26,960	0·533	0·615	1,657,700
February	29,100	18,560	22,880	0·452	0·471	1,270,700
March	19,180	15,500	17,320	0·343	0·395	1,064,900
April	16,700	14,400	14,590	0·288	0·321	868,200
May	20,420	14,400	16,290	0·322	0·371	1,001,600
June	33,440	21,660	28,030	0·554	0·618	1,667,900
July	34,060	30,340	32,020	0·634	0·731	1,968,800
August	34,060	30,340	31,340	0·620	0·715	1,927,000
September	39,020	34,680	37,140	0·735	0·820	2,210,000
October	43,980	39,020	42,520	0·841	0·970	2,614,400
November	42,740	42,120	42,680	0·845	0·913	2,539,600
December	42,740	36,540	39,500	0·782	0·902	2,428,800
The year	43,980	14,400	29,460	0·579	7·872	21,219,600
1908.						
January	40,260	35,300	36,880	0·729	0·81[illegible]	2,267,700
February	40,880	32,820	36,650	0·725	0·782	2,108,200
March	33,440	28,480	31,380	0·621	0·716	1,924,500
April	29,100	27,240	28,500	0·564	0·629	1,695,900
May	37,780	29,100	32,600	0·645	0·744	2,004,500
June	43,980	38,400	41,640	0·824	0·919	2,477,800
July	43,980	41,500	42,980	0·850	0·980	2,642,700
August	41,500	37,780	39,560	0·782	0·902	2,432,500
September	39,020	33,440	35,900	0·710	0·792	2,136,200
October	34,680	30,340	33,040	0·654	0·754	2,031,400
November	30,340	25,380	28,400	0·562	0·627	1,689,900
December	24,760	21,660	23,340	0·462	0·533	1,435,100
The year	43,980	21,660	34,230	0·677	9·219	24,851,400
1909.						
January	28,480	22,280	24,770	0·490	0·565	1,523,000
February	26,620	22,280	24,180	0·478	0·498	1,342,900
March	22,280	16,700	18,820	0·372	0·429	1,157,200
April	17,320	16,100	16,700	0·330	0·368	993,700
May	24,140	16,100	20,300	0·402	0·464	1,248,200
June	24,760	24,140	24,560	0·486	0·542	1,461,400
July	25,070	23,830	24,650	0·488	0·563	1,515,700
August	25,070	23,520	24,530	0·485	0·559	1,508,300
September	23,520	21,660	22,290	0·441	0·492	1,326,400
October	21,660	19,490	20,330	0·402	0·464	1,250,000
November	21,040	19,490	20,470	0·405	0·452	1,218,000
December	25,070	21,010	22,530	0·446	0·514	1,385,300
The year	28,480	16,100	22,010	0·435	5·910	16,930,100
1910						
January	27,240	24,140	25,260	0·500	0·576	1,553,200
February	24,760	24,110	24,280	0·480	0·500	1,349,500
March	24,140	22,900	23,830	0·472	0·544	1,465,300
April	50,240	25,380	39,900	0·789	0·880	2,374,200
May	53,440	50,880	52,820	1·045	1·204	3,247,700
June	52,160	43,360	48,690	0·963	1·074	2,897,300
July	43,050	27,550	36,950	0·731	0·843	2,272,000
August	28,480	21,970	24,700	0·488	0·563	1,518,700
September	21,660	18,560	19,630	0·388	0·433	1,168,100
October	18,250	15,500	17,000	0·336	0·387	1,045,300
November	15,500	13,450	14,280	0·283	0·316	849,700
December.	13,450	12,400	12,920	0·255	0·294	794,400
The year	53,440	12,400	28,360	0·561	7·614	20,535,400

Berens River. First Rapids above Eleventh Falls.

Berens River, Eleventh Falls.

WINNIPEG RIVER, PINAWA CHANNEL, BELOW THE CONTROL DAM.

History.—The Pinawa channel was a high-water or back channel of the Winnipeg river. and was utilized as a diverting channel for a power-house built about 9 miles below the inlet by the Winnipeg Street Railway. At first the plant depended upon the stage of the river for water down this channel, but the rapid growth of the load necessitated the building of a diverting dam in the main river to ensure sufficient flow down the Pinawa channel. Meterings were made below the control dam by engineers of the company from 1907 to 1911. In May, 1912, the present station was established for the Manitoba Hydrographic Survey by A. M. Beale.

Location of Section.—The station is about 200 feet below the control dam, and 9 miles above the Winnipeg Street Railway's plant on the Pinawa channel. The initial point is a point chiselled in the rock on the left bank of the channel and referenced by a rock painted " I.P. 5 feet N."

Records available.—A daily gauge record at the control dam was kept by the Winnipeg Street Railway Company from April 28, 1906, to the end of 1914. They are not continuous, but cover the greater part of the period. They have been placed at the disposal of the Manitoba Hydrographic Survey.

Daily discharge estimates, based upon a curve plotted from discharge measurements taken between 1907 and 1911, are available. These cover the period of the years from May to October (the open water months). On account of back-water due to ice jams in the channel below, estimates have not been made for the winter months.

Gauge.—A vertical staff gauge bolted to the upstream side of the control dam. It is referred to W.P.S. datum.

Channel.—The channel is straight for 100 feet above the section and the same distance below; the section is regular, being a rock cut channel, the water being confined to the channel at all stages.

Discharge Measurements.—Discharge measurements are made from a boat held in place by a stay line stretched across the channel; a tagged wire also stretched across the channel indicates the intervals.

Diversions.—All the water passing through the dam passes the section, but there is a diversion channel just above the dam, down which water may be diverted.

Accuracy.—For the earlier years the discharge curve is well defined, but since the power station has been heavily loaded the load fluctuation may be noticed at the section, making estimates of discharge rather susceptible to error.

Discharge Measurements of Pinawa Channel below Control Dam, 1907–14.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1907.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 2	W. E. S. R. Co.					101·45	5,571
" 11	"					101·45	[1]5,582
Oct. 8	"					102·10	6,700
1908.							
April 3	"					101·75	4,421
July 12 & 14	"					104·20	5,644
Nov. 7 & 8	"					104·60	5,706
1909.							
Mar. 24	"					101·40	4,545
May 24	"					104·25	5,650
July 17	"					105·00	5,076
1910.							
Mar. 9	"					104·50	8,515
May 5	"					104·50	10,845
July 28	"					105·40	6,832
1911.							
May 19	"					102 60	8,984
1912.							
May 11	A. M. Beale	1196	[illegible]	1,657	5·54	103·00	9,179
June 1	G. H. Burnham	1187	[illegible]	1,783	5·65	103·53	10,074
" 22	"	1187	131·5	1,758	5·78	103·57	10,159
July 17	"	1187	131·5	1,718	5·75	103·27	9,879
1913.							
Mar. 28	G. H. Burnham	1186	131·5	1,746	4·29	103·51	7,497
July 16	S. C. O'Grady	1435	131·5	1,758	5·68	103·67	9,986
" 28	"	1435	131·5	1,705	5·71	103·36	9,738
1914.							
Jan. 15	E. B Patterson	1496	131·5	1,664	4·64	102·90	7,721
Feb. 17	W. J. Ireland	1469	131·5	1,715	4·05	103·30	6,951
May 4	M. S. Madden	1435	131·2	1,594	4·88	102·31	7,780
" 26	"	1435	131·2	1,664	5·01	102·97	8,235
June 5	"	1534	131·2	1,751	5·29	103·52	9,265
" 12	"	1435	131·2	1,778	5·25	103·75	9,332
" 19	"	1435	131·2	1,791	5·55	103·85	9,939
" 29	"	1497	131·2	1,804	5·34	103·90	9,643
July 8	"	1497	131·2	1,817	5·46	104·00	9,926
" 23	E. B Patterson	1497	131·2	1,796	5·82	103·94	10,457
" 27	J. C. Wilson	1497	131·2	1,796	5·77	103·91	10,355
Aug. 1	"	1497	131·2	1,781	5·88	103·82	10,483
" 4	"	1497	131·2	1,781	5·79	103·82	10,320
" 5	"	1497	131·2	1,781	5·75	103·79	10,247
" 8	"	1497	131·2	1,772	5·82	103·74	10,323
" 19	P. K. Telford	1497	131·2	1,770	5·92	103·68	10,495

[1] Weir measurement.

Note.—Gauge heights refer to upper gauge at control dam. Measurements taken by metre over spillway.

Daily Gauge Height and Discharge of Winnipeg River at Pinawa Channel, for 1908-9.

Day.	May.		June		July.		August.		September.		October.	
	Gauge Height	Dis-charge	Gauge Height.	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet	Sec.-ft	Feet.	Sec.-ft.
1	100·75	7,025	98·80	5,520	98·90	5,590	98·80	5,520	99·00	5,660	99·00	5,660
2	100·75	7,025	98·70	5,450	98·80	5,520	98·80	5,520	99·05	5,695	99·00	5,660
3	100·70	6,980	98·70	5,450	98·85	5,555	98·80	5,520	99·05	5,695	99·00	5,660
4	100·70	6,980	98·70	5,450	98·90	5,590	98·80	5,520	99·05	5,695	99·00	5,660
5	100·70	6,980	98·70	5,450	98·90	5,590	98·80	5,520	99·10	5,730	99·10	5,660
6	100·75	7,025	98·70	5,450	98·90	5,590	98·80	5,520	99·10	5,730	99·00	5,660
7	100·75	7,025	98·70	5,450	98·90	5,590	98·80	5,520	99·10	5,730	99·00	5,660
8	100·20	6,560	98·70	5,450	98·90	5,590	98·85	5,555	99·10	5,730	99·00	5,660
9	99·70	6,165	98·65	5,417	98·90	5,590	98·85	5,555	99·10	5,730	99·00	5,660
10	99·70	6,165	98·65	5,417	98·90	5,590	98·85	5,555	99·00	5,660	99·00	5,660
11	99·70	6,165	98·75	5,485	98·85	5,555	98·90	5,590	99·00	5,660	99·00	5,660
12	99·80	6,240	98·80	5,520	98·80	5,520	98·90	5,590	99·00	5,660	99·00	5,660
13	99·20	5,800	99·00	5,660	98·85	5,555	98·90	5,590	99·00	5,660	99·00	5,660
14	99·20	5,800	99·00	5,660	98·85	5,555	98·90	5,590	99·00	5,660	99·00	5,660
15	99·20	5,800	99·00	5,660	98·85	5,555	98·90	5,590	99·00	5,660	99·00	5,660
16	99·20	5,800	99·00	5,660	98·85	5,555	98·95	5,625	99·00	5,660	99·00	5,660
17	99·20	5,800	99·00	5,660	98·85	5,555	98·95	5,625	99·00	5,660	99·00	5,660
18	99·20	5,800	99·00	5,660	98·80	5,520	98·95	5,625	99·00	5,660	99·00	5,660
19	99·20	5,800	99·00	5,660	98·80	5,520	98·95	5,625	99·00	5,660	99·00	5,660
20	99·45	5,977	99·00	5,660	98·85	5,555	98·95	5,625	99·00	5,660	99·00	5,660
21	99·50	6,015	98·90	5,590	98·85	5,555	98·90	5,590	99·00	5,660	99·00	5,660
22	99·50	6,015	98·90	5,590	98·85	5,555	98·90	5,590	99·00	5,660	99·00	5,660
23	99·50	6,015	99·00	5,660	98·85	5,555	98·90	5,590	98·90	5,590	99·00	5,660
24	99·50	6,015	98·90	5,590	98·85	5,555	98·90	5,590	98·90	5,590	99·10	5,730
25	99·50	6,015	98·95	5,625	98·80	5,520	98·90	5,590	98·90	5,590	99·30	5,870
26	99·50	6,015	98·90	5,590	98·80	5,520	98·90	5,590	99·00	5,660	99·50	6,015
27	99·50	6,015	98·90	5,590	98·80	5,520	98·90	5,590	99·10	5,730	99·50	6,015
28	99·60	6,090	98·90	5,590	98·80	5,520	99·00	5,660	99·00	5,660	99·50	6,015
29	99·60	6,090	98·90	5,590	98·80	5,520	99·00	5,660	99·00	5,660	99·50	6,015
30	99·60	6,090	98·90	5,590	98·80	5,520	99·00	5,660	99·00	5,660	99·40	5,940
31	99·30	5,870			98·80	5,520	99·00	5,660			99·40	5,940

Day.	May, 1909		June, 1909		July, 1909		August, 1909		Sept., 1909		Oct., 1909	
1	100·30	6,640	99·85	6,280	98·60	5,385	97·60	4,790	98·50	5,320	99·00	5,660
2	100·30	6,640	99·70	6,165	98·70	5,450	98·50	5,320	98·50	5,320	99·00	5,660
3	100·30	6,640	99·85	6,280	98·60	5,385	98·60	5,385	98·50	5,320	99·00	5,660
4	100·30	6,640	99·85	6,280	98·60	5,385	98·60	5,385	98·70	5,450	98·70	5,450
5	100·40	6,720	98·10	5,080	98·65	5,417	98·50	5,320	98·70	5,450	98·70	5,450
6	100·50	6,800	98·10	5,080	98·65	5,417	98·60	5,385	98·70	5,450	98·70	5,450
7	100·60	6,890	98·05	5,050	98·65	5,417	98·10	5,260	98·80	5,520	99·20	5,800
8	100·60	6,890	98·05	5,050	98·70	5,450	96·70	4,330	98·80	5,520	99·20	5,800
9	100·70	6,980	98·15	5,110	98·70	5,450	98·50	5,320	98·80	5,520	99·20	5,800
10	100·80	7,070	98·15	5,110	98·70	5,450	98·50	5,320	98·80	5,520	99·10	5,730
11	100·90	7,160	98·10	5,080	98·70	5,450	98·50	5,320	98·80	5,520	99·20	5,800
12	101·00	7,260	98·15	5,110	98·70	5,450	98·50	5,320	98·80	5,520	99·50	6,015
13	101·05	7,310	98·20	5,140	98·70	5,450	98·50	5,320	98·80	5,520	99·50	6,015
14	101·30	7,560	98·15	5,110	98·90	5,590	98·50	5,320	98·80	5,520	99·50	6,015
15	100·00	6,400	98·15	5,110	98·90	5,590	98·50	5,320	98·80	5,520	99·50	6,015
16	99·00	5,660	98·15	5,110	98·90	5,590	98·50	5,320	98·80	5,520	99·50	6,015
17	99·20	5,800	98·15	5,110	99·00	5,660	98·50	5,320	98·80	5,520	99·50	6,015
18	99·24	5,828	98·10	5,080	99·00	5,660	98·50	5,320	99·00	5,660	99·50	6,015
19	99·60	6,090	98·10	5,080	99·05	5,695	98·50	5,320	99·00	5,660	99·50	6,015
20	99·60	6,090	98·10	5,080	99·05	5,695	98·50	5,320	99·00	5,660	100·20	6,560
21	99·60	6,090	98·10	5,080	99·40	5,730	98·50	5,320	99·00	5,660	100·20	6,560
22	99·70	6,165	98·15	5,110	99·10	5,730	98·50	5,320	99·00	5,660	100·20	6,560
23	99·65	6,127	98·10	5,080	99·10	5,730	98·50	5,320	99·00	5,660	100·20	6,560
24	99·65	6,127	98·25	5,170	99·10	5,730	98·50	5,320	99·00	5,660	100·20	6,560
25	99·65	6,127	98·30	5,200	99·10	5,730	98·20	5,140	99·00	5,660	100·20	6,560
26	99·55	6,052	98·30	5,200	99·10	5,730	98·20	5,140	99·00	5,660	100·20	6,560
27	99·55	6,052	98·30	5,200	98·60	5,385	98·20	5,140	99·00	5,660	100·65	6,935
28	[illegible]	[illegible]	[illegible]	[illegible]	98·50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	99·70	6,165	98·60	5,385	98·50	5,320	97·30	4,630	99·00	5,650	100·7	6,980
30	99·80	6,240	98·60	5,385	98·50	5,320	98·20	5,140	99·00	5,660	100·70	6,980
31	99·80	6,240			98·50	5,320	98·20	5,140			100·70	6,980

Note.—Below gauge height 192·50 the rating curve is not well defined.

DAILY GAUGE HEIGHT AND DISCHARGE of Winnipeg River at Pinawa Channel, for 1910-11.

Day.	May, 1910.		June, 1910.		July, 1910.		Aug., 1910.		Sept., 1910.		Oct., 1910	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	104·2	10,975	104·1	10,850	99·6	6,090	99·1	5,730	99·0	5,660	99·1	5,730
2	104·2	10,975	104·1	10,850	99·6	6,090	99·1	5,730	99·0	5,660	99·1	5,730
3	104·2	10,975	104·1	10,850	99·6	6,090	99·1	5,730	99·0	5,660	99·1	5,730
4	104·2	10,975	104·1	10,850	99·5	6,015	99·1	5,730	99·0	5,660	99·1	5,730
5	104·2	10,975	104·1	10,850	99·4	5,940	99·1	5,730	99·0	5,660	99·2	5,800
6	104·2	10,975	104·1	10,850	99·4	5,940	99·1	5,730	98·9	5,590	99·2	5,800
7	104·3	11,100	104·0	10,725	99·4	5,940	99·1	5,730	98·9	5,590	99·2	5,800
8	104·3	11,100	104·0	10,725	99·4	5,940	99·4	5,730	98·9	5,590	99·2	5,800
9	104·3	11,100	104·0	10,725	99·4	5,940	99·1	5,730	98·9	5,590	99·3	5,870
10	104·3	11,100	104·0	10,725	99·4	5,940	99·0	5,660	98·9	5,590	99·3	5,870
11	104·3	11,100	104·0	10,725	99·5	6,015	98·9	5,590	98·9	5,590	98·3	5,870
12	104·3	11,100	104·0	10,725	99·5	6,015	98·9	5,590	98·9	5,590	98·4	5,940
13	104·0	10,725	103·9	10,600	99·6	6,090	98·8	5,520	98·9	5,590	98·4	5,940
14	104·1	10,850	103·9	10,600	99·5	6,015	98·8	5,520	98·9	5,590	98·4	5,940
15	104·4	11,225	103·9	10,600	99·5	6,015	98·8	5,520	98·9	5,590	98·4	5,940
16	104·3	11,100	103·9	10,600	99·5	6,015	98·8	5,520	98·9	5,590	99·4	5,940
17	104·3	11,100	103·1	9,600	99·4	5,940	98·8	5,520	98·9	5,590	99·4	5,940
18	104·3	11,100	103·0	9,475	99·4	5,940	98·8	5,520	98·9	5,590	99·5	6,015
19	104·3	11,100	103·0	9,475	99·4	5,940	98·8	5,520	98·9	5,590	99·5	6,015
20	104·3	11,100	103·0	9,475	99·4	5,940	98·8	5,520	98·9	5,590	99·9	6,320
21	104·3	11,100	103·0	9,475	99·4	5,940	98·9	5,590	98·9	5,590	99·9	6,320
22	104·3	11,100	103·0	9,475	99·3	5,870	98·9	5,590	98·9	5,590	100·4	6,720
23	104·3	11,100	103·0	9,475	99·2	5,800	98·9	5,590	99·0	5,660	100·4	6,720
24	101·3	11,100	101·8	8,080	99·2	5,800	98·9	5,590	99·0	5,660	100·4	6,720
25	104·3	11,100	101·1	7,360	99·2	5,800	98·9	5,590	99·0	5,660	100·4	6,720
26	104·2	10,975	100·3	6,640	99·2	5,800	98·9	5,590	99·0	5,660	100·4	6,720
27	104·2	10,975	100·0	6,400	99·2	5,800	98·9	5,590	99·0	5,660	100·4	6,720
28	104·2	10,975	99·9	6,320	99·2	5,800	98·9	5,590	99·0	5,660	100·4	6,720
29	104·2	10,975	99·9[1]	6,320	99·1	5,730	98·9	5,590	99·0	5,660	100·5	6,800
30	104·2	10,975	99·8	6,240	99·1	5,730	99·0	5,660	99·1	5,730	100·5	6,800
31	104·2	10,975			99·1	5,730	99·0	5,660			100·5	6,800

Day.	May, 1911.		June, 1911.		July, 1911.		August, 1911.		Sept., 1911.		Oct., 1911	
1	102·0	8,300	102·6	8,975	102·9	9,350	103·2	9,735	103·1	9,600	103·1	9,600
2	102·0	8,300	102·6	8,975	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
3	102·1	8,410	102·7	9,100	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
4	102·1	8,410	102·7	9,100	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
5	102·1	8,410	102·7	9,100	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
6	102·1	8,410	102·7	9,100	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
7	102·1	8,410	102·7	9,100	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
8	102·1	8,410	102·7	9,100	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
9	102·2	8,520	102·8	9,225	103·0	9,475	103·2	9,725	103·1	9,600	103·1	9,600
10	102·2	8,520	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	103·1	9,600
11	102·2	8,520	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	103·2	9,725
12	102·3	8,630	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	102·5	8,850
13	102·3	8,630	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	102·1	8,410
14	102·3	8,630	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	102·1	8,410
15	102·4	8,710	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	101·9	8,190
16	102·4	8,740	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	101·7	7,950
17	102·4	8,710	102·8	9,225	103·1	9,600	103·2	9,725	103·1	9,600	101·5	7,760
18	102·4	8,740	102·9	9,350	103·1	9,600	103·2	9,725	103·1	9,600	101·1	7,360
19	102·4	8,740	102·9	9,350	103·1	9,600	103·2	9,725	103·1	9,600	100·9	7,160
20	102·4	8,740	102·9	9,350	103·2	9,725	103·2	9,725	103·1	9,600	100·8	7,070
21	102·5	8,850	102·9	9,350	103·2	9,725	103·2	9,725	103·1	9,600	100·8	7,070
22	102·5	8,850	102·9	9,350	103·2	9,725	103·2	9,725	103·1	9,600	100·8	7,070
23	102·5	8,850	102·9	9,350	103·2	9,725	103·2	9,725	103·1	9,600	100·8	7,070
24	102·5	8,850	102·9	9,350	103·2	9,725	103·2	9,725	103·1	9,600	100·8	7,070
25	102·5	8,850	102·9	9,350	103·2	9,725	103·2	9,725	103·1	9,600	100·8	7,070
26	102·6	8,975	102·9	9,350	103·2	[illegible]	103·2	9,725	103·1	9,600	100·8	7,070
27	102·6	8,975	102·9	9,350	103·2	[illegible]	103·2	9,725	103·1	9,600	100·8	7,070
28	102·6	8,975	102·9	9,350	103·2	[illegible]	103·2	9,725	103·1	9,600	100·8	7,070
29	102·6	8,975	102·9	9,350	103·2	[illegible]	103·2	9,725	103·1	9,600	100·8	7,070
30	102·6	8,975	102·9	9,350	103·2	9,725	103·2	9,725	103·1	9,600	100·8	7,070
31	102·6	8,975	...		103·2	9,725	103·2	9,725			100·8	7,070

NOTE Below gauge height 102·50 the rating curve is not well defined.

DAILY GAUGE HEIGHT AND DISCHARGE of Winnipeg River at Pinawa Channel, for 1912–13.

Day.	May, 1912.		June, 1912.		July, 1912.		Aug., 1912.		Sept., 1912.		Oct., 1912.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.
1	102·5	8,850	103·5	10,100								
2	102·7	9,100	103·5	10,100								
3	102·7	9,100	103·5	10,100								
4	102·7	9,100	103·6	10,225								
5	102·7	9,100	103·6	10,225								
6	102·8	9,225	103·6	10,225								
7	102·8	9,225	103·6	10,225					103·4	9,975		
8	102·8	9,225	103·6	10,225								
9	102·8	9,225	103·6	10,225								
10	102·9	9,350	103·6	10,225								
11	102·9	9,350	103·6	10,225			101·0	7,260				
12	102·9	9,350	103·6	10,225								
13	102·9	9,350	103·6	10,225								
14	103·0	9,475	103·6	10,225								
15	103·1	9,600	103·6	10,225					103·4	9,975		
16	103·1	9,600	103·5	10,100								
17	103·1	9,600	103·5	10,100	103·2	9,725						
18	103·1	9,600	103·5	10,100								
19	103·2	9,725	103·5	10,100								
20	103·2	9,725	103·4	9,975							103·8	10,475
21	103·2	9,725	103·4	9,975	103·2	9,725						
22	103·5	9,850	103·4	9,975								
23	103·3	9,850	103·4	9,975								
24	103·3	9,850	103·4	9,975								
25	103·3	9,850										
26	103·3	9,850										
27	103·3	9,850					103·2	9,725				
28	103·4	9,975					103·2	9,725				
29	103·4	9,975					103·2	9,725				
30	103·5	10,100										
31	103·5											

Day.	May, 1913.		June, 1913		July, 1913.		Aug., 1913.		Sept., 1913.		Oct., 1913.	
1			103·60	10,200								
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15			103·70	10,400								
16					103·50	10,100						
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												

DAILY GAUGE HEIGHT AND DISCHARGE of Winnipeg River at Pinawa Channel, for 1914.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.
1	102·20	8,500			103·89	10,600	103·73	10,400	103·44	10,000	103·10[1]	9,600
2	102·20	8,500			103·90	10,600	103·71	10,400	103·40	10,000	103·10[1]	9,600
3	102·20	8,500			103·93	10,600	103·70	10,400	103·37	9,950	103·10	9,600
4	102·20	8,500			103·93	10,600	103·71	10,400	103·35	9,900	103·10[1]	9,600
5	102 30	8,650			103·90	10,600	103·69	10,300	103·36	9,950	103·05[1]	9,550
6	102·40	8,750			103·90	10,600	103·65	10,300	103·29	9,850	103·05[1]	9,550
7	102·50	8,850			103·90	10,600	103·60	10,200	103·25	9,800	103·05	9,550
8	102·40	8,750			103·90	10,600	103·65	10,300	103·26	9,800	103·05[1]	9,550
9	102·40	8,750			103·87	10,600	103·65	10,300	103·23	9,750	103·10[1]	9,600
10					103·90	10,600	103·62	10,300	103·30	9,750	103·10[1]	9,600
11					103·87	10,600	103·62	10,300	103·20	9,750	103·15[1]	9,650
12			103·65	10,300	103·87	10,600	103·62	10,300	103·20	9,750	103·15	9,650
13			103·65	10,300	103·95	10,700	103·59	10,200	103·17	9,700	103·15[1]	9,650
14			103·65	10,300	103·97	10,700	103·59	10,200	103·15	9,650	103·20[1]	9,750
15			103·70[1]	10,400	103·97	10,700	103·59	10,200	103·15	9,650	103·20	9,750
16			103·70[1]	10,400	103·93	10,600	103·59	10,200	103·10	9,600	103·20[1]	9,750
17			103·70[1]	10,400	103·90	10,600	103·59	10,200	103·13	9,650	103·20[1]	9,750
18			103·75	10,400	103·87	10,600	103·58	10,200	103·13	9,650	103·20[1]	9,750
19			103·80	10,500	103·85	10,500	103·58	10,200	103·12	9,650	103·20	9,750
20			103·80	10,500	103·87	10,600	103·57	10,200	103·10	9,600	103·20[1]	9,750
21			103·80	10,500	103·87	10,600	103·57	10,200	103·10	9,600	103·15[1]	9,650
22			103·81	10,500	103·83	10,500	103·57	10,200	103·10	9,600	103·15	9,650
23			103·80	10,500	103·84	10,500	103·56	10,200	103·15	9,650	103·15[1]	9,650
24			103·82	10,500	103·81	10,500	103·55	10,200	103·15	9,650	103·10[1]	9,600
25			103·82	10,500	103·80	10,500	103·57	10,200	103·15[1]	9,650	103·10[1]	9,600
26			103·83	10,500	103·80	10,500	103·57	10,200	103·15[1]	9,650	103·00	9,500
27			103·83	10,500	103·81	10,500	103·57	10,200	103·15	9,650	103·00[1]	9,500
28			103·83	10,500	103·80	10,500	103·56	10,200	103·15[1]	9,650	103·00[1]	9,500
29			103·84	10,500	103·79	10,500	103·53	10,100	103·10[1]	9,600	102·95	9,400
30			103·90	10,500	103·77	10,400	103·51	10,100	103·10	9,600	102·90[1]	9,350
31				10,600	103·75	10,400	103·48	10,100			102·90[1]	9,350

NOTE.—Gauge heights marked thus ([1]) interpolated.

Below gauge height 102·50 the rating curve is not well defined.

MONTHLY DISCHARGE of Winnipeg River at Pinawa Channel (Below Control Dam), for the years 1908–14.

Month.	Discharge in Second-feet.			Run off.
	Maximum	Minimum.	Mean.	Total in acre-feet
1908				
May	7,025	5,800	6,250	384,300
June	5,660	5,417	5,550	330,300
July	5,690	5,520	5,550	341,300
August	5,600	5,520	5,600	344,300
September	5,730	5,590	5,651	336,200
October	6,015	5,660	5,750	353,600
The period	7,025	5,417	5,730	2,090,000
1909				
May	7,560	5,860	6,450	396,600
June	6,660	5,050	5,300	315,400
July	5,730	5,320	5,500	338,200
August	5,385	4,100	5,200	319,700
September	5,660	5,320	5,550	330,300
October	6,980	5,450	6,150	378,200
The period	7,560	4,100	5,700	2,078,400
1910				
May	11,225	10,725	11,000	676,400
June	10,850	6,240	9,500	565,300
July	6,090	5,730	5,900	362,800
August	5,730	5,520	5,600	344,300
September	5,730	5,590	5,600	333,200
October	6,800	5,730	6,200	381,200
The period	11,225	10,725	7,300	2,663,200
1911				
May	8,975	8,300	8,700	531,900
June	9,350	8,975	9,250	550,400
July	9,725	9,350	9,600	590,300
August	9,725	9,725	9,750	599,500
September	9,600	9,600	9,600	571,200
October	9,725	7,070	8,200	504,200
The period	9,725	7,070	9,180	3,350,500
1912				
May	10,100	8,850	9,250	568,800
June	10,225	9,975	[1]10,000	595,000
July				
August		7,260		
The period	10,225	7,260	9,600	1,163,800
1914				
June	10,600	10,300	[1]10,400	618,800
July	10,700	10,400	10,600	651,800
August	10,400	10,100	10,200	627,200
September	10,000	9,600	9,700	577,200
October	9,750	9,350	9,600	590,300
The period	10,700	9,350	10,100	3,065,300

Note.—Discharges marked thus [1] estimated.

PINAWA CHANNEL, ABOVE CONTROL DAM.

History.—The station above the control dam on the Pinawa channel was first established tentatively by engineers of the Winnipeg Electric Railway during construction. Mr. Burnham fixed this point as a metering station for the Manitoba Hydrographic Survey in June, 1912.

Location of Section.—The section is on the Pinawa channel, three-quarters of a mile above the control dam and approximately 9¾ miles above the plant of the Winnipeg Street Railway. The initial point is a triangle painted black and referenced on the vertical face of rock on the left bank of the channel by a painted mark reading "I.P. 1.5 feet south."

Records Available.—Discharge measurements from 1912 have been taken, and daily gauge heights for the year 1914 have been obtained. No daily discharges have been computed, as there are not sufficient data available on which to base them.

Drainage Area.—The channel is a by-pass of the Winnipeg river, and the drainage area is not significant.

Gauge.—The gauges used in connection with this section are three in number, one at the mouth of the channel and two at the control dam. The upper one of these is used for daily records. It is a vertical staff gauge fastened to the left abutment of the control dam on the upstream side.

Channel.—For 150 feet above and 150 feet below the channel is straight. It is a rock cut, having a depth of about 16 feet under normal conditions, and with high banks not subject to overflow.

Discharge Measurements.—Three have been taken at this point, the measurements are made with Price meter from a boat.

Diversions.—Between the metering section and the control dam there is a by-channel which allows of water being diverted, the amount depending upon the stage, as the flow is controlled by a small dam with a permanent crest.

DISCHARGE MEASUREMENTS of Pinawa Channel above Control Dam, 1912.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height.	Discharge
1912			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
June 3	G. H. Burnham	1,187	126	2,007	5.17	103.6	10,377
" 22	"	1,187	125	1,944	4.97	103.55	9,660
July 18	"	1,187	125	1,921	5.11	103.27	9,817

PINAWA CHANNEL, WINNIPEG STREET RAILWAY POWER HOUSE.

History.—The station was established to obtain a rating on the power station under as wide a range in load and head as possible. One section was established by W. J. Ireland in the forebay on February 18, 1914, and a second in the tail-race by M. S. Madden on May 7, 1914.

Location of Section.—The winter section in the forebay is located about 75 feet above the racks. The initial point is marked on the north side of the forebay below the coping. The summer section is 150 feet below the power-house, in the tail-race of the plant. The initial point is marked by an arrow chiselled on a boulder on the north side of the tail-race.

Records Available.—Discharge measurements taken under a wide range in load and head have been taken, sixty-three being made at the forebay section and 115 at the tail-race section.

Gauges.—The forebay gauge is a vertical staff fastened to the north wing wall, near its intersection with the rack structure; it is referred to W.P.S. datum. The tail-race gauge is a vertical staff fastened to the near wall of the power-house on the north side; it is also referred to W.P.S. datum.

Channel.—The section in the forebay is liable to cross currents due to the operation of the several machines. The tail-race section is in a channel fairly uniform above and below the station.

Discharge Measurements.—The measurements above the station were taken from the ice. In the tail-race they were made from a boat.

Diversions.—All the water going through the power-house passes the section in the forebay, but the measurements made in the tail-race must be corrected for leakage through the dam.

Accuracy.—Sufficient measurements have been made to give a very good rating on the station under a wide range in load and head.

DISCHARGE MEASUREMENTS of Pinawa Channel at Head-race W. E. S. Ry., 1914.

Date	Hydrographer.	Meter No	Width	Area of Section.	Mean Velocity	Gauge Height.	Discharge.
1914.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Feb. 18	W. J. Ireland	1,469	270	4,763	1·50	87·35	7,174
March 6	M. S. Madden	1,435	267	4,722	1·76	87·4	8,335
" 6	"	1,435	267	4,670	1·69	87·13	7,910
" 7	"	1,435	267	4,712	1·54	87·6	7,329
" 8	"	1,435	267	5,196	0·82	87·5	4,268
" 9	"	1,435	267	4,742	1·61	87·6	7,645
" 9	"	1,435	267	4,691	1·67	87·4	7,836
" 10	"	1,435	268	4,715	1·57	87·5	7,438
" 10	"	1,435	267	4,662	1·63	87·3	7,640
" 11	"	1,435	267	4,688	1·42	87·4	6,680
" 12	"	1,435	267	4,768	1·74	87·7	8,305
" 12	"	1,435	267	4,715	1·66	87·6	7,811
" 12	"	1,435	267	4,715	1·57	87·5	7,423
" 13	"	1,435	267	4,796	1·72	87·8	8,245
" 14	"	1,435	267	4,662	1·94	87·3	9,061
" 14	"	1,435	267	4,566	1·82	86·9	8,325
" 14	"	1,435	267	4,662	1·61	87·3	7,531
" 15	"	1,435	267	5,275	1·89	89·6	4,716
" 18	"	1,435	267	4,688	1·86	87·4	8,737
" 18	"	1,435	267	4,688	1·78	87·4	8,340
" 19	"	1,435	267	4,715	1·80	87·5	8,488
" 19	"	1,435	267	4,715	1·66	87·5	7,822
" 19	"	1,435	267	4,690	1·71	87·4	8,019
" 20	"	1,435	267	4,742	1·72	87·6	8,165
" 20	"	1,435	267	4,688	1·76	87·45	8,251
" 23	"	1,435	267	4,820	1·62	87·9	7,803
" 23	"	1,435	267	4,742	1·85	87·6	8,747
" 21	"	1,435	267	4,742	1·74	87·6	8,227
" 24	"	1,435	267	4,688	1·59	87·4	7,460
" 24	"	1,435	267	4,688	1·60	87·4	7,496
" 26	"	1,435	267	4,715	1·61	87·5	7,598
" 26	"	1,435	267	4,688	1·66	87·4	7,793
" 27	"	1,435	267	4,849	1·62	88·0	7,878
" 27	"	1,435	267	4,768	1·77	87·7	8,446
" 27	"	1,435	267	4,715	1·79	87·5	8,423
" 28	"	1,435	267	4,929	1·48	88·3	7,328
" 28	"	1,435	267	4,919	1·46	88·3	7,190
" 29	"	1,435	267	5,250	0·98	89·5	5,181
" 29	"	1,435	267	5,206	1·08	89·3	5,641
" 29	"	1,435	267	5,206	1·14	89·3	5,971
" 30	"	1,435	267	4,875	1·75	88·1	8,554
April 4	"	1,435	267	4,825	1·50	87·9	7,267
" 5	"	1,435	267	5,119	0·91	89·0	4,676
" 5	"	1,435	267	5,093	0·99	88·9	5,046
" 5	"	1,435	267	5,093	0·97	88·9	4,908
" 5	"	1,435	267	5,093	0·94	88·9	4,804
" 7	"	1,435	267	4,823	1·74	87·9	8,419
" 7	"	1,435	267	4,771	1·48	87·7	7,072
" 7	"	1,435	267	4,878	1·27	88·1	6,174
" 8	"	1,435	267	4,798	1·49	87·8	7,148
" 8	"	1,435	267	4,878	1·23	88·1	6,004
" 10	"	1,435	267	5,065	1·15	88·5	5,809
" 10	"	1,435	267	5,039	1·19	88·7	5,984
" 10	"	1,435	267	5,039	1·17	88·7	5,895
" 10	"	1,435	267	5,012	1·11	88·6	5,542
" 12	"	1,435	267	5,146	0·97	89·1	4,987
" 12	"	1,435	267	5,119	0·89	89·0	4,593
" 12	"	1,435	267	5,093	0·97	88·9	4,986
" 12	"	1,435	267	5,119	0·90	89·0	4,587
" 13	"	1,435	267	5,124	0·84	88·7	4,326
" 13	"	1,435	267	4,956	1·34	88·1	6,695
" 14	"	1,435	267	5,148	0·73	88·8	3,784
" 14	"	1,435	267	4,963	1·30	88·1	6,479

NOTE.—All measurements taken under ice conditions.

DISCHARGE MEASUREMENTS of Pinawa Channel at Tail-race, W. E. S. Ry., 1914.

Date.		Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height	Discharge
1914				Feet.	Sq. ft.	Ft. per sec	Feet.	Sec.-ft.
May	7	M. S. Madden	1435	283	3,724	1·97	48·4	7,380
"	7	"	1435	283	3,615	2·14	48·0	7,750
"	8	"	1435	283	3,756	2·17	48·5	8,147
"	8	"	1435	283	3,699	2·05	48·3	7,597
"	9	"	1435	283	3,728	1·97	48·4	7,355
"	9	"	1534	283	3,586	2·02	47·9	7,271
"	9	"	1435	283	3,615	2·12	48·0	7,668
"	10	"	1435	283	3,558	1·24	47·8	4,421
"	10	"	1435	283	3,558	1·50	47·8	5,356
"	11	"	1435	283	3,841	2·22	48·8	8,54[illegible]
"	11	"	1435	283	3,671	2·29	48·2	8,437
"	11	"	1435	283	3,643	2·30	48·1	8,394
"	12	"	1435	283	3,813	2·20	48·7	8,383
"	12	"	1435	283	3,699	2·11	48·3	7,844
"	12	"	1435	283	3,644	2·22	48·1	8,099
"	13	"	1435	283	3,445	1·89	47·4	6,530
"	14	"	1435	283	3,476	1·86	47·6	6,502
"	15	"	1435	283	3,756	2·05	48·5	7,716
"	15	"	1435	283	3,501	1·89	47·7	6,626
"	15	"	1435	283	3,699	2·13	48·3	7,866
"	17	"	1435	283	3,586	1·32	47·9	4,752
"	18	"	1435	283	3,841	2·06	48·8	7,912
"	18	"	1435	283	3,756	1·93	48·5	7,244
"	19	"	1435	283	3,837	2·16	48·8	8,299
"	19	"	1435	283	3,756	1·93	48·5	7,246
"	19	"	1435	283	3,699	2·19	48·3	8,116
"	20	"	1435	283	3,841	2·22	48·8	8,527
"	20	"	1435	283	3,670	2·26	48·2	8,276
"	20	"	1435	283	3,671	2·15	48·2	7,924
"	21	"	1435	283	3,751	2·17	48·6	8,170
"	21	"	1435	283	3,697	2·25	48·3	8,321
"	21	"	1435	283	3,560	1·97	47·8	7,004
"	22	"	1435	283	3,834	2·23	48·9	8,607
"	22	"	1435	283	3,669	2·19	48·2	7,977
"	22	"	1435	283	3,697	2·28	48·3	8,442
"	23	"	1435	283	3,784	1·99	48·6	7,564
"	23	"	1435	283	3,615	1·99	48·0	7,202
"	24	"	1435	283	3,586	1·10	47·9	3,950
"	24	"	1435	283	3,586	1·12	47·9	4,031
"	24	"	1435	283	3,615	1·32	48·0	4,766
"	24	"	1435	283	3,615	1·52	48·0	5,460
"	25	"	1435	283	3,699	1·56	48·3	5,774
"	25	"	1435	283	3,643	1·52	48·1	5,534
"	27	"	1435	382	3,586	1·80	47·9	6,459
"	28	"	1435	283	3,756	2·22	48·5	8,314
"	28	"	1435	283	3,615	1·94	48·0	7,040
"	29	"	1435	283	3,701	2·07	48·3	7,686
"	29	"	1435	283	3,530	1·72	47·7	6,083
"	31	"	1435	283	3,615	1·09	48·0	3,947
"	31	"	1435	283	3,671	1·28	48·2	4,720
"	31	"	1435	283	3,699	1·46	48·3	5,396
"	31	"	1435	283	3,699	1·38	48·3	5,103
June	3	"	1435	283	3,955	1·67	49·2	6,600
"	3	"	1435	293	3,898	1·88	49·0	7,332
"	4	"	1435	283	3,955	1·90	49·2	7,490
"	4	"	1435	283	3,841	1·91	48·8	7,347
"	6	"	1435	283	3,841	1·77	48·8	6,784
"	6	"	1435	283	3,756	1·68	48·5	6,315
"	7	"	1435	283	3,756	1·16	48·5	4,346
"	7	"	1435	283	3,756	1·31	48·5	4,917
"	7	"	1435	283	3,784	1·23	48·6	4,665
"	8	"	1435	285	3,643	0·79	48·1	2,884
"	8	"	1435	283	3,869	2·11	48·9	8,166
"	9	"	1435	283	3,869	2·10	48·9	8,115
"	9	"	1435	283	3,643	1·00	48·1	3,643
"	10	"	1435	283	3,843	2·07	48·8	7,966
"	10	"	1435	283	3,841	2·19	48·8	8,411
"	11	"	1435	283	3,615	1·00	48·0	3,608
"	13	"	1435	238	3,699	1·11	48·3	4,112
"	14	"	1534	283	3,841	1·36	48·8	5,212
"	14	"	1435	283	3,841	1·42	48·8	5,449
"	14	"	1435	283	3,813	1·36	48·7	5,202
"	15	"	1435	283	3,699	0·87	48·3	3,243
"	17	"	1435	283	3,671	1·02	48·2	3,757
"	17	"	1534	283	3,756	1·94	48·5	7,293
"	19	"	1435	283	3,699	1·04	48·3	3,859
"	20	"	1435	283	3,841	1·82	48·8	6,998
"	20	"	1435	283	3,841	1·81	48·8	6,962
"	21	"	1435	283	3,813	1·37	48·7	5,226
"	21	"	1435	283	3,841	1·64	48·8	6,304

Discharge Measurements of Pinawa Channel at Tail-race, W. E. & S. Ry., 1914—*Concluded.*

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
June	21	M. S. Madden	1435	283	3,860	1·43	48·9	5,557
"	22	"	1435	283	3,898	2·15	49·0	8,389
"	24	"	1435	283	3,699	1·07	48·3	3,957
"	24	"	1435	283	3,898	2·19	49·0	8,542
"	25	"	1435	283	3,926	2·24	49·1	8,765
"	25	"	1435	283	3,926	2·16	49·1	8,496
"	28	"	1497	283	3,841	1·28	48·8	4,908
"	28	"	1497	283	3,813	1·24	48·7	4,745
"	29	"	1497	283	3,699	0·76	48·3	2,803
July	1	"	1497	283	3,926	1·50	49·1	5,879
"	1	"	1497	283	3,926	1·42	49·1	5,572
"	1	"	1497	283	3,841	1·55	48·8	5,966
"	2	"	1497	283	3,699	0·86	48·3	3,180
"	4	"	1497	283	3,699	0·88	48·3	3,209
"	5	"	1497	283	3,841	1·36	48·8	5,231
"	5	"	1497	283	3,813	1·35	48·7	5,136
"	6	"	1497	283	3,898	2·05	49·0	7,983
"	7	"	1497	283	3,728	0·94	48·4	3,494
"	7	"	1497	283	3,784	1·73	48·6	6,562
"	9	"	1497	283	3,813	1·86	48·7	7,088
"	10	"	1497	283	3,954	1·82	49·2	7,195
"	11	"	1497	283	3,728	0·94	48·4	3,524
"	11	"	1497	283	3,841	1·75	48·8	6,717
"	12	"	1435	283	3,898	1·24	49·0	4,818
"	12	"	1497	283	3,841	1·25	48·8	4,823
"	13	"	1497	283	3,728	0·81	48·4	3,038
"	13	"	1497	283	3,898	1·93	49·0	7,538
"	14	"	1497	283	3,898	2·00	49·0	7,789
"	15	"	1497	283	4,011	2·07	49·4	8,325
"	15	"	1497	283	3,784	1·79	48·6	6,771
"	16	"	1497	283	3,671	1·03	48·2	3,797
"	19	"	1497	283	3,841	1·37	48·8	5,281
"	19	"	1497	283	3,841	1·40	48·8	5,375
"	21	"	1497	283	3,728	0·91	48·4	3,389

Berens River, Twenty-ninth Falls.

DAILY DISCHARGE of Winnipeg River at Pinawa Channel, for 1913.

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1		4,160		6,240		5,920		5,780		5,490		3,640
2		5,720		4,470		4,120		5,680		5,465		5,090
3		5,835		5,640		3,560		5,770		5,245		5,410
4		5,915		5,915		5,750		5,760		3,245		5,470
5		3,860		5,715		5,790		5,260		5,970		5,625
6		6,650		5,730		5,720		3,560		5,500		5,700
7		6,340		5,740		5,800		5,665		5,440		5,550
8		6,160		5,560		5,740		6,135		5,475		3,515
9		6,120		4,040		3,850		6,100		5,440		4,910
10		6,040		[illegible],640		5,540		5,815		5,200		4,900
11		5,960		6,060		5,925		5,880		3,345		5,060
12		4,030		5,920		5,870		5,440		4,700		4,920
13		5,690		6,090		5,850		3,440		4,980		5,100
14		5,610		6,050		5,730		4,720		5,025		5,070
15		5,690		6,090		5,785		5,015		4,835		3,720
16		5,865		4,225		3,900		4,830		4,945		5,490
17		6,050		5,970		5,450		4,860		4,775		5,820
18		5,980		6,250		5,720		5,100		3,210		5,650
19		4,100		6,270		5,960		5,120		5,000		5,640
20		5,815		6,200		5,845		3,370		5,040		5,645
21		6,190		6,140		5,100		4,930		4,990		5,500
22		6,020		6,285		5,465		5,400		4,885		4,835
23		5,950		3,880		3,800		5,420		5,125		5,250
24		5,890		5,770		5,460		5,500		4,050		5,340
25		5,940		6,000		5,920		5,730		3,180		3,500
26		4,400		6,015		5,740		5,520		4,930		5,625
27		5,460		5,870		5,770		3,460		5,2[illegible]		5,800
28		5,685		5,935		5,740		4,940		5,320		5,270
29		5,840				5,620		5,310		5,120		4,570
30		6,285				3,960		5,600		5,460		5,080
31		6,200				4,900				5,325		

Day	July		August		September		October		November		December	
1		4,650		5,745		4,035		5,820		5,695		6,500
2		5,550		5,090		4,990		5,645		3,830		6,100
3		5,725		3,800		5,400		5,775		5,840		6,240
4		5,750		5,090		5,500		5,705		6,365		6,050
5		5,310		5,640		5,915		4,670		6,350		6,265
6		4,570		5,670		5,650		5,560		6,415		5,525
7		5,270		5,700		3,735		5,880		6,500		*
8		5,630		5,860		5,435		6,065		6,350		5,514
9		5,760		5,740		5,900		5,925		4,330		6,100
10		5,710		3,600		5,750		5,980		6,180		6,240
11		5,995		4,625		5,900		5,825		6,440		6,350
12		5,700		5,700		5,880		3,545		6,370		6,200
13		3,700		5,915		5,840		5,480		6,540		6,125
14		5,375		5,62[illegible]		3,710		6,030		6,540		3,940
15		5,710		5,570		5,365		6,050		6,225		5,640
16		5,680		5,650		5,775		6,025		4,100		6,500
17		5,540		3,770		5,720		6,030		6,010		6,560
18		5,540		5,310		5,680		5,865		6,600		6,420
19		5,350		5,750		5,660		3,760		6,490		6,63[illegible]
20		3,725		5,765		5,950		4,580		6,360		6,37[illegible]
21		5,240		5,730		3,650		6,180		6,670		4,250
22		5,670		5,760		5,015		6,290		6,440		6,190
23		5,200		5,550		6,000		6,250		4,025		6,640
24		5,525		3,515		6,070		6,220		6,185		6,550
25		5,650		5,300		6,045		6,155		6,540		4,625
26		5,425		5,700		5,850		3,820		6,600		5,580
27		3,770		5,850		5,560		5,680		6,140		5,500
28		5,4[illegible]		5,760		3,470		6,025		6,135		4,095
29		5,765		5,750		415		6,020		5,740		5,950
30		5,840		5,720		50		5,910		3,815		6,315
31		5,650		3,675				5,880				6,210

NOTE.—* Plant shut down part of day, not sufficient data to estimate discharge.

DAILY DISCHARGE of Winnipeg River at Pinawa Channel, for 1914.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft
1		4,900		4,835		5,125		5,930		5,500		5,890
2		5,720		5,870		6,100		6,075		4,880		6,100
3		5,860		6,280		6,340		6,100		3,460		5,910
4		4,230		6,180		6,295		5,760		5,150		6,295
5		6,160		5,910		6,230		4,175		5,640		6,250
6		6,215		5,880		6,300		6,135		5,625		5,740
7		6,325		6,000		6,150		6,400		6,020		4,180
8		6,275		4,715		4,460		6,110		6,270		5,960
9		6,375		5,600		6,130		6,190		6,200		6,510
10		6,080		5,990		6,365		4,710		4,350		6,570
11		4,435		5,940		6,480		6,040		6,190		6,840
12		5,950		6,235		6,515		4,250		6,500		6,600
13		6,290		6,100		6,125		6,060		6,590		6,440
14		6,050		5,900		6,515		6,335		6,410		4,450
15		6,365		4,830		1,740		6,365		6,615		6,440
16		6,590		5,570		6,360		6,225		6,260		6,780
17		6,525		6,200		6,770		6,370		4,485		6,650
18		4,410		6,330		6,750		6,500		6,400		6,950
19		6,365		6,020		6,570		4,275		6,635		6,480
20		6,660		6,070		6,830		6,200		6,880		6,005
21		6,375		6,165		6,615		6,660		6,800		4,710
22		6,100		5,040		4,670		6,640		6,860		6,490
23		6,410		5,785		6,120		6,470		6,250		6,810
24		6,345		6,335		6,525		6,280		4,275		6,940
25		4,565		6,290		6,065		5,980		4,970		6,940
26		5,800		6,385		6,545		4,100		5,930		6,500
27		6,130		6,430		6,160		6,130		6,300		6,500
28		6,250		6,390		5,680		6,740		6,235		4,520
29		6,370				3,970		6,540		6,140		5,575
30		6,210				5,600		6,300		5,750		5,700
31		5,925				5,950				4,450		

Day	July	August	September	October	November	December
1	5,210	6,280	6,775	6,720	6,670	6,760
2	6,240	4,525	6,785	6,450	4,830	6,775
3	6,270	6,130	6,760	6,370	6,265	[1]5,115
4	5,740	6,165	6,810	4,660	6,465	6,540
5	4,435	5,850	6,465	6,650	6,220	6,520
6	6,430	5,985	4,735	6,835	6,170	4,390
7	6,450	6,805	5,800	6,840	6,380	6,045
8	6,460	6,670	6,950	6,810	6,400	[1]4,415
9	6,290	4,450	6,865	7,015	4,870	5,455
10	5,995	5,640	6,785	7,010	6,155	6,260
11	6,060	6,780	6,885	4,765	6,660	6,365
12	4,290	6,600	6,875	5,720	6,480	5,640
13	6,220	6,850	4,860	6,990	7,050	4,100
14	6,615	6,770	6,660	6,995	6,670	5,910
15	6,635	6,420	6,720	6,790	6,850	6,220
16	6,985	4,715	5,915	6,930	4,990	6,205
17	6,965	6,560	6,455	6,380	6,570	6,050
18	6,155	6,915	6,425	4,745	6,965	6,140
19	4,675	6,730	6,165	6,285	6,935	5,615
20	6,375	6,485	1,370	6,750	7,050	3,950
21	6,650	6,530	6,350	6,900	6,840	5,950
22	6,800	6,375	6,480	6,730	6,865	6,000
23	6,780	4,650	6,615	6,915	6,430	5,970
24	6,500	6,545	6,740	6,570	6,860	5,935
25	6,550	6,780	6,540	4,825	6,815	4,710
26	4,600	6,640	6,240	6,725	6,910	5,435
27	6,285	6,700	4,375	7,140	6,670	4,140
28	6,450	6,340	6,610	7,000	6,735	5,635
29	6,560	6,250	6,990	7,015	4,860	5,705
30	6,530	4,570	6,880	[illegible]	6,570	5,815
31	6,620	6,375		6,670		5,730

NOTE.—(1) On these days ice trouble was experienced.

Winnipeg River, Head of Grand du Bonnet Falls.

History.—The station on the Winnipeg river at Grand du Bonnet falls was established December 1, 1911, by A. M. Beale.

Location of Section. —The section is 1½ miles above Grand du Bonnet falls and 400 feet downstream from B.M. 138 B., W.P.S. The initial point is a point chiselled in the rock on a high bare point on the left bank of the river. It is referenced by a 12-inch poplar 56 feet distant, a 6-inch oak tree 31 feet distant, and a 7-inch oak tree 48 feet distant.

Records available. —A record of gauge heights has been kept from July 16, 1911, to March 10, 1912, also from May 16 to November 3, 1913, and from May 14 to July 25, 1914. These records are not continuous during each period. Discharge measurements were taken during the period 1911-12.

Drainage area.—Approximately 53,100 square miles.

Gauge.—A vertical staff gauge is placed in a small bay on the right shore, 500 feet above the crest of the Grand du Bonnet falls, and at the head of the portage. It is referenced to W.P.S. datum.

Channel.—Left shore straight for 500 feet above the station, the right shore is slightly curved. Below the station there is a small bay on the left shore and the right shore is curved about 600 feet below the station; the river bends to the west and widens. There are two channels at the section, divided by a small island 50 feet wide and 500 feet from the left shore, the right channel is 170 feet wide. The bed of the channel is rock and clay, and not subject to shifting.

Discharge measurements.—Are made from a boat held in position by a stay line.

Acc. y.—Not sufficient measurements have been made to define a discharge curve and arrive at the daily discharges.

Pigeon River, Sturgeon Falls.

Discharge Measurements of Winnipeg River near Head of Grand du Bonnet Falls, 1911.

Date	Hydrographer.	Meter No.	Width	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1911			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Dec. 6, 7, 8	Beale & Pirie	1,187	600	21,910	1·04	5·08	22,827
" 9	"	1,187	600	21,910	1·06	5·05	23,216
1912							
Mar. 25	A. Pirie	1,187	386	20,391	0·66	3·70	13,432

WHITEMOUTH RIVER.

The source of the Whitemouth river is in Whitemouth lake, which lies in the southeastern part of the province. The course of the river is generally north from the source to its junction with the Winnipeg river just below the Seven Sisters rapids on the latter stream.

The drainage area of the river is 1,566 square miles. The upper part of the river flows through that part of the country known as the Julius muskeg, and as the name would imply, is low and wet. The lower part of the valley is narrow, and the land fertile; a considerable portion has been cleared and is now under cultivation. The lower 2 miles of the river flows through a well-timbered belt of country, spruce, oak, and poplar of merchantable size being plentiful.

The bed of the river is generally of clay, but at the lower end rock ridges extend across the river-bed, and at one point form what is known as Whitemouth falls, which is near the mouth. The valley is generally from 30 to 50 feet in height, and the valley proper varies from 200 to 600 feet wide.

Whitemouth River at Whitemouth.

History.—The metering section was established at Whitemouth, on the river of that name, by G. H. Burnham, on May 28, 1912.

Location of Section.—The station is located on the down-stream side of the traffic bridge which crosses the river about 900 feet northeast of the Canadian Pacific Railway station at Whitemouth. The initial point is marked by three wire nails driven in the handrail of the bridge directly above the south abutment, and the intervals are also marked on the handrail.

Records available.—Daily estimated discharges are available from May 29, 1912, for the open-water months. During the winters of 1912-13 and 1913-14 no gauge records were obtained, but for the winter of 1914 these records are available.

Drainage area.—The drainage area of the river above the station is 1,400 square miles. Much of this territory is low-lying and of a swampy nature; lately it has been cross cut by the drainage system in connection with the construction of the conduit for the Greater Winnipeg water supply, the Whitemouth being used as a discharging channel. This has noticeably affected the flow.

Gauge.—A vertical staff gauge, graduated to tenths, is fastened to a pile of the bridge opposite station 91 of the section. It is referred to a bench-mark consisting of an iron bolt sunk in a concrete pile near the bridge. An arbitrary datum is used.

Channel.—The river is divided into six channels by the pile bents of the bridge. The bed is of clay and liable to slight shifting. The depth over the section, under normal conditions, averages 4 feet. The banks are not subject to overflow.

Discharge measurements.—Sufficient meterings have been secured to define the discharge curve over a range of 4 feet in gauge height, for open-water conditions. Under ice conditions a number have been taken, but do not define the curve of discharge clearly. The measurements are made from the bridge.

Accuracy.—The accuracy for the discharge curve is high over a range in gauge heights of 4 feet, from 73.8 to 77.3.

Discharge Measurements of Whitemouth River at Whitemouth, 1912–14.

Date	Hydrographer	Meter No.	Width.	Area of Section	Mean Velocity.	Gauge Height	Discharge
			Feet.	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
1912							
May 29	G. H. Burnham	1,187	162	991	2·20	77·29	2,179
June 20	"	1,187	151	629	1·07	74·91	673
July 13	"	1,187	151	750	1·41	75·53	1,057
" 17	"	1,187	158	858	1·67	76·15	1,434
Aug 9	W. G. Worden	1,187	150	700	1·30	75·10	910
Sept 3	"	1,187	150	845	1·59	76·17	1,328
Oct 15	R. H. Nelson	1,187	172	927	2·02	76·93	1,892
1913							
Jan 21	A. Pare	1,169	110	189	0·145	73·65	[1]27
April 18	"	1,186	154	752	1·650	75·74	1,241
May 9	G. Elner	1,186	151	732	1·380	75·22	1,010
Aug 15	W. J. Ireland	1,469	113	578	0·680	74·10	392
Sept 26	C. O. Allen	1,135	136	512	0·300	73·89	153
1914							
Jan 20	L. I. Budge	1,162	111	207	0·077	73·23	[1]16
Mar 16	W. J. Ireland	1,162	99	97	0·20	73·33	[1]20
May 20	A. Pare	1,959	137	636	1·13	74·92	720
July 27	M. S. Madden	1,769	147	609	0·76	74·55	467
Aug 18	J. A. Page	1,920	136	443	0·10	73·60	44
Sept. 4	H. Boyd	1,919	142	492	0·28	73·80	134
Oct 7	M. S. Madden	1,911	142	522	0·30	73·91	158
Nov 3	M. S. Madden	1,922	147	586	0·77	74·51	451
" 30	C. O. Allen	1,911	140	408	0·36	73·85	[1]146
Dec 28	M. S. Madden	1,162	[illegible]	[illegible]	0·07	73·52	[1]17

[1]Measurement taken under ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Whitemouth River at Whitemouth, for 1912.

[Drainage area, 1,400 square miles.]

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1											6·80	1,760
2											6·48	1,570
3											6·35	1,500
4											6·53	1,600
5											6·58	1,630
6											6·48	1,570
7											6·25	1,440
8											6·19	1,410
9											6·07	1,340
10											5·67	1,110
11											5·66	1,100
12											5·47	1,000
13											5·45	987
14											5·41	964
15											5·25	873
16											5·21	850
17											4·99	724
18											4·97	713
19											4·94	696
20											4·93	690
21											4·79	610
22											4·63	579
23											4·61	508
24											4·59	496
25											4·59	496
26											4·58	491
27											4·56	479
28											4·54	468
29									7·25	2,010	4·43	405
30									7·26	2,020	4·29	325
31									6·99	1,860		

Day	July		August		September		October		November		December	
1	4·19	271	5·75	1,160	6·12	1,370	7·22	2,000	6·35	1,500		
2	4·09	226	5·49	1,010	6·16	1,390	7·13	1,940	6·39	1,520		
3	3·97	181	5·38	917	6·15	1,390	6·97	1,850	6·45	1,560		
4	3·94	172	5·06	764	6·20	1,410	6·94	1,840	6·36	1,510		
5	3·93	169	5·05	759	6·68	1,690	6·86	1,790	6·29	1,470		
6	4·33	348	5·03	747	6·56	1,620	6·83	1,770	6·20	1,410		
7	4·38	377	5·07	770	6·47	1,570	6·77	1,740	6·07	1,340		
8	4·77	599	5·18	833	6·36	1,510	7·00	1,870	5·96	1,280		
9	4·98	719	5·37	941	6·32	1,480	7·25	2,010	5·87	1,230		
10	5·03	747	5·37	941	6·37	1,510	7·25	2,010	5·81	1,190		
11	5·07	770	5·36	935	6·42	1,540	7·24	2,010	5·76	1,160		
12	5·06	764	5·36	935	6·44	1,550	7·20	1,980	5·73	1,150		
13	5·59	1,070	5·17	827	6·43	1,550	7·16	1,960	5·67	1,110		
14	5·91	1,250	5·10	787	6·41	1,530	7·05	1,900	5·64	1,100		
15	6·17	1,400	5·02	741	6·38	1,520	6·92	1,820	5·61	1,080		
16	6·22	1,430	4·97	713	6·63	1,660	6·64	1,660	5·57	1,060	4·19	
17	6·22	1,430	4·83	633	6·75	1,730	6·55	1,560	5·57	1,060		
18	6·21	1,420	4·77	599	6·70	1,700	6·37	1,510	5·51	1,020		
19	6·21	1,420	4·73	576	6·63	1,660	6·36	1,510	5·47	1,000		
20	5·91	1,250	4·51	451	6·40	1,530	6·33	1,490	5·45	987		
21	5·83	1,200	4·49	439	6·98	1,860	6·17	1,400	5·36	935		
22	5·73	1,150	4·57	485	7·43	2,120	6·09	1,350	5·31	906		
23	5·84	1,210	4·67	542	7·53	2,170	5·97	1,280	5·23	861		
24	6·03	1,320	4·80	616	7·59	2,210	5·87	1,230	5·39			
25	6·18	1,400	4·86	650	7·57	2,200	5·66	1,110	5·61			
26	6·25	1,440	4·89	667	7·53	2,170	5·51	1,020	5·77			
27	6·29	1,470	4·91	679	7·45	2,130	5·93	1,260	5·83			
28	6·37	1,510	4·95	702	7·44	2,120	6·11	1,360	5·87			
29	6·26	1,450	4·97	733	7·45	2,070	6·21	1,420	5·87			
30	6·12	1,370	5·37	941	7·30	2,040	6·27	1,450	5·87			
31	5·93	1,260	5·97	1,280			6·29	1,470				

NOTE.—Ice conditions from November 23, information insufficient to compute daily discharges.

Daily Gauge Height and Discharge of Whitemouth River at Whitemouth, for 1913.

[Drainage Area, 1,400 square miles.]

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1			3.79		3.57				5.78	1,180	4.75	588
2									5.71	1,150	4.72	570
3									5.66	1,110	4.70	560
4									5.60	1,070	4.70	560
5									5.57	1,060	4.70	560
6									5.51	1,040	4.78	605
7									5.45	987	5.06	764
8					3.59		7.56	2,190	5.45	987	4.97	713
9							7.77	2,310	5.37	941	4.88	662
10							7.87	2,370	5.37	931	4.80	616
11							8.27	2,600	5.43	961	4.68	548
12							8.70	2,850	5.39	952	4.63	519
13							7.93	2,400	5.36	935	4.66	536
14							7.41	2,100	5.33	918	4.62	513
15			3.61		3.59		7.63	2,360	5.27	873	4.53	462
16							7.27	2,020	5.15	816	4.53	462
17							7.21	1,990	5.07	770	4.33	348
18							5.74	1,350	5.07	770	4.31	337
19							5.70	1,130	5.03	747	4.19	271
20							5.70	1,130	4.97	713	4.21	282
21							5.67	1,110	4.91	696	4.13	214
22			3.59		3.59		5.66	1,130	4.90	673	4.12	209
23							5.93	1,250	4.90	673	4.05	230
24	3.65	27					6.04	1,320	4.88	662	4.03	202
25	3.79						6.31	1,360	4.86	650	3.97	181
26							6.37	1,400	4.84	633	3.94	172
27							6.17	1,400	4.80	616	3.90	160
28							6.15	1,390	4.80	616	3.90	160
29							6.07	1,340	4.78	605	4.32	239
30							5.95	1,270	4.75	588	4.27	315
31									4.73	576		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge
1	4.81	622	3.91	163	4.53	462	3.83	143	4.71	565
2	4.98	719	3.87	153	4.48	431	3.79	133	4.68	548
3	4.96	707	3.81	138	4.40	388	3.71	117	4.65	536
4	4.93	690	3.79	133	4.38	377	3.69	133	4.34	354
5	4.81	622	3.73	121	4.33	348	3.73	124	4.31	337
6	4.73	576	3.73	121	4.28	320	3.78	331	4.26	309
7	4.64	525	3.67	110	4.21	282	3.76	327	4.21	282
8	4.51	451	3.63	102	4.16	258	3.74	123	4.21	282
9	4.51	451	3.59	96	4.08	222	3.83	143	4.17	262
10	4.45	417	3.56	92	4.13	244	3.91	163	4.13	241
11	4.53	462	3.53	89	4.21	298	4.03	202	4.09	226
12	4.63	519	3.53	89	4.07	238	5.03	747	4.05	210
13	5.21	850	3.49	84	4.05	210	5.20	844	4.05	210
14	5.50	1,020	4.07	218	4.00	190	5.46	992	4.05	210
15	5.55	1,040	4.29	325	3.93	169	5.51	1,020	4.05	210
16	5.71	1,130	4.68	548	3.91	163	5.54	1,040	4.05	
17	5.40	958	5.07	770	3.83	143	5.48	1,000	4.05	
18	5.28	890	5.21	850	3.91	163	5.39	952	4.05	
19	5.06	764	5.36	821	4.03	202	5.42	969	4.05	
20	4.99	724	5.13	793	3.99	187	5.35	930	4.05	
21	4.81	622	5.08	776	3.96	178	5.33	918	4.05	
22	4.65	531	4.99	721	3.95	175	5.23	861	4.05	
23	4.65	531	4.93	690	3.93	169	5.22	855	4.05	
24	4.58	491	4.91	679	3.93	169	5.15	816	4.05	
25	4.53	462	4.83	633	3.91	163	5.11	793	4.05	
26	4.41	394	4.83	633	3.87	155	5.05	759	4.05	
27	4.27	314	4.74	582	3.88	155	4.96	707	4.05	
28	4.14	248	4.66	536	3.86	150	5.01	736	4.05	
29	4.13	244	4.61	519	3.83	143	4.98	719	4.05	
30	4.00	190	4.57	485	3.81	138	4.90	707	4.05	
31	3.99	187	4.59	496			4.81	622	4.05	

NOTE.—Discharge curve is not well defined below gauge height 3.80. Ice conditions until April 7; information insufficient to compute daily discharges.

Daily Gauge Height and Discharge of Whitemouth River at Whitemouth, for 1914.

(Drainage Area 1,400 square miles.)

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1							3.58		4.76	593	5.14	810
2							3.58		4.81	622	5.14	810
3							3.58		4.86	650	7.24	2,010
4							3.58		5.31	907	7.67	2,250
5							3.58		5.57	1,060	7.19	1,980
6							3.58		5.81	1,190	6.28	1,400
7							3.58		5.93	1,260	6.10	1,350
8							3.58		5.97	1,280	6.35	1,500
9							3.58		5.71	1,130	6.72	1,710
10							3.58		5.44	975	6.62	1,650
11							3.58		5.36	935	6.74	1,720
12							3.58		5.27	884	6.46	1,560
13							3.58		5.27	884	6.24	1,450
14							3.58		5.12	798	5.94	1,270
15							3.58		4.98	719	5.72	1,140
16					3.33	20	3.98		4.89	667	5.48	1,000
17							4.69		4.76	593	5.24	867
18							5.55		4.61	508	5.20	844
19							6.02		4.57	485	5.15	816
20	3.23	16					6.08		4.79	610	5.13	804
21							6.16	1,390	5.09	781	5.01	736
22							6.23	1,430	5.21	850	5.01	736
23							6.01	1,310	5.32	912	4.97	713
24							5.76	1,160	5.32	912	4.82	627
25							5.76	1,160	5.34	924	4.69	554
26							5.43	975	5.36	935	4.62	514
27							5.17	827	5.28	890	4.47	428
28							4.96	707	5.24	867	4.39	382
29							4.93	690	5.18	833	4.31	337
30							4.76	593	5.37	941	4.19	271
31									5.32	912		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	4.19	271	4.22	287	3.87	153	4.05	210	4.39	382	3.86	
2	4.12	[illegible]	4.11	248	3.85	148	3.96	178	4.31	337	3.83	
3	4.46	422	4.08	222	3.79	133	3.91	163	4.31	337	3.87	
4	4.19	[illegible]	4.06	214	3.83	143	3.88	155	4.40	[illegible]	3.87	
5	4.19	[illegible]	4.03	202	3.79	133	3.91	163	4.48	434	3.88	
6	4.48	434	3.98	184	3.75	125	3.89	158	4.46	422	3.88	
7	4.48	434	3.92	166	3.75	125	3.89	158	4.37	371	3.87	
8	4.46	422	3.84	145	3.75	125	3.92	166	4.37	371	3.87	
9	4.55	[illegible]	3.77	129	3.73	121	4.06	214	4.34	354	3.85	
10	4.27	315	3.71	117	3.75	125	4.79	610	4.34	354	3.85	
11	4.08	222	3.67	110	3.77	129	5.61	1,080	4.33	348	3.83	
12	4.80	616	3.65	106	3.79	133	5.59	1,070	4.26	309	3.85	
13	7.14	1,950	3.56	92	3.79	133	5.55	1,040	4.26	309	3.85	
14	6.62	1,650	3.54	90	3.81	138	5.55	1,040	4.21	282	3.81	
15	6.54	1,490	3.51	90	3.81	145	5.51	1,020	4.16	258	3.83	
16	5.90	1,290	3.48	85	3.88	155	5.44	975	4.12	239	3.85	
17	5.7[illegible]	1,150	[illegible]	[illegible]	3.91	163	5.40	945	4.11	235	3.83	
18	5.44	981	[illegible]	97	3.87	153	5.31	907	4.08	222	3.83	
19	5.42	969	3.60	97	3.87	153	5.25	873	4.08	222	3.73	
20	5.38	947	3.53	89	3.87	153	5.22	855	4.08	222	3.62	
21	5.30	904	3.49	84	3.89	158	5.18	834	4.08	222	3.52	
22	5.26	878	3.47	82	4.00	190	5.18	834	4.00	190	3.55	
23	[illegible]	854	3.47	82	4.16	258	5.01	736	4.00	190	3.55	
24	5.04	755	3.66	115	4.19	271	4.89	667	4.00	190	3.52	
25	4.92	684	3.71	117	4.24	298	4.76	593	3.93	169	3.53	
26	4.77	599	3.76	127	4.24	298	4.71	582	3.93	169	3.53	
27	4.61	508	3.81	138	4.20	276	4.69	553	3.93	169	3.52	
28	4.52	456	3.83	145	4.15	253	4.61	508	3.93	169	3.49	17
29	4.46	422	3.85	[illegible]	4.09	226	4.55	474	3.90	160	3.49	
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	234	[illegible]	451	3.85	[illegible]	3.44	
31	[illegible]	[illegible]	3.86	[illegible]			4.43	405			3.41	

NOTE.—Ice conditions existed January 1 to April 2[illegible]; not sufficient information to compute daily discharges. [illegible] Ice conditions from 18th November; information insufficient to compute daily discharges for [illegible].

SESSIONAL PAPER No. 25f

MONTHLY DISCHARGE of Whitemouth River at Whitemouth, for the years 1912-14.

(Drainage area, 1,400 square miles.)

Month	Discharge in Second Feet: Maximum	Minimum	Mean	Per square mile	Run Off: Depth in inches on Drainage area	Total in acre feet
1912						
May			[1]2,000	1.429	1.648	[illegible],000
June	1,760	325	944	0.674	0.752	56,200
July	1,540	469	993	0.709	0.817	61,100
August	1,280	439	770	0.550	0.634	47,300
September	2,210	1,370	1,730	1.236	1.379	102,900
October	2,010	1,020	1,630	1.164	1.342	100,200
November			[1]1,000	0.714	0.797	59,500
December			[1]100	0.071	0.082	6,100
The period	2,210	469	1,150	0.818	7.451	556,300
1913						
April			[1]1,600	1.143	1.275	95,200
May	1,180	576	836	0.597	0.688	51,400
June	704	160	420	0.300	0.335	25,000
July	1,130	187	592	0.423	0.488	36,400
August	850	84	405	0.289	0.333	24,900
September	462	138	229	0.163	0.182	13,600
October	1,040	113	597	0.426	0.491	36,700
November			[1]230	0.164	0.183	13,700
December			[1]50	0.036	0.041	3,100
The period	1,180	84	551	0.393	4.016	300,000
1914						
January			[1]15	0.011	0.013	922
February			[1]10	0.007	0.007	555
March			[1]20	0.014	0.016	1,230
April			[1]450	0.321	0.358	26,800
May	1,280	485	855	0.611	0.704	52,600
June	2,250	271	1,080	0.772	0.861	64,300
July	1,050	222	708	0.506	0.583	43,500
August	287	82	136	0.097	0.112	8,400
September	298	121	174	0.124	0.138	10,400
October	1,080	155	600	0.428	0.494	36,900
November	159	146	274	0.195	0.218	16,300
December			[1]50	0.036	0.042	3,075
The year	2,250	15	364	0.260	3.717	264,962

NOTE.—All marked thus [1] estimated.

RED RIVER AND TRIBUTARIES.

The Red River.—The Red river, one of the most important flowing in the [illegible]rovince of Manitoba, has its source near the central part of the state of Minne-[illegible]ota. It flows south and west to the town of Breckenbridge, then north to [illegible]e international boundary, forming the boundary in that stretch between [illegible]e states of Minnesota and North Dakota.

The general direction of the river from Breckenbridge to lake Winnipeg, [illegible]o which body of water the river empties, is north. The river follows very [illegible]sely a straight line, though it is very sinuous in its course, nearly doubling [illegible] length between the points mentioned.

The drainage basin of the river is 116,347 square miles, of which 42,547 [illegible] in Minnesota and Dakota, 50,500 in Saskatchewan, and 23,300 in Manitoba.

The valley of the river is not defined by high banks, as in most cases, but [illegible]e whole country slopes gently toward the river, which lies in a channel cut to [illegible]lepth of from 25 to 50 feet below the plain.

The valley of the Red river is the oldest district in the province, the land being practically all settled and farmed. Little standing timber is to be found, only clumps of elm and ash, with poplar and cottonwood, being found along the river.

The stream afforded the first means of access to the country, and was navigated for a number of years before the advent of the railways to the country between Grand Forks and lake Winnipeg. This traffic has, however, practically ceased to exist except upon the stretch of the river between Winnipeg and the lake. The Dominion Government have built a dam and lock near the mouth of the river, and by operating it, an 8-foot depth for navigation purposes is ensured between the lake and the city of Winnipeg.

There are a number of important centres which are located along the river, among these within the province of Manitoba are: Emerson, which is just north of the international boundary; Winnipeg, at the junction of the Assiniboine with the Red river and Selkirk. In addition to these there are a number of small communities located along the banks of the river.

Metering stations have been located from time to time and maintained for certain periods at the following points along the river in the province of Manitoba:

1. At the Canadian Northern Railway bridge at Emerson.
2. Three miles below Emerson.
3. At Elm Park bridge, in Winnipeg.
4. At Redwood bridge, in Winnipeg.

Tributaries. The tributaries of the Red which enter that river within the province of Manitoba, or close to its boundaries, are: Pembina river, Roseau river, Rat river, Morris river, Assiniboine river, Seine river. Of these, the Assiniboine is the most important, and is given a separate section in this report. The others are considered along with the Red river; they enter it in the order given, from source to mouth. Records of discharge for the Roseau and Rat are fairly continuous, but for the others only isolated meterings are available, and are therefore listed under the head of miscellaneous meterings.

In the case of the Pembina, note should be made that this river flows partly through United States territory. Records of its discharge were kept by the United States Geological Survey at Neche, North Dakota, during the years 1903 to 1910, inclusive, and are included in the report.

Red River at Emerson.

History.—The station was established by S. S. Scovil on May 3, 1912, and has been operated steadily from that date.

Location of Section.—The section is located on the downstream side of the Canadian Northern Railway bridge at Emerson. The initial point is at the inter-section of the end post of the bridge with the wooden hand-rail at the left hand end of the bridge on the downstream side.

Records Available.—Daily gauge height records have been kept for each open-water season since the station was established, and intermittent readings under winter conditions have been obtained for the same period. A discharge curve for open-water and winter conditions has been constructed, and from it estimates of daily discharge have been arrived at.

Drainage Area.—The area tributary to the river above this station is 34,600 square miles, and practically all of it is south of the international boundary.

Gauge.—A 9-foot vertical staff gauge was nailed to the sheet piling around the west pier, 10 feet upstream from the section. On March 5, 1914, it was changed to a position on the west side of the icebreaker above the section, and referred to the Canadian Geodetic Survey datum.

Channel. The channel is divided by the bridge piers, otherwise it remains the same under all conditions. The bottom is hard clay inlaid with gravel. It is straight for 400 feet above the station and 500 feet below. The banks are high and not subject to overflow except under extraordinary conditions. The floods of 1879, 1882, and 1897 overflowed the banks.

Discharge Measurements. They are taken from the downstream side of the bridge, except under winter conditions when they are taken from the ice.

Accuracy. A range in stage under open-water conditions of 26.16 feet is covered, the discharge curve being well defined between gauge heights 749.0 and 765.0, beyond these limits the definition is not so good. Under ice conditions a discharge curve is well defined between the limits 749.0 and 751.5.

DISCHARGE MEASUREMENTS of Red River at Emerson, 1912-14.

Date	Hydrographer	Meter No.	Width	Area of section	Mean velocity	Gauge height	Discharge
1912			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
May 3	S. S. Scovil	1187	222	876	1.88	751.62	1,646
May 18	S. S. Scovil	1187	215	1,353	2.25	754.08	3,045
June 12	G. H. Burnham	1187	213	885	1.92	751.88	1,699
June 15	G. H. Burnham	1187	213	852	1.62	751.30	1,380
July 9	G. H. Burnham	1187	214	649	1.53	750.35	994
July 21	G. H. Burnham	1187	210	682	1.70	750.71	1,159
Aug. 6	W. G. Worden	1187	210	679	1.74	750.69	1,183
Aug. 22	W. G. Worden	1187	214	672	1.59	750.22	1,070
Oct. 18	G. J. Lamb	1187	213	1,038	1.69	752.35	1,751
Oct. 31	G. J. Lamb	1187	221	881	1.63	751.68	1,436
1913							
April 10	G. H. Burnham	1197	357	7,190	3.41	776.27	24,521
April 22	A. Pirie	1186	304	3,645	2.81	761.72	10,230
April 29	E. Bankson	1469	270	2,437	2.44	759.09	5,936
May 13	E. Bankson	1469	244	1,333	2.41	754.57	3,211
July 30	A. Pirie	1469	213	638	1.59	750.31	1,015
Aug. 19	C. O. Allen	1435	220	492	1.62	749.85	797
Sept. 19	C. O. Allen	1435	222	751	1.96	751.55	1,524
1914							
Jan. 5	E. J. Budge	1192	171	797	0.53	750.01	[1]429
Mar. 5	W. J. Ireland	1169	200	834	0.57	751.00	[1]478
Mar. 21	T. J. Moore	1474	214	1,226	0.78	752.54	[1]957
April 27	A. Pirie	1187	221	1,789	1.86	754.87	3,332
May 27	A. Pirie	1939	239	1,475	1.98	753.70	2,923
June 16	C. O. Allen	1760	282	3,184	2.29	759.48	7,303
July 30	M. S. Madden	1760	237	1,443	1.46	752.42	2,107
Aug. 15	J. A. Page	1919	199	990	1.44	751.07	1,422
Sept. 7	H. Boyd	1919	196	871	1.36	750.82	1,197
Oct. 13	M. S. Madden	1911	222	906	1.28	750.80	1,158
Nov. 1	M. S. Madden	1912	252	1,117	1.33	751.64	1,486
Dec. 4	C. O. Allen	1912	215	1,245	0.92	751.96	[1]1,151
Dec. 30	M. S. Madden	1462	190	669	1.04	751.25	[1]693

[1]Measurement taken under ice conditions.

Daily Gauge Height and Discharge of Red River at Emerson, for 1912.

[Drainage area, [illegible] square miles.]

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet.	Sec. ft.	Feet.	Sec. ft.	Feet.	Sec. ft.	Feet.	Sec. ft.	Feet.	Sec. ft.	Feet.	Sec. ft.
1											53.63	2,642
2											53.48	2,564
3									51.60	1,590	53.48	2,590
4									51.64	1,608	53.24	2,442
5									51.80	1,710	53.1[illegible]	2,366
6									51.82	1,69[illegible]	53.00	2,300
7									51.97	1,770	52.88	2,234
8									52.12	1,845	52.74	2,152
9									52.27	1,920	52.52	2,030
10									52.42	1,995	52.[illegible]	1,895
11									52.85	2,218	52.0[illegible]	1,795
12									53.18	2,390	51.87	1,720
13									53.70	2,690	51.71	1,640
14									53.91	2,816	51.57	1,564
15									54.05	2,900	51.46	1,482
16									54.10	2,933	51.21	1,415
17									54.09	2,924	51.16	1,392
18									54.09	2,924	51.15	1,388
19									54.07	2,912	51.15	1,388
20									53.98	2,8[illegible]4	51.15	1,388
21									53.87	2,792	51.15	1,388
22									53.62	2,642	51.15	1,388
23									53.52	2,586	51.14	1,388
24									53.42	2,531	51.13	1,379
25									53.32	2,476	51.18	1,401
26									53.12	2,366	51.25	1,432
27									53.30	2,465	51.30	1,482
28									53.59	2,625	51.40	1,541
29									53.67	2,672	51.45	1,509
30									53.70	2,690	51.26	1,437
31									53.72	2,702		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	51.92	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51.57	1,577	[illegible]	
2	51.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51.47	[illegible]	[illegible]	
3	51.62	[illegible]	51.24	1,428	[illegible]	[illegible]	[illegible]	[illegible]	51.42	[illegible]	[illegible]	
4	51.52	[illegible]	[illegible]	[illegible]	49.88	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
5	51.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
31	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]				

Note.— [illegible]

DAILY GAUGE HEIGHT AND DISCHARGE of Red River at Emerson, for 1913.

(Drainage Area 34,800 square miles.)

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1	50.42						51.82		57.77	5,171	52.92	2,256
2							52.82		57.57	5,041	51.82	2,201
3							54.62		56.12	4,262	52.[illegible]	2,[illegible]
4	50.32						56.27		56.12	4,142	52.72	2,146
5							58.22		56.02	4,082	52.62	2,095
6							65.7[illegible]	11,232	55.92	4,022	52.57	2,070
7							69.[illegible]	15,593	55.62	3,842	52.55	2,060
8	50.32						72.77	19,578	55.42	3,722	52.52	2,045
9							74.77	22,378	55.22	3,602	52.47	2,020
10							76.07	24,198	55.02	3,482	52.42	1,995
11							77.07	25,598	54.82	3,362	52.[illegible]	1,980
12							77.07	25,598	54.72	3,302	52.32	1,945
13							76.77	25,178	54.52	3,182	52.27	1,920
14	50.17						76.17	24,338	54.42	3,122	52.17	1,870
15							75.17	22,938	54.22	3,002	52.07	1,820
16							74.17	21,538	54.12	2,942	51.97	1,770
17							73.17	20,138	54.02	2,882	51.84	1,705
18	50.15						71.67	18,055	53.92	2,822	51.74	1,655
19							70.42	16,311	53.82	2,762	51.62	1,594
20							68.77	14,376	53.72	2,702	51.47	1,532
21							66.7[illegible]	12,200	[illegible]	2,642	51.[illegible]	1,487
22	50.12						65.[illegible]	10,588	[illegible]	2,642	51.[illegible]	1,464
23							63.77	9,466	53.[illegible]	2,580	51.27	1,442
24							62.47	8,326	53.[illegible]	2,[illegible]	51.24	1,428
25							61.47	7,65[illegible]	53.47	2,55[illegible]	51.2[illegible]	1,410
26							[illegible]	6,914	53.32	2,476	51.15	1,[illegible]
27							[illegible]	6,471	53.17	2,[illegible]	51.12	[illegible]
28							58.77	5,82[illegible]	53.12	2,[illegible]	51.[illegible]	1,[illegible]
29	50.12						58.07	[illegible]	[illegible]	2,[illegible]	[illegible]	1,[illegible]
30							57.07	5,501	[illegible]	2,[illegible]	[illegible]	1,2[illegible]
31									[illegible]	2,284		

NOTE.—Ice conditions January 1 to April 5. [illegible] Discharge [illegible] measurements taken 2½ miles below this station. Discharge curve not well defined above [illegible] feet gauge height.

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	50.87	1,262	50.17	974	50.66	1,120	[illegible]	[illegible]	[illegible]	[illegible]		
2	50.92	1,284	50.22	[illegible]	50.62	1,15[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
3	50.92	1,284	50.30	1,0[illegible]	50.42	1,07[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
4	50.89	1,270	50.40	1,0[illegible]	50.34	1,04[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
5	50.87	1,262	50.37	1,1[illegible]	50.22	99[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
6	50.84	1,248	50.32	1,0[illegible]	[illegible]	95[illegible]	[illegible]	84[illegible]	[illegible]	[illegible]		
7	50.74	1,20[illegible]	50.34	1,024	[illegible]	925	[illegible]	[illegible]		[illegible]		
8	50.72	1,194	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		
9	50.62	1,15[illegible]	[illegible]	981	[illegible]	848						
10	50.62	1,153	50.18	977	49.72	8[illegible]2	[illegible]	[illegible]				
11	50.52	1,11[illegible]	50.17	97[illegible]	49.82	[illegible]	[illegible]	[illegible]				
12	50.79	1,225	50.12	97[illegible]	49.8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			
13	51.[illegible]	1,2[illegible]	50.12	95[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
14	51.42	1,5[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]				
15	51.82	1,6[illegible]	49.92	87[illegible]	[illegible]		[illegible]	[illegible]				
16	52.[illegible]	1,7[illegible]	49.82	8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
17	51.9[illegible]	1,745	49.72	8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
18	51.87	1,72[illegible]	49.72	8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
19	51.7[illegible]	1,645	49.82	8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
20	51.57	1,577	49.8[illegible]	8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
21	51.[illegible]	1,487	49.8[illegible]	861	[illegible]	[illegible]	[illegible]	[illegible]				
22	51.[illegible]	1,464	49.92	87[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
23	51.24	1,4[illegible]	49.97	8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
24	51.2[illegible]	1,410	50.02	91[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
25	51.[illegible]	1,[illegible]	49.9[illegible]	87[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
26	50.[illegible]	1,[illegible]	49.8[illegible]	861	51.12	1,7[illegible]	[illegible]	[illegible]				
27	50.74	[illegible]	[illegible]	[illegible]	50.92	1,[illegible]	[illegible]	[illegible]				
28	50.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
29	50.42	1,07[illegible]	[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible]				
30	50.29	1,021	50.37	1,0[illegible]	[illegible]	1,487	[illegible]	1,217				
31	50.22	993	50.42	1,07[illegible]			[illegible]	[illegible]				

Ice conditions from November [illegible] to end of year. Information insufficient [illegible] to compute discharges.

Daily Gauge Height and Discharge of Red River at Emerson, for 1914.

(Drainage area 46,000 square miles.)

Day	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.
1	[1]50.42	581	[1]51.06	733	[1]50.90	575	53.94		54.22	3,002	53.67	2,672
2	[1]50.42	550	[1]51.08	724	[1]50.92	550	54.12		54.02	2,882	53.47	2,559
3	[1]50.22	519	[1]51.10	730	[1]50.94	525	54.14		54.09	2,924	53.37	2,504
4	[1]50.12	488	51.12	736	50.97	504	54.24		54.15	2,960	53.34	2,487
5	50.01	429	[1]51.09	727	[1]51.00	482	54.52		54.27	3,032	53.34	2,487
6	[1]50.21	516	[1]51.06	718	[1]50.92	457	55.02		55.64	3,851	53.37	2,504
7	50.42	581	[1]51.03	708	[1]50.94	463	55.72		56.71	4,496	53.37	2,504
8	[1]50.48	600	[1]51.00	699	[1]50.96	470	56.62		57.01	4,677	53.35	2,492
9	[1]50.51	618	[1]50.97	690	[1]50.98	476	58.12		57.21	4,807	53.39	2,515
10	[1]50.60	637	[1]50.94	680	[1]51.00	467	58.21		57.01	4,677	53.77	2,732
11	50.66	656	50.92	674	[1]51.02	457	58.71		56.71	4,496	53.97	2,852
12	[1]50.72	674	[1]50.92	674	51.02	457	59.11		56.21	4,196	54.57	3,212
13	[1]50.77	690	[1]50.91	671	[1]51.07	504	59.21		55.91	4,016	55.14	3,554
14	50.82	705	[1]50.90	668	[1]51.17	597	59.41		55.61	3,836	56.91	4,616
15	[1]50.84	711	[1]50.90	668	[1]51.28	694	59.11		55.21	3,596	58.21	5,457
16	[1]50.86	718	[1]50.89	665	[1]51.38	817	59.71		55.01	3,476	59.51	6,302
17	[1]50.88	724	[1]50.88	662	[1]51.44	956	59.91		54.17	2,972	60.21	6,767
18	[1]50.90	730	50.87	659	[1]51.54	990	59.01	5,977	54.14	2,951	60.71	7,117
19	[1]50.92	736	[1]50.87	659	[1]51.62		58.21	5,457	54.84	2,774	60.91	7,257
20	[1]50.95	746	[1]50.86	656	[1]51.83		57.71	5,132	53.57	2,614	60.71	7,117
21	50.97	752	[1]50.85	653	[1]52.01		57.21	4,807	53.37	2,504	60.51	6,977
22	50.97	752	[1]50.84	649	[1]52.24		56.71	4,496	53.24	2,432	60.21	6,767
23	[1]50.98	755	[1]50.83	646	52.46		56.21	4,196	53.12	2,366	59.71	6,442
24	[1]51.00	761	[1]50.82	643	52.72		55.91	4,016	53.02	2,306	58.71	5,782
25	[1]51.00	761	50.82	643	53.02		55.51	3,776	53.22	2,421	58.01	5,327
26	[1]51.01	733	[1]50.84	649	53.34		55.21	3,596	53.37	2,504	57.21	4,807
27	[1]51.02	736	[1]50.86	625	53.62		54.87	3,392	53.62	2,642	56.71	4,496
28	51.02	736	[1]50.88	600	53.87		54.62	3,242	53.83	2,708	56.21	4,196
29	[1]51.02	736			53.97		54.42	3,122	53.94	2,834	55.91	4,016
30	[1]51.03	739			53.87		54.25	3,020	53.92	2,822	55.71	3,896
31	[1]51.04	742			53.87				53.77	2,742		

Day	July		August		September		October		November		December	
1	55.22	3,602	52.08	1,825	50.79	1,226	51.17	1,397	51.62	1,599	51.57	
2	56.21	4,196	52.04	1,805	50.99	1,316	51.07	1,352	51.62	1,599	51.62	
3	56.71	4,496	51.97	1,770	51.09	1,361	50.94	1,293	51.62	1,599	51.77	
4	57.21	4,807	51.85	1,710	[illegible]	1,374	50.87	1,262	51.62	1,599	51.94	
5	57.71	5,132	51.72	1,645	[illegible]	1,374	50.82	1,239	51.65	1,613	52.17	
6	57.91	5,262	51.57	1,577	51.09	1,361	50.77	1,216	51.62	1,599	52.37	
7	57.91	5,262	51.47	1,532	51.05	1,343	50.77	1,216	51.59	1,586	52.52	
8	57.71	5,132	51.39	1,496	51.02	1,329	50.75	1,208	51.67	1,622	52.62	
9	57.71	5,132	51.32	1,464	51.00	1,320	50.74	1,204	51.70	1,635	52.67	
10	57.41	4,937	51.30	1,455	50.90	1,275	50.73	1,199	51.72	1,645	52.62	
11	56.91	4,616	51.29	1,451	50.90	1,275	50.77	1,216	51.67	1,622	52.62	
12	56.71	4,496	51.26	1,437	50.87	1,262	50.82	1,239	51.63	1,604	52.62	
13	56.41	4,316	51.22	1,419	50.85	1,253	50.81	1,235	51.50	1,545	52.42	
14	55.91	4,016	51.12	1,374	50.82	1,239	50.87	1,262	51.45	1,523	52.32	
15	55.02	3,482	51.02	1,329	50.82	1,239	50.90	1,275	51.35	1,478	52.12	
16	54.62	3,242	50.97	1,307	50.79	1,226	50.93	1,289	51.20	1,410	52.07	
17	54.37	3,092	50.92	1,284	50.77	1,216	51.00	1,320	51.14	1,383	51.97	
18	54.12	2,942	50.87	1,261	50.72	1,194	51.05	1,343	51.62		51.82	
19	53.92	2,822	50.82	1,239	50.77	1,216	51.12	1,374	51.67		51.82	
20	53.67	2,672	50.80	1,230	50.84	1,248	51.22	1,419	51.59		51.82	
21	53.44	2,542	50.77	1,216	50.92	1,284	51.32	1,464	51.37		51.82	
22	53.32	2,476	50.72	1,194	51.02	1,329	51.42	1,509	51.07		51.84	
23	53.22	2,421	50.69	1,181	51.22	1,419	51.42	1,509	50.96		51.57	
24	53.12	2,366	50.72	1,194	51.32	1,464	51.52	1,554	50.92		51.37	
25	53.02	2,311	50.72	1,194	51.37	1,487	51.52	1,554	50.99		51.27	
26	52.92	2,256	50.72	1,194	51.42	1,509	51.52	1,554	51.31		51.22	
27	52.77	2,174	50.77	1,216	51.37	1,487	51.62	1,599	51.56		51.22	
28	52.52	2,045	50.74	1,203	51.37	1,487	51.62	1,599	51.62		51.27	
29	52.47	2,020	50.72	1,194	51.34	1,473	51.62	1,599	51.52		51.27	
30	52.35	1,960	50.73	1,199	51.25	1,433	51.72	1,645	51.47		51.23	
31	52.22	1,895	50.74	1,203			51.62	1,599			51.2[illegible]	

NOTE.—Ice conditions January 1 to April 18, not sufficient information to compute daily discharges from March 19 to April 17.

Curve under ice conditions not defined above gauge height 751·50. Gauge heights, marked (1) interpolated. Ice conditions from November 17 to end of year; not sufficient information to compute daily discharges.

MONTHLY DISCHARGE of Red River at Emerson, for the years 1912-14.

[Drainage area, 34,000 square miles.]

Month	Discharge in Second-Feet				Run-Off	
	Maximum	Maximum	Mean.	Per square mile	Depth in inches on Drainage area	Total in acre feet
1912						
May	2,930		[1]2,150	0.062	0.071	132,200
June	2,640	1,380	1,760	0.051	0.057	104,700
July	1,[illegible]	993	1,210	0.035	0.041	74,400
August	[illegible]	858	1,050	0.031	0.036	64,600
September		858	1,140	0.033	0.037	67,800
October		1,310	2,280	0.066	0.076	140,200
November		1,230	1,440	0.042	0.047	85,700
December						
The period		[illegible]	580	0.040	0.365	669,000
1913						
January			[illegible]	0.015	0.017	30,700
February			[illegible]	0.009	0.009	16,700
March						
April	[illegible]		[illegible]400	0.387	0.432	797,400
May	[illegible]	[illegible]	[illegible],180	0.092	0.016	195,600
June			1,760	0.051	0.057	104,700
July		[illegible]	[1]1,340	0.038	0.044	82,400
August		[illegible]	957	0.027	0.031	58,800
September		[illegible]	1,210	0.035	0.039	72,000
October	[illegible]	[illegible]	1,190	0.034	0.039	73,200
November			[1]800	0.023	0.025	47,600
December			[1]600	0.018	0.021	36,900
The year	[illegible]	[illegible]	2,290	0.066	0.820	1,516,000
1914						
January	761	429	670	0.019	0.022	41,200
February	736	600	675	0.019	0.020	37,500
March			[1]600	0.017	0.020	36,900
April			[1]2,000	0.058	0.065	119,000
May	4,800	2,420	3,250	0.094	0.108	199,800
June	7,250	2,490	4,400	0.128	0.143	261,800
July	5,250	1,900	3,475	0.101	0.116	213,700
August	1,830	1,380	1,380	0.040	0.046	84,900
September	1,510	1,190	1,330	0.039	0.044	79,100
October	1,650	1,200	1,380	0.040	0.046	84,900
November			[1]1,400	0.040	0.045	83,300
December			[1]800	0.023	0.027	49,200
The year	7,250	429	1,780	0.051	0.702	1,291,300

NOTE.—Marked thus [1] estimated.
Not sufficient information to estimate discharge for December, 1912, and March, 1913.

RED RIVER TWO MILES BELOW EMERSON.

History.—The station was established by G. H. Burnham on June 13, 1912. It was abandoned in April, 1913, on account of the inaccessability of the station.

Location of Section.—The section was on the farm of Thos. Clark, $2\frac{1}{2}$ miles below the Canadian Northern Railway bridge in the town of Emerson. The initial point is a nail driven in the foot of a blazed elm tree on the right bank of the river, just above high-water mark.

Records available.—Records of daily gauge height from June 17, 1912, to April 12, 1913, are available; also several discharge measurements. The discharge curve was not defined sufficiently well to admit of daily discharge estimates.

Drainage Area.—The drainage area is approximately 34,700 square miles.

Gauge.—A vertical staff 9-foot gauge is spiked to a pile driven in the stream bed 120 feet from the initial point. It is referred to a bench-mark set at arbitrary datum.

Channel.—A single channel under all stages, straight for 900 feet above the section and 1,500 feet below. The bottom is of soft mud and liable to shift. The banks are not liable to overflow.

Discharge measurements—Are made from a boat in summer, and ice in winter.

DISCHARGE MEASUREMENTS of Red River 2½ miles below Emerson, 1912-13.

Date	Hydrographer	Meter No.	Width.	Area of Section	Mean Velocity	Gauge Height	Discharge
1912			Feet	Sq. ft.	Ft. per sec.	Feet	Sec. ft.
June 17	G. H. Burnham	1,187	196	1,127	1·11	79·48	1,251
July 9	Burnham & Nelson	"	187	927	1·11	78·68	1,029
" 24	"	"	191	992	1·22	79·05	1,210
Aug. 6	Worden & Nelson	"	191	1,000	1·26	79·02	1,260
" 22	W. G. Worden	"	188	902	1·12	78·59	1,010
1913							
Jan. 15	G. J. Lamb	1,375	190	754	0·66	79·21	500
Feb. 21	A. Pirie	1,462	185	625	0·45	79·17	278

NOTE.—Measurements taken under ice conditions.

RED RIVER AT ELM PARK.

History.—The station was established by M. S. Madden on August 19, 1914; the object of establishing a station at this point was to secure information regarding discharge, with a view to making determinations by slope measurement.

Location of Section.—The meter section is situated on the downstream side of Elm Park Traffic bridge which crosses the Red river at Elm park within the city limits of Winnipeg and about 4½ miles above the junction of the Assiniboine and Red rivers. The initial point of the section is marked on the wooden hand-rail at the north end of the bridge on the downstream side.

Records available.—Daily gauge height readings have been taken from August 19, 1914, on. A number of discharge measurements have also been secured.

The presence of the St. Andrews dam in the Red river has a material effect upon the discharge measurements taken at this point, but one of the objects of establishing the station was to secure records over that period when the dam was opened. There have been no estimates made of daily discharge for this station.

Drainage Area.—The area tributary to the Red river above Elm park bridge is 41,060 square miles.

Gauge.—A 9-foot vertical staff gauge was spiked to the wooden ice-breaker opposite station 1+60 on the metering section. This was replaced on November 6 by a vertical staff gauge which was fastened to the concrete pier in mid-stream and just below the ice-breaker. The gauge is referred to M.H.S. datum.

Channel.—The channel is straight for 1,000 feet above the section and 1,500 feet below; the banks are high and not liable to overflow; the bed of the channel is composed of sand and clay and somewhat liable to shifting. The channel itself is divided into two channels by a centre bridge pier.

Discharge measurements.—The discharge measurements are taken from the downstream side of the bridge.

Accuracy.—Owing to the effect of the operation of the St. Andrews dam it has not been possible to construct a discharge curve for this station. Primarily the station was established with the object of making slope discharge experiments under conditions obtaining when the dam was closed, but owing to the distance that the water is backed up beyond the station, sufficient fall could not be obtained in a stretch of several miles to render the results obtained at all reliable. When the dam is open the discharge measurements are quite reliable.

DISCHARGE MEASUREMENTS of Red River at Elm Park, Winnipeg, 1914.

Date	Hydrographer	Meter No.	Width.	Area of Section	Mean Velocity	Gauge Height.	Discharge
1914			Feet	Sq. ft.	Ft. per sec.	Feet	Sec. ft.
Aug. 19	M. S. Madden	1920	421	5,321	0·23	5·99	1,224
Sept. 28	"	1911	428	5,427	0·31	6·21	1,708
Oct. 22	C. G. Allen	1920	421	5,303	0·42	5·78	2,227
" 24	"	"	400	5,008	0·51	5·06	2,554
"	"	"	401	5,119	0·52	4·98	2,662
" 26	"	"	395	4,816	0·44	4·57	2,119
" 26	"	"	389	4,917	0·51	4·10	2,510
" 27	"	"	381	4,250	0·67	3·18	2,847
" 27	"	"	381	4,222	0·65	3·06	2,744
" 28	"	"	373	3,921	0·65	2·30	2,549
" 28	"	"	373	3,902	0·62	2·22	2,419
" 29	"	"	367	3,675	0·65	1·62	2,389
" 29	"	"	368	3,641	0·62	1·54	2,257
" 30	"	"	366	3,509	0·69	1·15	2,421
" 30	"	"	365	3,487	0·70	1·05	2,441
" 31	"	"	364	3,349	0·63	0·70	2,110
" 31	"	"	364	3,335	0·63	0·66	2,098
Nov. 2	"	"	362	3,227	0·65	0·36	2,098
" 3	"	"	359	3,154	0·69	0·16	2,176

NOTE.—[illegible] should be added to gauge heights given to bring to true gauge height.

RED RIVER AT REDWOOD BRIDGE.

History.—The station was established at Redwood bridge, Winnipeg, on March 8, 1913, by G. H. Burnham.

Location of Section.—The section is located on the down-stream side of the Redwood traffic bridge. The initial point of the section is marked on the hand-rail at the left end of the bridge on the downstream side.

Records available.—Daily gauge height readings from January 1, 1910, to June 21, 1914, have been furnished by the City of Winnipeg High Pressure Plant. From August 21, 1912, to the end of 1914, intermittent gauge heights are available from our own records. No estimates of daily discharge have been made.

Drainage Area.—The drainage area lying above the section at Redwood bridge includes the area drained by the Assiniboine river, in addition to that drained by the Red above the station.

Gauge.—The first gauge was installed on August 21, 1912; it was placed on the inside face of the ice-breaker opposite concrete pier, and 6 feet above it. On November 17, 1912, it was replaced by a new gauge which was placed nearer the centre of the ice-breaker. Both were referred to R. P. S. datum.

Channel.—The channel is straight for a considerable distance both above and below the section. The bottom is sandy clay and liable to shift; the banks are high and not liable to overflow. The channel at this point is divided by the piers of the bridge.

Discharge Measurements.—Measurements have been taken from the downstream side of the bridge, but sufficient meterings have not been made to define a discharge curve.

Discharge Measurements of Red River at Redwood Bridge, Winnipeg, 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1913			Feet	Sec. ft.	Ft. per sec.	Feet	Sec.-ft.
Mar. 8	G. H. Burnham.	1,197	340	3,397	0·18	728·42	627
1914							
Jan. 23	E. J. Budge	1,462	316	3,092	0·26	726·85	823

Note.—Measurements taken under ice conditions.

PEMBINA RIVER.

The Pembina river is one of the tributaries of the Red river entering from the west. The headwaters rise on the northern slope of Turtle mountain and the main river flows easterly and then south, crossing the international boundary into North Dakota in tp. 1, R. 6 W.P.M.; it then turns east and flows in a direction roughly paralleling the boundary to its junction with the Red river, 5 miles above Emerson.

The drainage area of the Pembina is 4,180 square miles, 1,440 square miles of which are in Dakota, the balance being in Manitoba. In the upper portion of the river the river flows through a well-defined valley, especially in that part where it approaches the boundary. The lower part of the river is in typical prairie country, the banks being cut sharply down from the surrounding country and being composed of clay and sand.

The river-bed is of sand, gravel, and clay, the banks are easily eroded, and the channel is generally shifting. It varies from 20 to 90 feet in width, but in several places in the upper reaches it widens out into lakes, as Pelican, Rock, and Swan lakes.

The country drained is well settled, and good roads are to be found throughout the district.

From records kept by the United States Geological Survey at Neche, N.D., for the years 1903 to 1910, inclusive, it has been found that the discharge varies between 3 c.f.s. in August, September, and October, 1910, to 3,870 c.f.s. in May, 1904.

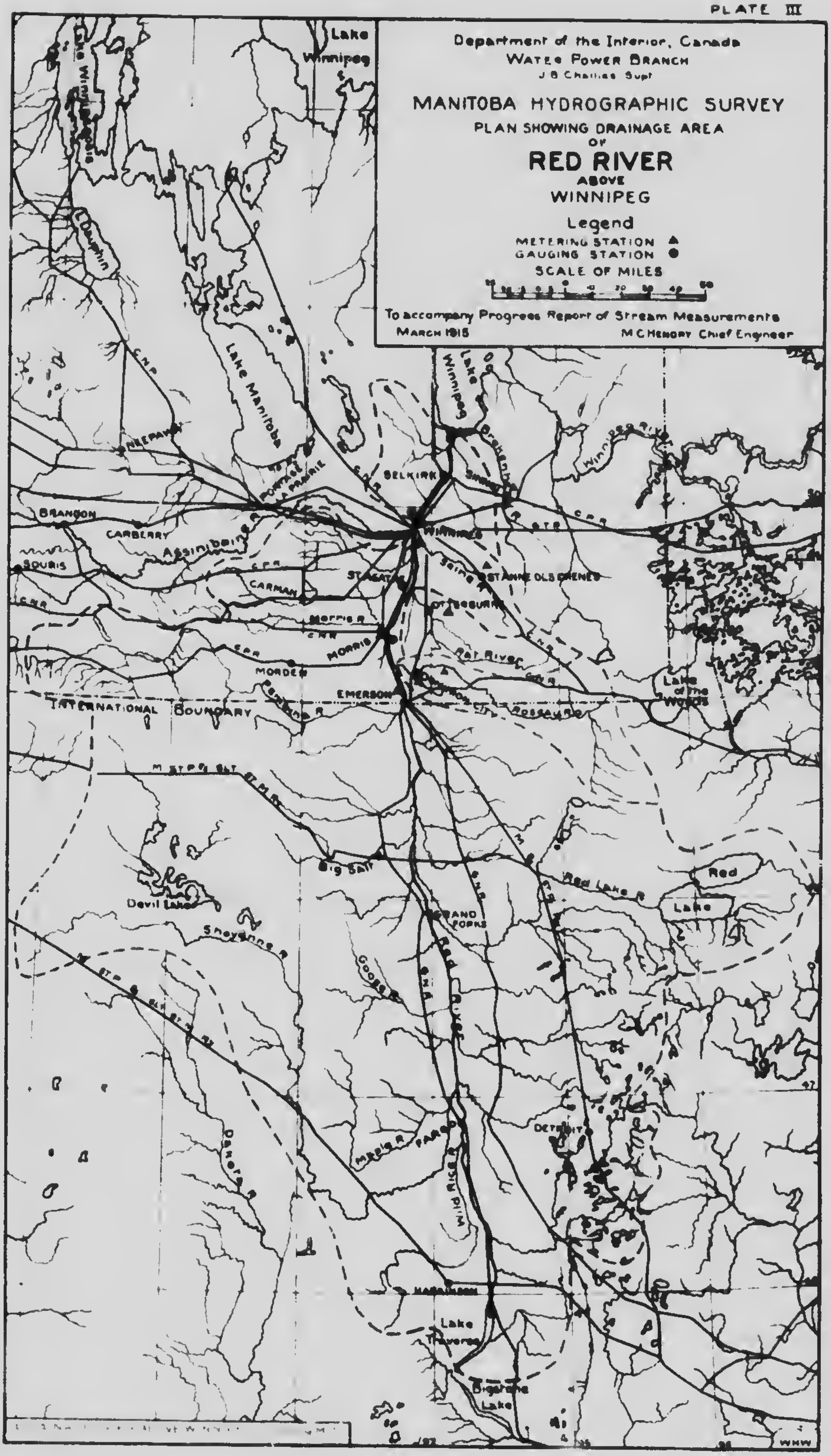
Monthly Discharge of Pembina River at Neche, North Dakota, for 1903.

[Drainage area 2,940 square miles.]

Month	Discharge in Second-feet			Run-off
	Maximum	Minimum	Mean	Total in Acre-feet
1903				
April				
May			202	12,420
June	198	110	119	8,866
July	110	35	60	3,689
August			25	555
September				
October			42	1,749
November			42	1,1[illegible]
December				
The period				

Note.—Obtained from records of Water Resources Branch, U. S. Geological Survey.

PLATE III


Department of the Interior, Canada
Water Power Branch
J. B. Challies Supt.
MANITOBA HYDROGRAPHIC SURVEY
PLAN SHOWING DRAINAGE AREA
OF
RED RIVER
ABOVE
WINNIPEG
Legend
METERING STATION
GAUGING STATION
SCALE OF MILES
To accompany Progress Report of Stream Measurements
March 1915
M. C. Hendry Chief Engineer
Lake Winnipeg
Lake Winnipegosis
L. Dauphin
Lake Manitoba
Lake Winnipeg
Selkirk
Neepawa
Portage la Prairie
Brandon
Carberry
Assiniboine R.
Souris
Winnipeg
Carman
Morris R.
Morris
Morden
Emerson
Red River
Pembina R.
International Boundary
Roseau R.
Lake of the Woods
Winnipeg R.
Big Salt
Devil Lake
Sheyenne R.
Grand Forks
Red Lake R.
Red Lake
Goose R.
Red River
Fargo
Detroit
Wild Rice R.
Dakota R.
Lake Traverse
Bigstone Lake
WHW

Monthly Discharge of Pembina River, at Neche, North Dakota, 1904–10.

[Drainage area 2,940 square miles.]

Month.	Discharge in Second-feet: Maximum	Minimum.	Mean.	Per Square Mile	Run-off: Depth in Inches on Dr'n'ge area	Total in Acre-feet.
1904						
April	3,580	217	1,920	0·653	0·56	87,600
May	3,870	1,420	2,640	0·898	1·04	162,000
June	2,530	926	1,690	0·575	0·64	101,000
July	2,690	399	839	0·285	0·33	51,600
August	420	315	385	0·131	0·15	23,700
September	315	236	302	0·103	0·11	18,000
October	275	217	235	0·080	0·09	14,400
November	217	131	183	0·062	0·06	9,440
The period	3,870	131	1,024	0·348	2·98	468,000
1905						
March 23–31	672	530	606	0·216	0·072	10,820
April	1,372	311	549	0·196	0·219	18,510
May	1,180	218	447	0·160	0·184	27,480
June	1,180	279	485	0,173	0·193	16,600
July	399	119	206	0·074	0·085	12,670
August	137	60	97	0·035	0·040	5,964
September	119	65	93·9	0·034	0·038	5,587
October	150	70	119	0·042	0·048	7,317
November 1–26	137	91	116	0·041	0·040	5,982
The period	1,372	60	302·1	0·108	0·919	110,900
1906						
April	220	193	479	0·163	0·18	28,500
May	231	175	193	0·066	0·08	11,900
June	340	193	271	0·092	0·10	16,100
July	270	119	175	0·060	0·07	10,800
August	143	119	141	0·045	0·05	8,000
September	166	136	147	0·050	0·06	8,750
October	150	136	144	0·049	0·06	8,850
November	136	82	111	0·038	0·03	4,180
The period	1,220	82	206	0·703	0·63	97,100
1907						
April 21–30			860·0	0·293	0·11	17,100
May	2,190	826	1,600·0	0·544	0·63	98,400
June	805	263	507·0	0·172	0·19	30,200
July	272	76	156·0	0·053	0·06	9,590
August	80	16	54·3	0·014	0·02	3,340
September	47	23	34·8	0·012	0·01	2,070
October	66	46	55·2	0·019	0·02	3,390
November			38·0	0·013	0·01	2,260
December			19·0	0·006	0·01	1,170
The period	2,190	23	209·7	0·125	1·06	168,000
1908						
January			6·[illegible]	0·002	0·002	369
February			5·0	0·001	0·001	173
March			3·0	0·001	0·001	184
April	927		375·9	0·128	0·14	22,300
May	591	310	474·0	0·161	0·19	29,100
June	486	136	224·0	0·076	0·08	13,300
July	136	36	87·8	0·030	0·03	5,400
August	66	36	52·1	0·018	0·02	3,200
September	78	55	60·9	0·021	0·02	3,620
October 1–10	55	45	49·0	0·170	0·006	972
The period	927	36	131·08	0·063	0·490	78,600
1909						
June	654	268	427·0	0·145	0·07	11,000
July	161	71	113·0	0·038	0·04	5,600
August	100	22	48·3	0·016	0·02	2,970
September	42	22	27·7	0·0094	0·01	1,650
October	73	32	45·9	0·016	0·02	2,970
November	67	38	51·9	0·018	0·009	1,440
The period	654	22	110·0	0·040	0·189	25,630
1910						
March	685	115	349·0	0·118	0·08	11,800
April	250	147	166·0	0·056	0·06	9,880
May	164	86	120·0	0·041	0·05	7,380
June	100	7	60·4	0·021	0·02	3,590
July	100	10	34·9	0·012	0·01	2,150
August	10	3	6·87	0·0023	0·004	422
September	7	3	3·93	0·0013	0·001	234
October	10	3	6·39	0·0022	0·003	393
The period	685	3	93·41	0·0316	0·227	35,849

Note.—Obtained from records of Water Resources Branch, U. S. Geological Survey.

Pembina River at La Rivière.

History.—The meter station on the Pembina river at La Rivière was established on October 3, 1912, by W. G. Worden. The operation of the station was discontinued the end of March, 1913.

Location of Section.—The station is located on the downstream side of the traffic bridge at La Rivière, half-a-mile west of the Canadian Pacific Railway station, 1 mile below the railroad bridge, and three-quarters of a mile below the dam. The initial point is marked by an arrow cut in the handrail of the bridge at the southeast corner.

Records Available.—A few gauge heights are available for the period during which the station was operated, and two discharge measurements were taken during October, 1912.

Drainage Area.—The area tributary to the Pembina river above La Rivière is 1,840 square miles.

Channel.—The river is confined to one channel at all stages; the bed of the stream is of silt and clay, and fairly permanent. The channel is straight for 250 feet above the section and 500 feet below. The banks are high and not liable to overflow.

Discharge Measurements—Discharge measurements were taken from the downstream side of the traffic bridge.

Diversions.—A dam placed in the river about three-quarters of a mile above the station forms a pond which is used by the railway as a source of water supply. During the low-water season a very large proportion of the water is used for this purpose.

Accuracy.—As only two discharge measurements have been made at the station, no estimates of daily discharge have been made.

Discharge Measurements of Pembina river at La Rivière, 1912.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge.
1912			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
Oct. 4	Worden & Lamb	1496	76	364	0.18	101.21	66
Oct. 28	C. H. Lamb	1186	73	357	0.23	101.15	82

ROSEAU RIVER.

[illegible]e Roseau river is the largest tributary entering the Red river from the [illegible] thin the province of Manitoba. The mouth of the Roseau is about 12 [illegible] north of the international boundary, and it drains the territory lying to [illegible] west and south of the lake of the Woods.

The general direction followed by the Roseau is northwest, but the actual course of the river is very sinuous; about half its length lies in United States territory. The banks of the river vary from 10 to 12 feet in height, and are cut sharply down from the prairie level. The river bottom and banks are composed chiefly of heavy clay.

The drainage area is 1,987 square miles, 890 square miles being in Manitoba and 1,097 square miles in the state of Minnesota. A large part of the drainage area is under cultivation, there being little standing timber in that part within the province. What there is consists mostly of elm, ash, and oak, very little of which is of commercial size.

Considerable drainage work has been done in the basin, especially on the United States side of the line. There are no towns of any size to be found along the river, but three small villages are so located; these are Sprague, near the international boundary on the Ridgeville branch of the Canadian Northern railway; the second is Stewartburn, on the same line; and the third is

Dominion City, located at the crossing of the Emerson branch of the Canadian Pacific railway, it having a population of about two hundred.

Discharge measurements have been made at various sections on the river since the establishment of the survey in 1912. The sections were used and then abandoned in favour of more suitable ones, for various reasons, and are as follows:

1. At Dominion City.
2. At Baskerville's farm.
3. At Mayne's farm.
4. Below Dominion City, in use at present.

The records obtained at these stations and the results follow.

Roseau River at Baskerville's Farm.

History.—A station was established by G. J. Lamb, January 13, 1913, at Mayne's farm. It superseded the station at Dominion City, and was operated until April, 1913. The object was to obtain winter records, but the records were not satisfactory, and a station was established on April 23, 1913, by Alex. Pirie, to take its place, where more reliable records could be obtained and the operation would be more economical.

Location of Section.—The station is on the downstream side of the traffic bridge at Baskerville's farm, about 9 miles above Dominion City. The initial point is marked 0+00 on the southwest corner of the bridge.

Records available.—Daily gauge height records for the open-water season of 1913 and 1914 are available, and sufficient meterings were taken to define the discharge curve from which the estimated daily discharges have been computed.

Drainage Area.—The drainage area above Baskerville's farm is 1,900 square miles, a considerable portion of which lies south of the international boundary.

Gauge.—The gauge is a 9-foot vertical staff gauge spiked to a pile 10 feet above the bridge on the left side of the river. The gauge is referred to a M.H.S. bench-mark set to an arbitrary datum.

Channel.—One channel at all stages of the river. It is straight for 900 feet above the section and 500 feet below. The bottom is hard clay and not liable to scour; the banks are high and not liable to overflow.

Discharge Measurements.—Meterings are taken from the bridge, and have been taken over a range in stage of 11 feet.

Accuracy.—Between gauge heights 83·70 and 85·00 curve very well defined, between 85·00 and 94·77 the curve is fairly well defined; beyond these limits the curve is not well defined.

Discharge Measurements of Roseau River at Baskerville's farm, 1913-14

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1913			Feet	Sq. ft.	Ft. per sec.	Feet	Sec. ft.
Apr. 22	[illegible]	1496	73	484	2·16	90·12	1,041
[illegible]	A. Pirie	1186	91	910	2·20	94·66	2,003
May [illegible]	J. Bar[illegible]	1469	64	647	2·12	95·00	1,500
May 14		1469	64	355	1·69	88·13	600
June 28	G. [illegible]	1186	56	146	0·90	85·66	131
[illegible]	A. Pirie	1496	52	166	1·03	85·02	171
[illegible] 29	C. [illegible] Allen	1435	36	[illegible]	0·41	83·67	42
[illegible]		1435	47	105	0·54	83·84	57
1914							
[illegible]	J. J. Budge	1462	42	52	0·14	84·13	7
[illegible] 4	W. J. Ireland	1469	[illegible]	25	0·14	84·65	4
[illegible] 21	J. J. Moore	1371	54	69	0·2[illegible]	84·74	20

Note—Measurements [illegible] taken under ice conditions.

Daily Gauge Height and Discharge of Roseau River at Baskerville's Farm for 1913.

(Drainage area 1,900 square miles.)

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.
1									92·58	1,520	86·10	264
2									91·97	1,390	85·99	250
3									91·86	1,370	85·92	242
4									91·61	1,318	85·91	241
5									91·16	1,220	85·90	240
6									90·59	1,100	86·00	252
7									90·15	1,010	85·89	239
8									89·80	933	85·91	241
9									89·41	851	86·05	258
10									89·13	796	86·09	262
11									88·86	735	86·10	264
12							90·12	1,040	88·67	696	86·12	266
13									88·39	637	86·12	266
14									88·08	372	86·19	274
15									88·11	378	86·19	274
16									88·08	572	86·09	262
17									87·75	510	85·91	241
18									87·52	469	85·89	239
19									87·36	440	85·85	234
20									87·29	428	85·73	223
21									87·23	419	85·58	205
22									87·15	406	85·41	187
23							94·66	1,950	87·01	384	85·31	177
24							94·60	1,940	86·86	363	85·21	167
25							94·81	1,980	86·81	356	85·14	160
26							94·11	1,840	86·70	340	84·90	137
27							93·58	1,730	86·56	322	84·81	129
28							93·81	1,780	86·41	303	85·53	197
29							93·51	1,710	86·36	298	85·43	189
30							93·08	1,620	86·31	290	85·68	216
31									86·17	272		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	85·40	186	84·77	126	84·44	97	83·53	33	84·64	114		
2	85·22	168	84·64	113	84·35	89	83·52	32	84·73	122		
3	85·15	161	84·53	104	84·27	83	83·52	32	84·64	114		
4	85·20	166	84·42	95	84·20	77	83·51	31	84·52	103		
5	85·20	166	84·32	87	84·18	76	83·53	33	84·74	123		
6	85·13	157	84·21	78	84·13	72	83·60	33	84·54	107		
7	85·04	150	84·04	65	84·04	65	83·64	39	84·54	107		
8	85·08	153	84·01	61	83·93	58	83·67	41	84·61	111		
9	84·97	144	83·90	56	83·82	50	83·63	39	84·12	73		
10	84·89	136	83·80	49	84·01	63	83·64	39	83·74	45		
11	85·00	146	83·83	51	83·91	56	83·72	44	84·49	101		
12	85·09	[illegible]	83·73	45	83·84	51	83·87	54	84·43	96		
13	85·20	166	83·71	43	83·80	49	83·96	60	84·32	87		
14	85·13	157	83·66	40	83·79	48	83·92	57	84·31	86		
15	85·11	157	83·61	37	83·79	48	84·41	94	84·37	91		
16	85·21	167	83·64	39	83·79	48	84·72	121	84·40	93		
17	86·02	254	83·51	31	83·73	45	84·86	134	84·30	85		
18	85·44	190	83·51	31	83·91	56	85·02	148	84·31	86		
19	85·52	198	83·53	33	83·90	56	85·00	146	84·32	87		
20	85·53	199	83·58	36	83·91	56	84·93	140	83·97	61		
21	85·57	204	83·91	56	83·83	51	84·74	123	84·14	73		
22	85·61	208	83·75	46	83·83	51	84·52	103	83·95	59		
23	85·53	199	83·83	51	83·80	49	84·71	120	83·95	59		
24	85·51	197	83·83	51	83·83	51	84·75	125	83·93	64		
25	85·48	194	83·97	61	83·80	49	84·73	122	83·93	64		
26	85·42	188	84·18	76	83·75	46	84·54	105	84·00	63		
27	85·[illegible]	181	84·57	108	83·71	43	84·53	104	84·22	79		
28	85·25	171	84·64	114	83·64	39	84·46	98	84·13	72		
29	85·14	159	84·61	114	83·59	36	84·77	126	84·01	70		
30	85·10	156	84·59	109	83·54	33	84·15	73	84·93	70		
31	84·99	145	84·[illegible]	101			84·72	121				

Note.—Ice conditions November 2[illegible] to end of year; information insufficient to compute daily discharge.

DAILY GAUGE HEIGHT AND DISCHARGE of Roseau River at Baskerville's Farm, for 1914.

[Drainage area, 1,900 square miles.]

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1							85·78		89·47	863	87·78	515
2							86·00		89·41	851	87·84	527
3							85·77		89·30	827	88·02	561
4					84·65	1	85·80		89·23	813	88·11	578
5							85·90		89·16	798	88·23	603
6	84·13	7					85·92		89·10	786	88·32	622
7							85·90		88·98	760	88·13	582
8							85·92		88·93	750	87·06	391
9							85·98		88·87	747	87·88	534
10							86·31		88·81	725	88·02	561
11							86·57		88·78	718	87·72	505
12							86·83		88·78	718	87·66	494
13							87·06		88·70	702	87·86	531
14							87·33		88·54	668	88·13	582
15					85·11		87·24		88·38	634	88·36	630
16					85·06		87·55		88·26	609	88·54	668
17					84·90		87·80		88·04	565	88·68	698
18					84·85		88·51	662	87·82	523	88·87	738
19					85·01		88·17	590	87·64	491	88·88	740
20					84·95		87·92	542	87·50	466	88·92	748
21					84·71	20	87·04	388	87·33	435	88·92	748
22					84·73		87·56	476	87·17	400	88·86	735
23					84·90		88·29	615	87·15	406	88·78	719
24					84·76		88·52	664	87·49	448	88·58	677
25					84·70		88·80	722	87·54	473	88·40	639
26					84·60		88·97	758	87·80	520	88·19	595
27					84·64		89·12	790	87·78	515	88·07	571
28					84·71		89·20	807	87·89	536	87·96	550
29					84·72		89·42	853	88·12	580	87·67	496
30					84·80		89·48	865	88·10	576	87·43	451
31					84·90				87·84	527		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge
1	87·29	414	85·41	187
2	87·00	382	85·24	170
3	86·88	365	85·12	158
4	86·77	350	84·83	131
5	86·67	337	84·69	118
6	86·60	330	84·63	113
7	86·59	326	84·51	102
8	86·47	311	84·40	93
9	86·43	305	84·31	86
10	86·44	303	84·25	81
11	86·39	300	84·11	70
12	86·52	317	83·98	61
13	86·46	309		
14	86·28	286		
15	86·26	283		
16	86·15	270		
17	86·13	267		
18	86·03	255		
19	86·26	283		
20	86·30	288		
21	86·37	298		
22	86·48	312		
23	86·45	308		
24	86·39	300		
25	86·34	290		
26	86·19	274		
27	86·12	266		
28	85·95	246		
29	85·83	232		
30	85·71	219		
31	85·58	205		

NOTE.—Ice conditions January 1 to April 16, information insufficient to compute daily discharges.

MONTHLY DISCHARGE of Roseau River at Baskerville's Farm, for the years 1913-14.

(Drainage area, 1,900 square miles.)

Month	Discharge in Second-feet: Maximum	Minimum	Mean	Per square mile	Run-off: Depth in inches on Drainage area	Total in acre-feet
1913						
January			[illegible]	[illegible]	[illegible]	[illegible]
February		0	0			
March			0			
April			[illegible]	[illegible]	[illegible]	[illegible]
May	1,517	[illegible]	[illegible]	0.354	[illegible]	[illegible]
June	274	129	227	0.119	[illegible]	[illegible]
July	254	136	174	[illegible]	[illegible]	[illegible]
August	126	[illegible]	[illegible]	[illegible]	0.042	[illegible]
September	97	33	[illegible]	[illegible]	[illegible]	[illegible]
October	148	41	[illegible]	[illegible]	[illegible]	5,100
November	122	45	[illegible]	[illegible]	[illegible]	5,050
December			[illegible]	[illegible]	[illegible]	2,400
The year	1,517	0	215	[illegible]	[illegible]	[illegible]
1914						
January			[illegible]	[illegible]	[illegible]	[illegible]
February			[illegible]	[illegible]	[illegible]	278
March		4	[illegible]	[illegible]	0.015	1,540
April			570	[illegible]	[illegible]	[illegible]
May	[illegible]	406	626	[illegible]	[illegible]	[illegible]
June	[illegible]	391	600	0.316	[illegible]	[illegible]
July	414	205	298	0.157	0.181	[illegible]
August			[illegible]	0.040	0.046	[illegible]
The period	863	4	[illegible]	0.145	1.116	133,197

NOTE.—Marked thus (¹) estimated. Ice conditions November 29, 1913, to end of year. Ice conditions from January 1 to April 16, 1914.

Bloodvein River, Fourth Rapids.

Roseau River at Dominion City.

History. This station on the Roseau was established by S. S. Scovil, May 21, 1912, and was operated until December 31, 1912, at which time it was abandoned for a more favourable section located at Mayne's farm.

Location of Section. The station was located on the downstream side of the traffic bridge to the northeast of Dominion City and about five-eighths of a mile from the Canadian Pacific Railway station. The initial point of the section is marked by three 6-inch spikes driven in the guard-rail of the bridge approach at the southeast corner of the bridge.

Records available. A gauge height record from May 20, 1912, to December 31, 1912, was kept, and a sufficient number of meterings were taken to define the discharge curve fairly well. Estimates of daily discharge have been made for the period.

Drainage Area. The drainage area above the station is 1,910 square miles, part of which lies in United States territory. As the land is generally low-lying, considerable drainage work has been done, especially south of the international boundary.

Gauge. A vertical staff gauge spiked to the downstream side of a pile bent 4 feet below the section, and referred to Can. Geo. S. datum. A M. H. S. bench-mark (to the same datum), marked by a spike driven into an unused pile on the south side of the river opposite station 0+30 on the section is used as a reference.

Channel. One channel at all stages. Is straight for 50 feet above the section, and 250 below. The bed of the stream is clay, and permanent; the banks are liable to overflow at high stages.

Discharge Measurements. Made from the downstream side of the traffic bridge.

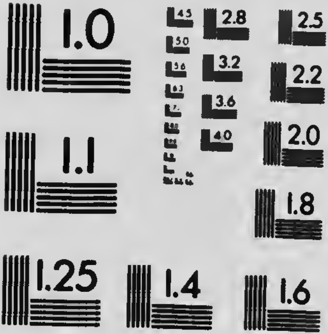
Accuracy. The discharge curve is well defined over the range in stage observed; a partial contraction of the channel half a mile below the station under high stages tends towards a back-water effect on the station.

Discharge Measurements of Roseau River at Dominion City, 1912.

Date.	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
May 21	S. S. Scovil	1187	81	334	1.22	766.49	408
June 18	G. H. Burnham	1187	74	239	0.65	765.12	155
July 11	G. H. Burnham	1187	68	124	0.25	761.65	31
Aug. 7	W. G. Worden	1187	74	216	0.63	764.91	117
Aug. 24	W. G. Worden	1187	72	199	0.52	764.68	103
Oct. 19	G. J. Lamb	1187	85	551	2.16	769.55	1,195
Nov. 1	G. J. Lamb	1187	86	582	2.19	769.70	1,274

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc
1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

Daily Gauge Height and Discharge of Roseau River at Dominion City, for 1912.

[Drainage area, 1,940 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1											66·49	410
2											66·20	336
3											66·23	344
4											66·22	341
5											66·12	318
6											66·18	332
7											66·11	316
8											66·05	304
9											65·99	292
10											65·91	276
11											65·84	263
12											65·70	238
13											65·68	235
14											65·60	222
15											65·55	214
16											65·46	200
17											65·33	182
18											65·19	163
19											64·90	129
20									66·48	408	64·98	138
21									66·49	410	64·87	126
22									66·49	410	64·70	107
23									66·51	416	64·58	95
24									66·47	405	64·44	83
25									66·41	390	64·33	74
26									66·34	371	64·21	66
27									66·37	379	64·13	60
28									66·52	418	64·03	53
29									66·71	468	63·90	45
30									66·71	468	63·90	45
31									66·62	444		

	July.		August.		September.		October.		November.		December.	
1	63·84	41	64·44	83	64·66	103	67·13	577	69·71	1,248	66·12	
2	63·74	36	64·60	97	64·67	104	67·35	634	69·50	1,193	65·92	
3	63·72	35	64·75	113	64·72	109	67·51	676	69·30	1,141	65·43	
4	63·72	35	64·83	121	64·90	129	67·61	702	69·20	1,115	65·05	
5	63·67	33	64·86	125	64·94	133	67·73	733	68·86	1,027	65·58	
6	63·63	30	64·92	131	64·90	129	68·61	962	68·51	936	65·33	
7	63·72	35	64·93	132	64·92	131	67·97	795	68·31	884	65·52	
8	63·66	32	64·88	127	64·88	127	68·14	839	68·22	860	65·48	
9	63·78	38	64·73	110	64·87	126	68·14	839	68·13	837	65·28	
10	63·81	40	64·64	101	64·92	131	68·31	884	68·01	806	65·24	
11	63·65	31	64·53	91	64·93	132	68·51	936	67·94	787	65·07	
12	63·89	44	64·53	91	64·84	122		[1]1,000	67·81	754	64·81	
13	63·88	44	64·73	110	64·87	126		[1]1,030	67·68	720	64·61	
14	64·00	51	64·81	119	64·90	129		[1]1,060	67·50	673	64·47	
15	64·11	59	64·87	126	64·93	132		[1]1,090	67·57	691	64·40	
16	64·24	68	64·84	122	64·95	134		[1]1,120	67·90	777	64·31	
17	64·28	71	64·88	127	64·94	133		[1]1,150	68·12	834	64·26	
18	64·28	71	64·90	129	64·95	134		[1]1,180	67·41	650	64·21	
19	64·31	73	64·90	129	64·94	133	69·57	1,211	67·81	754	64·17	
20	64·36	77	64·93	132	65·05	146	69·48	1,118	67·97	795	64·16	
21	64·41	81	64·93	132	65·29	177	69·62	1,224	67·84	761	64·15	
22	64·48	86	64·86	125	65·53	211	69·78	1,266	68·57	951	64·13	
23	64·55	93	64·75	113	65·58	219	69·71	1,248	67·76	741	64·13	
24	64·61	98	64·67	104	65·61	224	69·83	1,279	67·48	668	64·13	
25	64·52	90	64·64	101	65·68	235	70·01	1,326	67·63	707	64·13	
26	64·42	82	64·61	98	65·92	278	69·90	1,297	[2]67·36	639	61·13	
27	64·34	75	64·59	96	66·14	323	69·91	1,300	[2]67·13	579	64·13	
28	64·34	75	64·62	99	66·39	384	69·90	1,297	66·94	527	65·18	
29	64·43	82	64·63	100	66·67	457	70·08	1,344	66·51	416	65·81	
30	64·39	79	64·73	110	66·94	527	70·12	1,354	66·33	369	65·71	
31	64·41	81	64·79	117			69·81	1,274	...	...	65·68	

Note.—Station commenced May 20. Ice conditions November 30 to end of year. Information insufficient to compute daily discharge. Water over gauge from October 12 to 18. Discharges marked thus (1) estimated. Gauge heights marked thus (2) interpolated.

Monthly Discharge of Roseau River at Dominion City, for the year 1912.

[Drainage area, 1,940 square miles.]

Month.	Discharge in Second-feet.				Run-off	
	Maximum.	Minimum.	Mean.	Per square mile	Depth in inches on Drainage area.	Total in acre-feet.
1912.						
May			[1]416	0·214	0·247	25,600
June	410	45	200	0·103	0·115	11,900
July	98	30	60	0·031	0·036	3,700
August	132	83	113	0·058	0·067	6,950
September	527	103	186	0·096	0·107	11,100
October	1,354	577	[1]1,059	0·546	0·630	65,100
November	1,248	369	795	0·410	0·457	47,300
December			[1]240	0·124	0·143	14,800
The period	1,354	30	384	0·198	1·802	186,450

Note.—Station commenced May 20. Ice conditions November 30 to end of year. Discharges marked thus ([1]) estimated.

Roseau River below Dominion City.

History.—The section at Baskerville's farm, while satisfactory, was considerably out of the route and entailed a drive of nearly 18 miles. On April 14, 1914, the above station was established by D. B. Gow to supersede it.

Location of Section.—The station below Dominion City is about 2,000 feet below the Canadian Pacific Railway bridge over the Roseau, and about 2,100 feet below the Canadian Pacific Railway dam on the river. The initial point is a nail in an 8-inch white ash tree blazed and near the top of the left bank.

Records Available.—A daily gauge height record has been kept since April 14, 1914, and sufficient meterings have been taken to define the discharge curve. Daily discharges have been computed for the station.

Drainage Area.— The drainage area is 1,940 square miles.

Gauge.—The gauge is a vertical staff fastened to a 2-inch by 4-inch scantling driven into the stream bed and braced. It is located 1,000 feet below the section and is nearer the town, on account of the winding of the river.

Channel.—There is only one channel at all stages. The bottom is fairly permanent; the banks are sloping, and not subject to overflow. The channel is straight for 350 feet above the section and for 100 feet below.

Discharge Measurements.—They are made by means of a cable carrier, the cable being stretched across the stream, and the meterings are made by suspending the meter from it. The meterings cover a range in stage of 5 feet.

Accuracy.—The discharge curve is well defined between gauge heights 87·00 and 89·00, and fairly well defined between gauge heights 89·00 and 92·70.

Discharge Measurements of Roseau River below Dominion City, 1914.

Date.	Hydrographer.	Meter No	Width	Area of Section.	Mean Velocity	Gauge Height.	Discharge.
1914.			Feet.	Sq. ft.	Ft. per sec	Feet.	Sec.-ft.
April 17	C. O. Allen	1,497	60	280	1·36	91·02	381
April 28	Alex. Pirie	1,187	64·5	423	1·96	92·69	828
May 28	Alex. Pirie	1,939	60	307	2·02	91·11	624
June 17	C. O. Allen	1,760	61	406	1·92	92·04	781
July 31	M. S. Madden	1,760	55	187	1·32	88·77	246
Aug. 14	J. A. Page	1,919	46·5	91	·72	87·04	65
Sept. 18	H. Boyd	1,919	51	114	1·03	87·59	118
Sept. 18	H. Boyd	1,919	51	114	1·01	87·62	116
Oct. 14	M. S. Madden	1,911	53	151	1·04	88·22	158
Nov. 5	M. S. Madden	1,912	58	224	1·62	90·27	365
Dec. 3	C. O. Allen	1,912	55	131	·89	88·58	[1]117
Dec. 31	M. S. Madden	1,462	42	41	·28	87·26	[1]11

[1]Measurements taken under ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Roseau River at Dominion City, for 1914.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge.
	Feet.	Sec.-ft	Feet	Sec.-ft.	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft.
1									93·13	956	91·03	610
2									93·02	938	91·12	624
3									92·82	905	91·13	626
4									92·74	892	91·38	667
5									92·56	862	91·53	692
6									92·47	848	91·62	707
7									92·33	824	91·56	697
8									92·27	815	91·34	661
9									92·22	807	91·19	636
10									92·18	799	91·29	652
11									91·99	768	90·99	603
12									91·99	768	90·89	586
13									91·89	751	91·09	619
14							90·72		91·79	735	91·41	673
15							90·84		91·67	71	91·63	709
16							91·02	608	91·52	690	91·53	692
17							91·03	610	91·32	657	92·06	780
18							91·27	650	91·06	615	92·21	805
19							92·62	872	90·83	577	92·32	822
20							90·92	391	90·67	551	92·41	838
21							90·42	509	90·39	504	92·40	836
22							90·72	558	90·33	494	92·32	822
23							91·27	650	90·33	494	92·21	805
24							91·74	727	90·34	496	91·99	768
25							92·14	793	90·59	537	91·74	727
26							92·43	841	90·79	570	91·49	685
27							92·67	881	90·89	586	91·46	681
28							92·69	883	90·99	603	91·24	645
29							92·96	928	91·39	669	91·93	758
30							93·07	947	91·37	666	90·74	562
31									91·69	619	.....	....

Day.	July.		August.		September.		October.		November.		December.	
1	90·38	502	88·53	219	87·98	155	88·48	213	90·16	466	88·57	....
2	90·22	476	88·40	203	88·13	171	88·43	207	90·19	471	88·56	117
3	90·01	442	88·20	179	88·28	189	88·33	195	90·35	497	88·58	....
4	89·93	428	88·08	166	88·30	191	88·28	189	90·38	502	88·53	....
5	89·84	414	87·88	144	88·18	177	88·23	183	90·27	485	88·49	....
6	89·82	410	87·78	133	88·08	166	88·10	168	90·20	473	....	....
7	89·53	362	87·68	123	88·17	176	87·98	155	90·28	486	....	....
8	89·33	331	87·68	123	87·93	149	88·00	157	90·19	471	....	....
9	89·39	300	[1]87·57	112	87·88	144	88·03	160	90·04	447	....	....
10	89·37	337	[1]87·46	101	87·83	138	87·98	155	90·11	458	....	....
11	89·28	323	[1]87·36	92	87·78	133	87·90	146	89·97	435	....	....
12	89·48	354	[1]87·25	83	87·58	113	87·88	144	89·76	400	....	....
13	89·33	331	[1]87·14	74	87·53	108	87·87	143	89·69	380	....	....
14	89·18	308	87·04	65	87·63	118	88·32	193	88·19	178	....	....
15	89·13	301	87·03	64	87·58	113	89·09	295	88·04	161	....	....
16	89·08	293	86·88	53	87·63	118	89·39	340	89·39	....	....	....
17	88·98	278	86·87	52	87·58	113	89·44	348	88·79	....	....	....
18	88·91	268	86·88	53	87·73	128	89·49	356	88·59	....	....	....
19	89·13	301	86·78	46	87·78	133	89·54	364	89·75	....	....	....
20	89·18	308	86·87	52	87·83	138	88·59	372	90·36	....	....	....
21	89·28	323	86·78	46	88·44	208	89·64	381	90·02	....	....	....
22	89·63	379	86·88	53	88·63	231	89·69	388	89·51	....	....	....
23	89·67	386	86·83	49	88·68	237	89·74	397	89·29	....	....	....
24	89·58	370	86·88	53	88·75	247	89·75	399	89·26	....	....	....
25	89·48	354	86·87	52	88·78	250	89·77	402	89·07	....	....	....
26	89·38	338	86·78	46	88·83	257	89·78	403	88·96	....	....	....
27	89·29	325	86·88	53	88·73	244	89·69	389	88·77	....	....	....
28	89·18	308	86·93	56	88·75	247	89·79	405	88·59	....	....	....
29	88·98	278	86·98	60	88·68	237	89·84	414	88·54	....	....	....
30	88·83	257	87·03	64	88·58	225	89·99	438	88·53	....	....	....
31	88·78	250	87·38	94	....	....	90·09	454	....	....	87·26	11

NOTE.—Open water conditions from April 16. All marked thus ([1]) interpolated. Ice conditions, November 15 to end of year; information insufficient to compute daily discharge.

MONTHLY DISCHARGE of Roseau River at Dominion City, for the Year 1914.

[Drainage Area, 1,940 square miles.]

Month	Discharge in Second-Feet				Run-Off.	
	Maximum	Minimum.	Mean	Per square mile	Depth in inches on Drainage area.	Total in acre-feet
April			[1]650	0·335	0·374	38,700
May	956	494	700	0·361	0·416	43,000
June	858	562	700	0·361	0·403	41,700
July	562	250	344	0·177	0·204	21,200
August	219	46	89	0·046	0·053	5,450
September	257	108	175	0·090	0·100	10,400
October	454	143	289	0·149	0·172	17,800
November	502		[1]280	0·144	0·161	16,700
December	147	11	[1]65	0·034	0·039	4,000
The period	956	11	366	0·212	1·922	198,950

NOTE.—All marked thus [1] estimated. Ice conditions November 15 to end of year.

THE RAT RIVER.

The drainage area of the Rat river, from its source to its mouth, comprises 997 square miles. The northern boundary of this area is formed by the watersheds of the Whitemouth and Seine rivers, while its southern limits consist of the northern slope of the watershed of the Roseau river.

The west branch of the river takes its rise in the country lying to the southeast of the town of Woodridge on the Ontario branch of the Canadian Northern railway, and is confined chiefly to tp. 3, R. 11 E.P.M. The first 10 miles of its course the river has a southwesterly bearing; from this latter point it flows northwest for about 4 miles, then nearly due south for 3 miles, then north for about 6 miles. This latter point lies about 2 miles east of the town of Zhoda; from this point it flows through a swampy and marshy country due west for about 18 miles, and then in a northwesterly direction to its mouth at the Red river.

The territory drained is generally flat prairie country, except in the upper reaches, where the land is inclined to be wet and swampy. Nearly all the drainage area is under cultivation, being amongst the oldest settled land in the province.

RAT RIVER AT OTTERBURNE.

History.—The station was established by S. S. Scovil on May 23, 1912.

Location of Section.—The section is on the downstream side of the bridge which crosses the Rat at F. X. Joubert's farm, 4 miles from Otterburne by the Canadian Pacific railway, and 2 miles to St. Pierre. The initial point is marked by a spike driven in the south end of the downstream railing.

Records available.—A daily gauge-height record for the open-water periods from May 23, 1912, to date, has been kept. During the winter periods an intermittent record is available. Estimates of daily discharge have been prepared, based upon the rating curve constructed from the meter records.

Drainage Area.—The area drained is about 650 square miles. The basin lies between the Roseau on the south and the Seine and Whitemouth on the north and east.

Gauge.—The gauge is a 9-foot vertical staff nailed to a pile 16 feet from the left bank of the section. It is referred to a bench-mark set to arbitrary datum and located on the base of an ash tree 30 feet southwest from the initial point.

Channel.—Above the station it is straight for 200 feet and for 100 feet below. There is one channel at all stages. The bottom is of clay, and liable to shift.

Discharge Measurements.—They are made from the downstream side of the bridge. A range in stage of 8·4 feet has been defined on the rating curve. Under winter conditions it has not been possible to obtain a rating.

Diversions.—The Canadian Pacific railway have constructed a dam above the station and use the pond created as a source of supply. Under low-water conditions it is reported they take the whole flow of the river.

Accuracy.—From gauge height 88·30 to 92·40 the discharge curve is well defined; from 92·40 to 96·70 it is fairly well defined. Not possible to define a discharge curve for winter conditions.

DISCHARGE MEASUREMENTS of Rat River at Otterburne, 1912–14.

Date.	Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet	Sq. ft.	Ft. per sec	Feet	Sec.-ft.
May 23	S.S. Scovil	1187	20	172	1·24	91·95	213
June 18	G. H. Burnham	1187	44	86	0·99	90·13	85
July 10	G. H. Burnham	1187	34	48	0·74	89·02	35
Aug. 8	W. G. Worden	1187	47	122	1·11	91·02	135
" 24	W. G. Worden	1187	38	65	0·96	89·67	63
Oct 20	G. J. Lamb	1187	73	436	1·31	96·06	572
" 26	H. M. Nelson	1374	63	354	1·36	95·15	482
Nov 2	G. J. Lamb.	1187	61	303	1·09	94·27	330
1913.							
Jan 10	G. J. Lamb	1374	37	37	0·40	89·80	15[1]
April 11	G. H. Burnham	1496	82	704	1·63		1,146
" 24	A. Pirie	1186	74	456	1·35	96·70	616
May 1	E. Bankson	1462	61	326	1·30	94·75	424
" 15	E. Bankson	1462	49	154	1·09	91·42	168
June 27	G. Ebner	1186	36	53	0·70	89·06	37
Aug. 1	A. Pirie	1496	35	49	0·39	88·82	19
" 22	C. O. Allen	1435	36	63	0·63	89·26	38
Sept 17	C. O. Allen	1435	35	54	0·52	89·03	28
1914.							
Jan. 7	E. J. Budge	1462	16	12	0·12	88·98	1·4[2]
Mar. 3	W. J. Ireland.	1469	31	11	0·11	89·82	1·1[2]
" 20	T. J. Moore	1374	43	12	0·16	90·93	3·2[2]
April 16	C. O. Allen	1496	50	132	0·82	92·16	109
" 29	A. Pirie	1187	53	207	1·18	92·40	244
May 29	A. Pirie	1939	43	106	0·91	90·31	96
June 18	C. O. Allen	1760	49	144	1·12	91·10	161
July 29	M. S. Madden	1760	35	55	0·48	88·80	27
Aug 13	J. A. Page	1920	31	28	0·10	88·30	2·8
Sept. 16	H. Boyd	1919	33	38	0·32	88·73	12
Oct 15	M. S. Madden	1911	38	61	0·54	89·27	33
Nov 6	M. S. Madden.	1912	35	58	0·73	89·02	27
Dec 2	C. O. Allen	1912	36	35	0·30	89·34	11[2]

[1] Ice (1·4 feet thick).
[2] Measurements taken under ice conditions.

Daily Gauge Height and Discharge of Rat River at Otterburne, for 1912.

[Drainage area, 650 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1											93·34	311
2											93·19	299
3											93·03	287
4											92·91	277
5											92·82	270
6											92·74	263
7											92·65	256
8											92·48	242
9											92·18	219
10											91·85	196
11											91·52	172
12											91·17	148
13											90·99	135
14											90·81	125
15											90·57	110
16											90·45	103
17											90·28	93
18											90·15	85
19											90·00	77
20											89·87	71
21											89·75	65
22											89·65	60
23									91·95	203	89·52	53
24									91·87	197	89·38	46
25									91·75	189	89·29	42
26									91·61	179	89·17	36
27									91·65	182	89·10	32
28									91·86	196	89·00	28
29									92·85	272	88·95	26
30									93·33	310	88·90	24
31									93·45	320		

	July.		August.		September.		October.		November.		December.	
1	88·85	22	90·94	132	90·17	86			94·35	400	91·24	
2	88·80	20	91·00	136	90·50	106			94·28	393	90·57	
3	88·79	20	91·05	140	90·78	123			94·55	418	90·56	
4	88·75	18	91·08	142	90·95	133			94·47	410	90·48	
5	88·75	18	91·14	146	91·15	147			94·39	403	90·37	
6	88·75	18	91·24	153	91·27	155			94·32	397	90·24	
7	88·79	20	91·33	159	91·34	160			94·24	390	90·12	
8	88·75	18	91·03	138	91·50	171			93·95	364	90·03	
9	89·05	30	90·57	110	91·57	176			94·08	375		
10	89·00	28	90·49	100	91·70	185			94·23	389		
11	89·09	32	90·33	96	91·70	185			94·09	376		
12	89·55	55	90·24	90	91·68	184			93·92	361		
13	90·05	80	90·20	88	91·64	181			93·75	346		
14	90·26	92	90·09	82	91·68	184			93·59	331		
15	90·45	103	89·97	76	91·70	185			93·45	320	89·85	
16	90·55	109	89·85	70	91·73	187			93·31	309		
17	90·63	114	89·78	66	91·57	176			93·17	298		
18	90·68	117	89·77	66	91·55	175			93·02	286		
19	90·65	115	89·76	65	91·60	178			92·94	279		
20	90·58	111	89·68	61	91·89	198	96·06	566	92·86	273		
21	90·40	100	89·64	59	92·14	216			92·79	267		
22	90·25	91	89·67	61	92·85	272			92·70	260	90·00	
23	90·35	97	89·70	62	93·10	316			92·64	255		
24	90·43	102	89·73	64	93·73	344			92·57	250		
25	90·52	107	89·70	62	93·85	355			92·38	234		
26	90·60	112	89·70	62	93·99	367	95·15	473	92·22	222		
27	90·68	117	89·68	61	94·15	382	94·96	456	92·09	212		
28	90·65	115	89·65	60	94·40	404	94·78	438	91·98	205		
29	90·76	122	89·74	64		431	94·59	421	91·76	189	90·13	
30	90·93	132	89·84	69		469	94·25	391	91·45	168		
31	90·87	128	90·01	78			94·25	391				

Note.—September 29 to October 26 water above gauge. Ice conditions from November 30 to end of year. Information insufficient to compute daily discharges.

DAILY GAUGE HEIGHT AND DISCHARGE of Rat River at Otterburne, for 1913.

[Drainage area, 650 square miles.]

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.
1			89·81						94·74	435	88·95	75
2									94·37	401	90·01	78
3									93·88	357	90·09	82
4									93·57	330	90·14	84
5									93·33	310	90·17	86
6									93·14	295	90·16	86
7									92·91	277	90·11	83
8									92·77	266	90·11	83
9	89·91		89·79						92·64	255	90·13	84
10	89·80	15							92·41	237	90·22	89
11								1,146	92·10	213	90·39	99
12	89·72								91·93	201	90·57	110
13									91·76	189	90·83	126
14									91·71	186	91·08	142
15									91·44	167	91·14	146
16			89·80						91·35	161	90·74	120
17									91·29	156	90·17	86
18									91·18	149	89·89	72
19	89·69								91·10	143	89·68	64
20									90·98	135	89·51	53
21									90·87	128	89·43	49
22									90·73	120	89·32	43
23			90·01				97·20	682	90·59	111	89·25	40
24							96·76	636	90·45	103	89·18	36
25							96·39	599	90·51	107	89·24	39
26	89·77						96·25	585	90·45	103	89·17	36
27							96·24	584	90·42	101	89·04	30
28							95·76	536	90·30	94	89·13	35
29							95·00	460	90·18	87	89·16	35
30							94·79	439	90·05	80	89·15	35
31									90·00	77		......

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	89·14	34	88·84	22	88·91	24	88·88	23	89·57			......
2	89·37	46	88·77	19	88·84	22	88·85	22	89·53			......
3	89·54	54	88·72	17	88·84	22	88·83	21	89·51			......
4	89·94	74	88·69	16	88·81	20	88·83	21	89·50			......
5	90·08	81	88·67	15	88·77	19	88·89	24	89·48			......
6	90·17	86	88·63	13	88·74	18	88·84	22	89·46			......
7	90·12	83	88·60	12	88·70	16	88·84	22	89·44			......
8	89·98	76	88·57	11	88·67	15	88·90	24	89·43			......
9	89·91	73	88·56	14	88·64	14	88·97	27	89·24			......
10	89·73	64	88·57	11	88·69	15	89·04	30	89·13			......
11	89·79	66	88·57	11	88·69	15	89·27	41	89·01			......
12	89·83	69	88·60	12	88·69	15	89·39	47	89·24			......
13	90·11	83	88·63	13	88·76	18	89·44	49	89·34			......
14	90·29	93	88·66	14	88·75	18	89·61	58	89·32			......
15	90·34	96	88·79	19		22	89·77	66	89·30			......
16	90·39	99	88·87	23		26	89·98	76	89·28			......
17	90·97	134	88·96	26	89·03	29	90·02	78	89·27			......
18	91·03	138	89·04	30	88·97	27	90·00	77	89·26			......
19	91·04	139	89·08	31	88·89	24	89·93	74	89·24			......
20	91·04	139	89·10	32	88·84	22	89·78	66	89·23			......
21	90·76	122	89·16	35	88·86	22	89·74	64	89·21			......
22	90·19	87	89·24	39	88·88	23	89·54	54	89·19			......
23	90·98	135	89·22	38	88·89	24	89·48	51	89·18			......
24	90·74	120	89·20	37	88·79	20	89·54	54	89·17			......
25	90·55	109	89·18	36	88·82	21	89·49	52	89·28			......
26	89·34	44	89·18	36	88·82	21	89·46	50	89·33			......
27	89·24	39	89·17	36	88·83	21	89·38	46	89·33			......
28	89·11	33	89·16	35	88·83	21	89·37	46	89·34			......
29	89·08	31	89·14	34	88·84	22	[1]89·34	44	89·36			......
30	89·00	28	89·05	30	88·84	22	[1]89·32	43	89·37			......
31	88·91	24	88·98	27			[1]89·30	42				......

NOTES.—Ice conditions from January 1 to April 22; and from October 28 to end of year; information insufficient to compute daily discharges. Gauge heights marked thus [1] interpolated.

DAILY GAUGE HEIGHT AND DISCHARGE of Rat River at Otterburne, for 1914.

[Drainage Area, 650 square miles.]

Day.	January. Gauge Height	January. Discharge	February. Gauge Height	February. Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June. Gauge Height	June. Discharge
	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft
1							91·96		92·09	212	90·48	105
2							92·24		91·73	187	90·64	114
3					89·82	1	93·04		91·47	162	90·47	100
4							93·04		91·22	151	90·40	104
5							92·69		91·09	142	90·28	93
6							92·54		91·02	137	90·16	86
7	88·98	1					92·52		91·02	137	90·05	80
8							92·42		91·02	137	89·96	75
9							92·42		91·10	143	89·85	70
10							92·41		91·18	145	89·85	70
11							92·39		91·29	156	89·95	75
12							92·37		91·37	162	90·30	94
13							92·33		91·38	163	90·55	115
14							92·24		91·31	158	90·77	122
15					91·11		92·11		91·08	142	90·88	129
16							92·23		90·78	123	90·97	134
17							92·40		90·53	108		138
18							92·57		90·47	104	91·09	142
19							92·47		90·21	89	91·08	142
20					90·93	32	92·97		90·17	86	90·99	135
21							93·57		90·08	81	90·80	124
22					90·99		93·56		90·09	82	90·45	103
23							92·97	282	90·11	83	90·16	85
24					91·11		92·92	278	90·16	86	89·78	65
25							92·82	270	90·21	89	89·56	55
26							92·76	265	90·19	87	89·25	40
27							92·69	259	90·10	82	89·30	42
28							92·59	251	90·07	81	89·20	37
29					91·12		92·41	237	90·55	109	89·18	36
30							92·26	225	90·48	105	89·15	35
31									90·48	105		

Day.	July. Gauge Height	July. Discharge	August. Gauge Height	August. Discharge	September. Gauge Height	September. Discharge	October. Gauge Height	October. Discharge	November Gauge Height	November Discharge	December. Gauge Height	December. Discharge
1	89·15	35	88·65	14	88·91	24	88·78	19	89·08	34		
2	89·19	37	88·58	11	88·83	21	88·76	18	89·08	31	89·34	11
3	89·34	44	88·50	9	88·78	19	88·75	18	89·06	30		
4	89·38	46	88·45	8	88·76	18	88·73	17	89·04	30		
5	89·30	42	88·43	7	88·66	14	88·68	15	89·03	29		
6	89·25	40	88·39	6	88·62	13	88·66	14	89·02	29		
7	89·15	35	88·35	5	88·62	13	88·64	11	89·03	29		
8	89·09	32	88·18	2	88·62	13	88·63	13	89·04	30		
9	88·97	27	88·20	2	88·63	13	88·61	11	89·09	32		
10	88·89	24	88·22	2	88·66	14	88·69	16	89·05	30		
11	88·85	22	88·22	2	88·68	15	88·75	18	89·03	29		
12	88·87	23	88·22	2	88·65	14	88·92	25	89·00	28		
13	88·87	23	88·30	4	88·63	13	88·98	27				
14	88·95	26	88·31	4	88·64	14		34				
15	89·20	37	88·31	4	88·70	16	89·27	41	89·04			
16	89·60	57	88·31	4	88·78	19	89·59	57				
17	89·88	71	88·28	4	88·73	17	89·59	57				
18	90·21	89	88·43	7	88·77	19	89·52	53				
19	90·29	93	88·43	7	88·76	18	89·43	49				
20	90·25	91	88·43	7	88·76	18	89·39	47				
21	90·11	83	88·44	7	88·78	19	89·29	42				
22	89·96	75	88·45	8	88·82	21	89·26	40	89·03			
23	89·75	65	88·45	8	88·84	22	89·23	39				
24	89·47	51	88·44	7	88·80	20	89·21	38				
25	89·24	39	88·54	10	88·78	19	89·16	35				
26	89·15	35	88·54	10	88·78	19	89·14	34				
27	89·06	30	88·54	10	88·93	25	89·11	33				
28	89·03	29	88·58	11	88·92	25	89·12	33				
29	88·81	20	88·63	13	88·88	23	89·13	33	89·24			
30	88·73	17	88·67	15	88·85	22	89·11	33				
31	88·69	16	88·87	23			89·09	32				

NOTE.—Ice conditions from January 1 to April 23; and from November 12 to end of year; information insufficient to compute daily discharges.

Monthly Discharge of Rat River at Otterburne, for the years 1912-14.

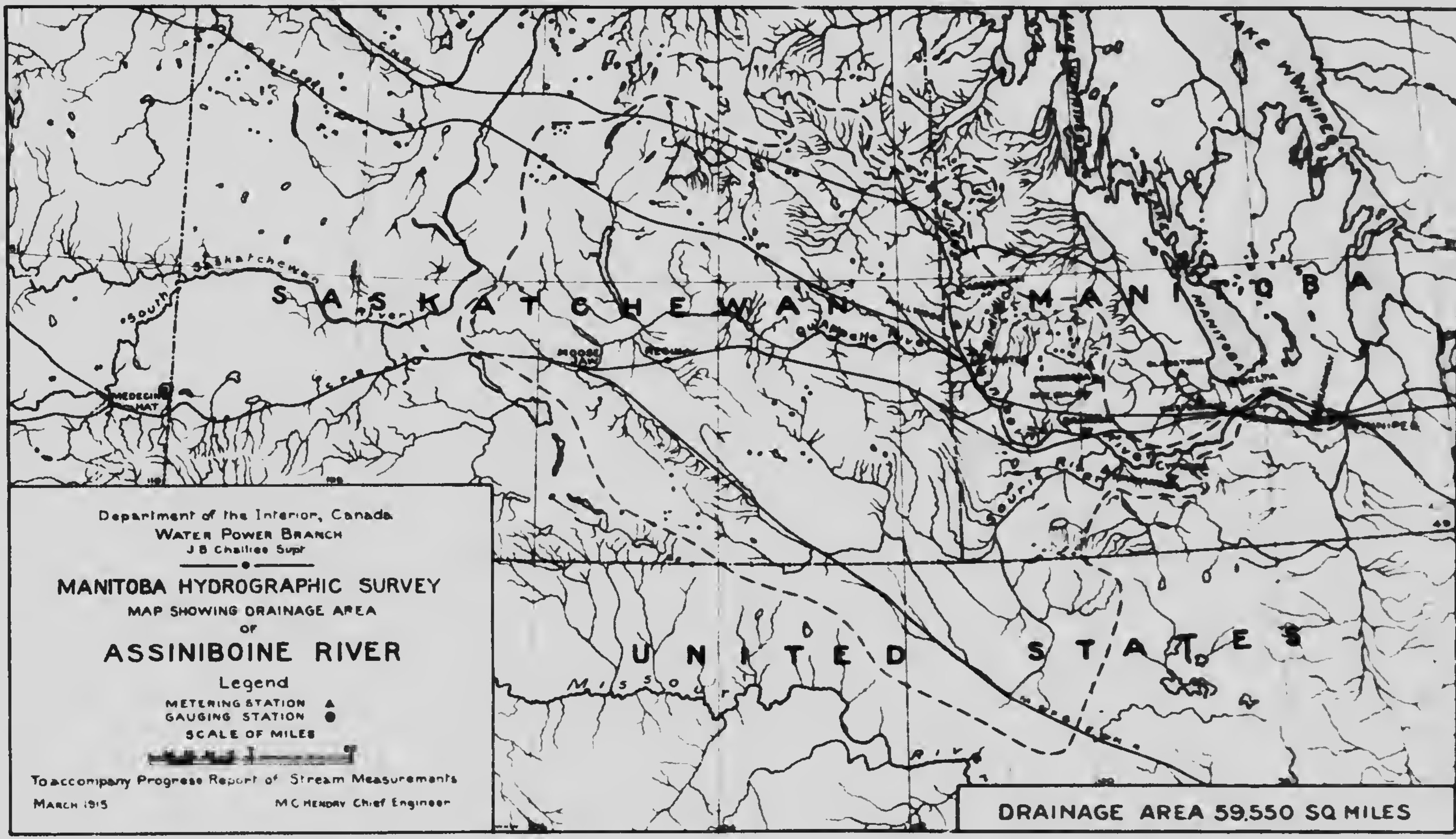
(Drainage Area, 650 square miles.)

Month.	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage area	Total in acre-feet.
1912						
May			230[1]	0·354	0·408	14,100
June	311	24	138	0·212	0·236	8,200
July	132	18	76	0·117	0·135	4,675
August	159	59	91	0·140	0·161	5,600
September	460	86	227	0·349	0·389	13,500
October			480[1]	0·738	0·851	29,500
November	418	168	313	0·482	0·538	18,600
December			30[1]	0·046	0·053	1,840
The period	460	18	198	0·305	2·771	96,015
1913						
January			15[1]	0·023	0·027	922
February			10[1]	0·015	0·016	555
March			10[1]	0·015	0·018	615
April			600[1]	0·921	1·030	35,700
May	435	77	193	0·297	0·342	11,900
June	146	30	74	0·114	0·127	4,400
July	139	24	81	0·125	0·144	4,980
August	39	11	24	0·037	0·043	1,480
September	29	14	21	0·032	0·036	1,250
October	78	21	16	0·071	0·082	2,825
November			30[1]	0·046	0·051	1,790
December			20[1]	0·031	0·036	1,230
The year	435	11	94	0·144	1·952	67,647
1914						
January		1	1[1]	0·002	0·002	61
February			1[1]	0·002	0·002	56
March		1	2[1]	0·003	0·004	123
April			75[1]	0·115	0·128	4,475
May	212	81	124	0·191	0·220	7,625
June	142	35	92	0·142	0·158	5,475
July	93	16	44	0·068	0·078	2,700
August	23	2	8	0·012	0·014	492
September	25	13	18	0·028	0·031	1,070
October	57	13	31	0·048	0·055	1,910
November			25[1]	0·038	0·042	1,490
December			5[1]	0·008	0·009	307
The year	212	1	36	0·055	0·743	25,784

Note.—Marked thus (1) estimated. Ice conditions from November 30 to end of year 1912.

Ice conditions, January 1 to April 22, and from October 28 to end of year 1913.

PLATE IV.


Department of the Interior, Canada
Water Power Branch
J B Challies Supt
MANITOBA HYDROGRAPHIC SURVEY
MAP SHOWING DRAINAGE AREA
OF
ASSINIBOINE RIVER
Legend
METERING STATION
GAUGING STATION
SCALE OF MILES
To accompany Progress Report of Stream Measurements
MARCH 1915
M C HENDRY Chief Engineer
DRAINAGE AREA 59,550 SQ MILES
SASKATCHEWAN
MANITOBA
UNITED STATES
LAKE WINNIPEG
South Saskatchewan River
MOOSE JAW
Missouri
Souris River
MEDECINE HAT

ASSINIBOINE RIVER AND TRIBUTARIES.

Assiniboine River.—The Assiniboine river is one of the chief tributaries of the Red river joining the latter within the city limits of Winnipeg. Its source is in the province of Saskatchewan on the southeastern slope of the Nut mountains. It flows in a southeasterly direction and crosses the Manitoba boundary in tp. 26, R. 28 W.P.M.; from that point its course is nearly due south until it reaches tp. 10, R. 25 W.P.M., where it turns and flows south and east to its junction with the Red river.

The principal tributaries of the Assiniboine are the Shell, Qu'Appelle, Little Saskatchewan, and Souris rivers. The total drainage area is 59,550 square miles, of which 8,800 square miles are in the state of North Dakota, 37,700 square miles in the province of Saskatchewan, and 13,050 square miles in the province of Manitoba.

The area drained varies between the open prairie to be found in the southwest part of the province, and the well-timbered country lying on the slopes of the Duck and Riding mountains. In the prairie country the banks are sharp cut, rising abruptly from the water's edge for a height varying between 3 or 4 feet to 25 feet. In the wooded section, or the upper part of the drainage area, the valley is well defined and narrow, the rise from the river in some places reaching an elevation of 250 feet above the water level.

In the lower part of the river basin the land is nearly all under cultivation, the soil is rich, but in the valley bottom it is subject to overflow. It flows through the most densely populated part of the province, the three largest cities, Portage la Prairie, Brandon, and Winnipeg, being built upon its banks.

This river is important as a source of water supply, and as a means of drainage and sewage disposal in a district where the natural water supply is somewhat limited. In order that a study may properly be made of its regimen and data for various purposes be gathered, several gauging stations have been established. All have not been in continuous operation, but discharge records have been obtained at the following places on the river:—1, Millwood; 2, Brandon; 3, Headingly; 4, St. James.

Tributaries.—The tributaries of the Assiniboine river in order from source to mouth are:—1, Shell river; 2, Qu'Appelle river; 3, Birdtail creek; 4, Little Saskatchewan river; 5, Souris river; 6, Cypress river.

On all of these, with the exception of the Qu'Appelle river, records of discharge are available.

Assiniboine River at Millwood.

History.—The station on the Assiniboine at Millwood was established by W. G. Worden on October 11, 1912, and has been in operation since that time.

Location of Section.—The meter section is located on the downstream side of the traffic bridge, 400 feet below the dam, one-quarter of a mile south from the town, and one-eighth of a mile below the Canadian Pacific Railway bridge. The initial point is an arrow cut and painted on the top of the wooden hand-rail of the bridge at the northeast corner on the downstream side. It is marked "0+00 I.P."

Records available.—Daily gauge height records are available for the station from October 11, 1912, to the end of 1914, except for the period February 9 to March 28, 1914. Estimates of daily discharge are available from January 27, 1913, to the end of 1914, except for the above period.

Drainage Area.—The area tributary to the Assiniboine river above the station is 7,590 square miles.

Manigotagan River, Meter Section. Outlet Moose Lake.

Gauge.—A 6-foot vertical staff enamelled gauge is fastened to a plank which is spiked to the middle crib of the bridge on the downstream side. It is referred to three bench-marks set at arbitrary datum, one of which is the head of a nail driven in the telephone post at the northwest corner of the bridge.

Channel.—For 400 feet above the section, and 200 feet below, the channel is straight. The river occupies one channel at all stages, which is divided just above the section by a central pier of the bridge. The bed of the stream is clay, sand, and gravel, and not subject to shifting. The banks are low and liable to overflow at high stages.

Discharge Measurements.—The discharge measurements are taken from the downstream side of the bridge, and cover a range in stage under open-water conditions of 8·3 feet.

Accuracy.—Under open-water conditions the discharge curve is well defined between the limits 98·91 and 107·4, beyond which it is not well defined. The discharge curve for ice conditions is fairly well defined between gauge heights 97·5 and 99·5.

Discharge Measurements of Assiniboine River at Millwood, 1912-14.

Date.	Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec	Feet	Sec.-ft.
Oct 11	W. G. Worden	1497	145	881	1·85	102·29	1,628
1913.							
Jan. 27	G. J. Lamb	1374	145	254	0·68	100·49	174[1]
April 19	E. Bankson	1469	157·5	1,484	3·08	106·45	4,571
May 9	E. Bankson	1469	192	1,705	3·08	107·42	5,253
July 3	A. Pirie	1496	145	740	1·82	101·65	1,346
Aug. 6	W. J. Ireland	1469	169	1,470	2·58	105·65	3,789
Sept 13	W. J. Ireland	1469	144	700	1·72	101·30	1,201
Oct 19	C. O. Allen	1435	144·5	537	1·18	100·30	630
Nov 20	C. O. Allen	1375	145	440	0·94	99·95	414[1]
1914							
Jan 15	E. J. Budge	1462	163	178	0·69	100·23	123[2]
Mar 17	C. O. Allen	1496	90	192	0·76	100·47	147[3]
April 28	M. S. Madden	1462	159	1,278	2·59	104·95	3,320
May 13	C. O. Allen	1497	150	1,367	3·05	105·61	4,171
June 10	C. O. Allen	1760	142	792	1·92	101·92	1,517
July 15	C. O. Allen	1760	142	545	0·72	99·62	390
Aug 10	M. S. Madden	1760	156	317	0·46	99·01	145
" 31	A. Pirie	1949	141	344	0·39	98·98	133
Sept 25	M. S. Madden	1911	156	345	0·34	98·91	116
Oct 25	M. S. Madden	1912	158	349	0·45	99·09	158
Nov 19	M. S. Madden	1912	149	360	0·37	99·42	134
Dec 6	T. J. Moore	1920	156	313	0·34	99·32	106[4]
" 30	C. O. Allen	1912	132	163	0·20	99·58	33[5]

[1] Measurement taken under ice conditions
[2] Ice, mean thickness 1·54 foot
[3] " " " 1·71 "
[4] " " " 0·55 "
[5] " " " 1·8 "

Daily Gauge Height and Discharge of Assiniboine River at Millwood, for 1913.

[Drainage area, 7,590 square miles.]

Day.	January. Gauge Height.	January. Discharge	February. Gauge Height.	February. Discharge	March. Gauge Height.	March. Discharge	April. Gauge Height	April. Discharge	May. Gauge Height	May. Discharge	June. Gauge Height	June. Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec. ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			100·41	64	[1]100·70	64	[1]101·05	151	108·30	6,080	104·80	3,270
2			100·40	64	100·80	70	[1]101·10	161	108·25	6,035	104·70	3,200
3			[1]100·38	64	[1]100·80	73	[1]101·20	172	107·80	5,630	104·50	3,060
4			[1]100·33	61	[1]100·80	76	[1]101·30	183	108·20	5,990	104·40	2,990
5			[1]100·32	58	[1]100·80	83	[1]101·40	207	107·70	5,545	104·40	2,990
6			[1]100·29	58	[1]100·80	83	[1]101·50	405	107·50	5,375	104·20	2,885
7			[1]100·26	56	[1]100·80	83	[1]101·70	490	107·20	5,120	104·00	2,725
8			[1]100·25	53	[1]100·80	83	[1]101·90	670	106·80	4,785	103·70	2,530
9			100·20	51	100·81	90	[1]102·10	1,020	107·40	5,290	103·40	2,340
10			[1]100·23	48	[1]100·82	90	[1]102·70	1,510	107·20	5,120	103·20	2,220
11			100·26	51	[1]100·84	94	[1]103·80	2,280	107·10	5,035	103·00	2,100
12			[1]100·29	51	[1]100·85	94	[1]105·40	3,550	107·00	4,950	102·70	1,925
13			[1]100·32	53	[1]100·87	94	107·50	5,275	106·80	4,785	102·70	1,925
14			[1]100·35	53	[1]100·89	97	106·83	4,809	106·60	4,620	102·50	1,800
15			[1]100·38	56	100·90	97	106·50	4,545	106·50	4,545	102·20	1,620
16			100·40	58	[1]100·87	97	106·50	4,545	106·40	4,465	102·10	1,565
17			[1]100·39	58	[1]100·87	101	106·58	4,609	106·20	4,305	102·00	1,510
18			[1]100·37	58	[1]100·85	101	106·42	4,481	106·00	4,145	101·90	1,455
19			[1]100·35	53	[1]100·84	101	106·50	4,545	105·90	4,070	101·70	1,345
20			[1]100·34	51	[1]100·83	101	106·83	4,809	105·80	3,995	101·60	1,290
21			[1]100·33	51	[1]100·82	105	107·83	5,657	105·70	3,920	101·50	1,235
22			[1]100·32	51	[1]100·81	109	[1]112·10	9,800	105·60	3,845	101·40	1,180
23			100·30	48	100·80	113	[1]114·10	11,800	105·50	3,770	101·30	1,125
24			[1]100·35	48	[1]100·81	113	[1]115·00	12,700	105·40	3,695	101·30	1,125
25			[1]100·40	48	[1]100·84	118	[1]114·40	12,100	105·40	3,695	101·20	1,070
26			[1]100·50	55	[1]100·87	118	[1]113·20	10,900	105·30	3,620	101·10	1,020
27	100·48	70	[1]100·55	56	[1]100·90	122	[1]112·30	10,000	105·20	3,550	101·00	970
28	[1]100·47	70	[1]100·60	58	[1]100·94	127	[1]111·60	9,300	105·20	3,550	101·00	970
29	[1]100·45	67			[1]100·97	127	[1]109·50	7,205	105·10	3,480	101·10	1,020
30	100·43	67			101·00	131	[1]108·60	6,350	105·00	3,410	101·30	1,125
31	100·42	64			[1]100·03	141			104·90	3,340		

Day.	July. Gauge Height	July. Discharge	August. Gauge Height	August. Discharge	September. Gauge Height	September. Discharge	October. Gauge Height	October. Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	101·40	1,180	105·60	3,845	102·17	1,607	100·34	643	100·29	620	[1]100·06	429
2	101·50	1,235	105·65	3,883	102·07	1,552	100·31	630	[1]100·26	607	[1]100·04	421
3	101·68	1,334	105·70	3,920	102·00	1,510	100·29	620	[1]100·23	591	[1]100·02	413
4	102·40	1,740	105·70	3,920	101·96	1,488	100·26	607	[1]100·20	580	[1]100·00	365
5	103·00	2,100	105·73	3,943	101·93	1,472	100·23	594	[1]100·17	567	[1]99·98	357
6	103·80	2,505	105·70	3,920	101·87	1,439	100·20	580	[1]100·14	553	[1]99·96	349
7	104·30	2,920	105·60	3,845	101·79	1,395	100·19	576	[1]100·11	540	[1]99·94	304
8	104·55	3,095	105·50	3,770	101·73	1,362	100·18	571	[1]100·08	526	[1]99·92	297
9	104·68	3,186	105·20	3,550	101·66	1,323	100·18	571	100·06	517	99·92	297
10	104·80	3,270	104·70	3,200	101·55	2,263	100·23	594	[1]100·06	517	[1]99·92	297
11	105·00	3,410	104·00	2,725	101·46	1,213	100·26	607	[1]100·05	468	[1]99·91	258
12	105·57	3,823	103·40	2,340	101·36	1,158	100·29	620	[1]100·05	468	[1]99·91	258
13	105·65	3,883	103·05	2,130	101·26	1,103	100·29	620	[1]100·04	463	[1]99·91	258
14	105·80	3,995	102·70	1,925	101·18	1,060	100·29	620	[1]100·03	459	[1]99·90	220
15	105·83	4,017	102·40	1,740	101·10	1,020	100·30	625	[1]100·02	454	99·90	151
16	105·88	4,055	102·40	1,740	101·01	975	100·30	625	[1]100·01	450	[1]99·90	151
17	105·92	4,085	102·48	1,784	100·91	925	100·23	634	100·00	445	[1]99·90	151
18	105·90	4,070	102·55	1,830	100·85	895	100·32	634	[1]100·02	454	[1]99·90	141
19	105·85	4,032	102·62	1,872	100·80	870	100·30	625	[1]100·01	463	[1]99·90	141
20	105·88	4,055	102·69	1,914	100·73	835	100·28	616	[1]100·09	486	[1]99·90	131
21	105·90	4,070	102·77	1,962	100·68	810	100·29	620	100·11	495	[1]99·90	131
22	105·95	4,108	102·84	2,004	100·61	775	100·14	553	[1]100·14	508	99·90	122
23	105·93	4,093	102·91	2,046	100·56	750	100·70	820	[1]100·17	522	[1]99·90	122
24	105·85	4,032	102·99	2,094	100·54	740	100·12	541	100·19	531	[1]99·90	113
25	105·80	3,995	102·92	2,052	100·50	720	100·25	603	[1]100·17	522	[1]99·90	113
26	105·75	3,958	102·79	1,979	100·49	715	100·29	620	[1]100·15	513	[1]99·90	105
27	105·70	3,920	102·77	1,967	100·46	700	100·20	580	[1]100·13	504	[1]99·99	105
28	105·60	3,845	102·67	1,902	100·42	680	99·96	482	[1]100·11	472	[1]99·99	105
29	105·60	3,845	102·51	1,808	100·40	670	99·77	393	[1]100·09	411	[1]99·90	90
30	105·60	3,845	102·39	1,734	100·37	657	100·18	571	[1]100·07	445	99·92	97
31	105·60	3,815	102·26	1,656			100·05	513			[1]99·91	96

NOTE.—All marked thus [1] interpolated. From January 27 to April 12, and from November 1 to December 31 under ice cover. From April 6 to 12, and from November 1 to December 14, open-water rating table used.

Daily Gauge Height and Discharge of Assiniboine River at Millwood, for 1914.

[Drainage area, 7,599 square miles.]

Day.	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	[1]99·96	94	[1]100·35	118			101·02	133	105·12	3,494	103·14	2,184
2	[1]99·98	96	[1]100·36	118			100·94	125	105·10	3,480	103·02	2,112
3	[1]100·03	92	[1]100·37	111			100·62	99	105·08	3,466	102·84	2,004
4	[1]100·06	94	[1]100·38	111			100·74	108	105·02	3,424	102·54	1,824
5	100·09	89	[1]100·39	112			100·84	117	105·09	3,473	102·41	1,746
6	[1]100·13	92	[1]100·40	105			100·67	103	105·22	3,564	102·29	1,674
7	[1]100·16	94	[1]100·41	106			100·50	90	104·99	3,403	102·28	1,668
8	[1]100·20	97	100·42	103			100·50	90	105·02	3,424	102·12	1,577
9	[1]100·25	101					100·71	106	105·04	3,438	102·07	1,552
10	[1]100·30	105					100·87	119	105·82	4,010	101·91	1,461
11	[1]100·34	108					100·99	131	105·33	3,643	101·82	1,411
12	100·38	111					101·32	163	105·42	3,710	101·74	1,367
13	[1]100·32	107					101·22	153	105·60	3,845	101·69	1,290
14	[1]100·27	103					101·42	174	106·22	4,321	101·51	1,241
15	100·23	107					102·85	1,740	106·07	4,201	101·42	1,191
16	[1]100·23	107					103·51	2,100	106·27	4,361	101·20	1,070
17	[1]100·22	107			100·47	88	103·62	3,069	106·45	4,505	101·12	1,030
18	[1]100·21	106					104·72	3,210	105·87	4,048	100·93	935
19	100·20	105					104·52	3,074	105·70	3,920	100·87	905
20	[1]100·20	105					104·53	3,081	106·63	4,644	100·74	840
21	[1]100·20	97					105·02	3,424	106·50	4,545	100·62	780
22	[1]100·21	98					104·83	3,291	106·18	4,289	100·54	740
23	[1]100·21	98					104·74	3,228	105·82	4,010	100·47	705
24	[1]100·22	99					105·54	3,800	105·53	3,793	100·43	685
25	[1]100·22	99					104·99	3,403	105·12	3,494	100·38	661
26	[1]100·22	99					105·01	3,417	104·91	3,347	100·30	625
27	100·23	99					104·92	3,354	104·53	3,081	100·23	594
28	[1]100·25	101					104·93	3,361	104·19	2,849	100·18	571
29	[1]100·27	103			100·62	99	105·02	3,424	103·92	2,673	100·17	567
30	[1]100·29	104			[1]100·75	109	105·04	3,438	103·64	2,491	100·12	544
31	[1]100·32	107			[1]100·90	122			103·42	2,352		....

Day.	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	100·09	531	99·18	184	98·96	120	98·94	115	99·08	154	99·24	117
2	100·08	526	99·15	175	98·95	118	98·94	115	99·08	154	99·23	116
3	100·11	540	99·13	169	98·92	110	98·93	113	99·05	145	99·28	107
4	100·06	517	99·12	166	98·91	108	98·93	113	99·07	151	99·30	109
5	100·02	499	99·09	157	98·90	105	98·93	113	99·05	145	99·32	107
6	100·00	490	99·06	148	98·90	105	98·95	118	99·07	151	99·32	115
7	99·97	487	99·03	139	98·91	108	98·99	128	99·09	157	99·31	110
8	99·88	437	99·01	133	98·93	113	99·00	130	99·09	157	99·31	110
9	99·82	413	98·99	128	98·96	129	99·03	139	99·09	157	99·26	102
10	99·76	389	99·01	133	99·00	130	99·06	148	99·08	154	99·30	97
11	99·72	373	98·99	128	99·01	133	99·07	151	99·00	130	99·30	97
12	99·72	373	98·97	123	99·02	136	99·08	151	98·86	80	99·30	97
13	99·72	373	98·96	120	99·02	136	99·09	157	98·90	105	99·27	88
14	99·71	369	98·94	115	99·01	133	99·10	160	99·00	130	99·28	85
15	99·70	365	98·93	113	98·99	128	99·10	160	99·01	111	99·31	80
16	99·60	325	98·93	113	98·99	128	99·10	160	99·07	119	99·40	80
17	99·60	325	98·93	113	98·97	123	99·10	160	99·20	131	99·34	82
18	99·61	329	98·92	110	98·97	123	99·10	160	99·30	131	99·31	80
19	99·62	333	98·92	110	98·97	123	99·10	160	99·41	134	99·25	76
20	99·63	337	98·90	105	98·98	125	99·10	160	99·44	131	99·24	66
21	99·64	341	98·89	103	98·98	125	99·09	157	99·40	131	99·21	71
22	99·61	341	98·88	100	98·96	120	99·09	157	99·33	125	99·35	58
23	99·57	315	98·88	100	98·91	115	99·08	154	99·31	123	99·30	46
24	99·47	273	98·89	103	98·93	113	99·08	154	99·30	122	99·28	36
25	99·42	252	98·90	105	98·91	108	99·08	154	99·27	119	99·50	28
26	99·41	250	98·91	108	98·91	108	99·07	151	99·23	116	99·70	21
27	99·37	245	98·92	110	98·90	105	99·06	148	99·25	116	99·46	21
28	99·33	231	98·93	113	98·90	105	99·06	148	99·21	117	99·50	21
29	99·29	217	98·96	120	98·90	105	99·00	130	99·25	118	99·52	20
30	99·26	208	98·97	123	98·91	108	99·06	148	99·25	118	99·56	26
31	99·22	196	98·98	125			99·08	154			99·60	22

NOTE.—Ice conditions from January 1 to April 18. Open-water rating table used from April 13 to 18. All marked thus (1) interpolated. From November 15 to December 31, inclusive, under ice cover.

MONTHLY DISCHARGE of Assiniboine River at Millwood, for the years 1913-14.

[Drainage area, 7,590 square miles.]

Month.	Discharge in Second-Feet				Run-Off	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage area	Total in acre-feet.
1913						
January			[1]70	0·009	0·010	4,300
February	64	48	55	0·007	0·007	3,050
March	141	64	100	0·013	0·015	6,150
April	[1]12,700	[1]151	[1]4,810	0·634	0·707	286,200
May	6,080	3,340	4,508	0·594	0·685	277,200
June	3,270	970	1,852	0·244	0·272	110,200
July	4,108	1,180	3,408	0·449	0·518	209,500
August	3,943	1,656	2,548	0·336	0·387	156,700
September	1,607	657	1,056	0·139	0·155	62,800
October	820	393	597	0·079	0·091	36,700
November	[1]620	[1]433	[1]506	0·067	0·075	30,100
December	[1]429	[1]90	[1]212	0·028	0·032	13,000
The year	12,700	48	1,640	0·216	2·954	1,195,900
1914						
January	[1]111	[1]89	[1]101	0·013	0·015	6,200
February			[1]96	0·013	0·014	5,350
March			[1]91	0·012	0·014	5,600
April	3,800	[1]90	[1]1,740	0·229	0·256	103,500
May	4,649	2,352	3,655	0·481	0·554	224,700
June	2,184	544	1,185	0·156	0·171	70,500
July	540	196	362	0·048	0·055	22,300
August	184	103	126	0·017	0·020	7,750
September	[illegible]	105	118	0·016	0·018	7,000
October	160	113	144	0·019	0·022	8,850
November	157	80	131	0·017	0·019	7,[illegible]
December	117	20	74	0·010	0·012	4,600
The year	4,649	20	669	0·086	1·173	474,150

NOTE.—[1]Estimated.

ASSINIBOINE RIVER AT BRANDON.

History.—The station on the Assiniboine at Brandon was established on July 4, 1912, by G. H. Burnham, and has been operated since that date.

Location of Section.—The meter section is located on the downstream side of First Street traffic bridge, locally known as the Iron bridge, in the city of Brandon, Man. The initial point is marked on the iron railing on the downstream side of the bridge at the south end.

Records available.—Nearly continuous records of daily gauge heights are available from July 4, 1912, to the end of 1914. Estimates of daily discharge have been made for the same period.

Drainage Area.—The drainage area of the Assiniboine river above Brandon is 34,000 square miles.

Gauge.—A 9-foot vertical staff gauge is nailed to the ice-breaker, 50 feet upstream from [illegible] pposite station 1+60 on the metering section.

Channel.—[illegible]0 feet upstream and 150 feet downstream the channel is straight. It is divided at the section into three parts by the bridge piers. The bottom is of mud and liable to shift, especially at high stages. The banks are high, but are liable to overflow at high stages.

Discharge Measurements.—The meterings are made from the downstream side of the bridge. They cover a range in stage under open-water conditions of 12·5 feet.

Accuracy.—Between gauge heights 97·5 and 104·1 the discharge curve is well defined; between 104·1 and 110·0 it is fairly well defined; above and below these limits it is not well defined for open-water conditions. Between gauge heights 96·5 and 98·0 the discharge curve for winter conditions is fairly well defined.

DISCHARGE MEASUREMENTS of Assiniboine River at Brandon, 1912-14.

Date.	Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet	Sq. ft	Ft. per sec	Feet.	Sec. ft
1912.							
July 4	G. H. Burnham	1187	232	986	2·74	101·44	2,701
" 6	"	1187	230	889	2·72	101·18	2,419
" 20	"	1187	231	870	2·72	100·96	2,367
" 22	"	1187	230	857	2·62	100·80	2,246
Aug. 10	W. G. Worden.	1187	229	791	2·59	100·64	2,049
" 23	Alex. Pirie	1197	225	738	2·03	99·84	1,498
Oct. 5	W. G. Worden	1497	248	1,505	3·16	103·93	4,745
" 25	G. J. Lamb	1187	231	951	2·74	101·52	2,604
1913.							
Jan. 22	G. J. Lamb	1375	148	239	1·62	99·60	[1]387
Feb. 20	Alex Pirie	1469	167	277	1·37	99·60	[1]380
April 17	E. Bankson	1469	262	2,400	3·77	106·19	7,578
May 6	"	1469	348	3,328	3·87	110·02	12,869
June 28	Alex Pirie	1496	205	827	2·48	100·86	2,048
Aug. 9	W. J. Ireland	1469	243	1,517	2·93	103·34	4,442
Sept. 9	"	1469	214	757	2·44	100·42	1,833
Oct 20	"	1469	183	506	1·74	99·12	880
1914							
Jan. 9	E. J. Budge	1462	180	490	0·50	98·85	[1]246
" 30	W. J. Ireland	1497	170	485	0·40	99·15	[1]192
Mar. 13	C. O. Allen	1496	146	601	0·69	99·95	[1]416
April 21	M. S. Madden	1462	239	1,242	2·91	102·50	3,615
May 7	C. O. Allen	1497	239	1,528	3·16	103·81	4,829
June 3	"	1760	235	1,350	3·07	102·86	4,145
July 10	"	1760	176	476	1·86	98·89	885
Aug. 4	M. S. Madden	1760	203	322	1·38	98·32	446
" 24	Alex Pirie	1940	156	268	1·02	97·61	275
Sept. 18	M. S. Madden	1911	161	222	0·83	97·55	185
Oct. 17	"	1912	196	219	0·87	97·66	190
Nov. 10	"	1912	199	276	0·98	97·81	271
Dec. 10	T. J. Moore	1920	297	346	0·53	98·10	[1]185

[1] Measurements taken under ice conditions.

DAILY GAUGE HEIGHT AND DISCHARGE of Assiniboine River at Brandon, for 1912.

Drainage area, 31,500 square miles.

Day.	July.		August		September		October		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			100·68	2,042	99·86	1,462	104·23	5,298	101·11	2,368	[1]100·96	1,430
2			100·73	2,080	99·91	1,497	104·17	5,232	101·05	2,329	[1]100·96	1,410
3			100·72	2,073	99·95	1,525	104·12	5,177	100·97	2,269	[1]100·96	1,390
4	101·30	2,520	100·64	2,012	99·92	1,504	104·00	5,045	100·90	2,208	[1]100·96	1,380
5	101·20	2,440	100·70	2,058	99·94	1,518	103·91	4,946	100·86	2,178	[1]100·96	1,360
6	101·13	2,384	100·73	2,080	99·97	1,539	103·84	4,869	100·83	2,155	[1]100·97	1,340
7	100·66	2,028	100·65	2,020	100·13	1,651	103·60	4,610	100·80	2,133	[1]100·97	1,320
8	100·74	2,088	100·56	1,953	100·42	1,854	103·17	4,480	100·77	2,110	[1]100·97	1,310
9	100·36	1,812	100·65	2,020	100·60	1,983	103·33	4,340	100·73	2,080	[1]100·97	1,290
10	100·41	1,847	100·63	2,005	100·86	2,178	103·15	4,160	100·70	2,058	[1]100·97	1,270
11	100·48	1,896	100·56	1,953	101·05	2,320	102·98	3,999	100·67	2,035	[1]100·98	1,250
12	100·54	1,938	100·56	1,953	101·37	2,576	102·78	3,809	100·65	2,020	[1]100·98	1,210
13	100·52	1,924	100·56	1,953	101·58	2,751	102	3,645	100·61	1,991	[1]100·98	1,220
14	100·16	1,882	100·41	1,868	102·25	3,330	102·45	3,510	790·57	1,960	[1]100·88	1,210
15	100·57	1,960	100·18	1,686	102·38	3,417	102·32	3,393	100·54	1,938	[1]100·78	1,170
16	100·68	2,012	100·24	1,728	102·43	3,492	102·20	3,285	100·52	1,924	[1]100·68	1,089
17	100·87	2,185	106·67	1,609	102·45	3,510	102·08	3,177	100·05	1,595	[1]100·58	1,020
18	101·05	2,320	99·96	1,542	102·43	3,492	102·00	3,108	100·05	1,595	[1]100·18	976
19	100·78	2,118	99·95	1,525	102·44	3,501	101·92	3,040	100·05	1,595	[1]100·38	928
20	100·78	2,118	99·98	1,546	102·44	3,501	101·83	2,963	100·04	1,588	[1]100·28	880
21	100·85	2,170	99·88	1,476	102·62	3,663	101·75	2,895	100·04	1,588	[1]100·18	830
22	100·79	2,125	99·80	1,423	103·11	1,122	101·63	2,793	99·91	1,197	[1]100·03	765
23	100·69	2,050	99·75	1,391	103·16	4,170	101·57	2,712	99·79	1,116	[1]99·98	736
24	100·60	1,983	99·70	1,358	103·24	4,256	101·53	2,708	99·79	1,116	[1]99·93	706
25	100·55	1,915	99·88	1,476	103·33	1,340	101·52	2,700	101·25	1,735	[1]99·88	676
26	100·36	1,812	99·68	1,345	103·36	4,370	101·45	2,640	101·36	1,690	[1]99·83	647
27	100·55	1,915	99·65	1,325	103·51	4,550	101·38	2,581	100·95	1,500	[1]99·78	617
28	100·46	1,882	99·55	1,261	103·65	4,660	101·33	2,544	[1]100·95	1,480	[1]99·73	588
29	100·67	2,035	99·85	1,455	103·52	4,557	101·27	2,496	[1]100·95	1,470	[1]99·68	558
30	100·66	2,028	99·78	1,281	101·09	5,141	101·22	2,456	[1]100·95	1,450	99·61	532
31	100·64	2,012	99·82	1,506			101·17	2,416			[1]99·55	488

NOTE.—All marked thus ([1]) interpolated. Ice conditions, November 27 to end of year.

DAILY GAUGE HEIGHT AND DISCHARGE of Assiniboine River at Brandon, for 1913.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.	Gauge Height	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			[1]99·50	220	[1]99·62	380			111·47	14,887	104·30	5,378
2			[1]99·52	227	[1]99·62	380			111·47	14,887	104·22	5,287
3			[1]99·54	234	[1]99·63	385			[1]111·11	14,400	104·05	5,100
4			[1]99·56	244	[1]99·63	385			[1]110·75	13,910	103·88	4,913
5			99·58	251	99·63	385			[1]110·39	13,400	103·74	4,759
6			[1]99·58	251					110·02	12,929	103·65	4,660
7			[1]99·58	251					[1]109·85	12,700	103·45	4,460
8			[1]99·58	251					[1]109·68	12,500	103·37	4,380
9			[1]99·56	248					[1]109·51	12,200	103·31	4,320
10			[1]99·56	248					[1]109·34	12,000	103·24	4,250
11			[1]99·56	248			103·53	4,540	[1]109·17	11,800	103·17	4,180
12			[1]99·56	248			104·09	5,114	[1]109·00	11,400	103·03	4,046
13			99·56	248			104·39	5,481	[1]108·83	11,300	102·61	3,654
14			[1]99·57	252			106·26	7,854	[1]108·66	11,100	102·45	3,510
15			[1]99·57	252			106·24	7,826	[1]108·49	10,900	102·37	3,438
16			[1]99·58	255			106·33	7,948	[1]108·32	10,600	102·25	3,330
17			[1]99·58	255			106·17	7,732	[1]108·15	10,400	102·10	3,195
18			[1]99·59	259			106·15	7,705	[1]107·98	10,200	101·98	3,090
19			[1]99·59	259			106·13	7,678	[1]107·81	9,950	101·87	2,997
20			99·60	262			106·13	7,678	107·59	9,649	101·49	2,674
21			[1]99·60	299			106·21	7,786	106·42	8,069	101·44	2,632
22	99·60	387	[1]99·60	299			106·26	7,854	106·26	7,854	101·35	2,560
23			[1]99·60	336			106·31	7,921	106·04	7,556	101·27	2,496
24			[1]99·61	336			106·48	8,150	105·77	7,192	101·19	2,432
25			[1]99·61	349			106·51	8,191	105·58	6,935	101·05	2,320
26			[1]99·61	360			106·64	8,366	105·43	6,745	100·95	2,245
27	99·40		99·61	373			[1]107·60	9,550	105·28	6,557	100·87	2,183
28			[1]99·67	380			[1]108·56	11,000	104·86	6,032	100·86	2,178
29							[1]109·52	12,300	104·66	5,792	100·87	2,185
30							[1]110·48	13,600	104·44	5,538	100·89	2,200
31									104·47	5,573		

Day.	July.		August.		September.		October.	
1	100·85	2,170	103·60	4,610	101·08	2,344	99·27	1,078
2	100·76	2,103	103·55	4,569	100·93	2,245	99·23	1,052
3	100·78	2,117	103·51	4,520	100·87	2,185	99·20	1,032
4	100·92	2,222	103·50	4,510	100·82	2,147	99·15	1,000
5	101·10	2,360	103·50	4,510	100·45	1,875	99·17	1,013
6	101·30	2,520	103·49	4,500	100·67	2,035	99·32	1,110
7	101·36	2,568	103·48	4,490	100·73	2,080	99·25	1,065
8	101·75	2,895	103·45	4,460	100·56	1,953	99·05	946
9	101·95	3,065	103·38	4,390	100·43	1,861	99·05	940
10	101·47	3,528	103·28	4,290	100·36	1,812	99·11	976
11	102·61	3,654	103·20	4,210	100·45	1,875	99·23	1,052
12	103·01	4,027	103·22	4,230	100·41	1,847	99·19	1,026
13	103·15	4,160	103·20	4,210	100·36	1,812	99·17	1,013
14	103·31	4,320	103·15	4,160	100·21	1,707	99·17	1,013
15	103·45	4,460	103·07	4,084	100·07	1,609	99·15	1,009
16	103·66	4,671	102·93	3,951	99·94	1,518	99·13	988
17	103·75	4,770	102·80	3,827	99·89	1,483	[1]99·43	988
18	103·98	5,023	102·73	3,762	99·82	1,435	[1]99·14	991
19	104·10	5,155	102·27	3,348	99·77	1,403	[1]99·15	1,009
20	104·15	5,210	101·54	2,716	99·70	1,357	99·15	1,000
21	104·20	5,265	101·41	2,608	99·64	1,318	99·14	991
22	104·25	5,320	101·46	2,649	99·50	1,227	99·15	1,000
23	104·23	5,298	101·35	2,560	99·41	1,169	99·25	1,065
24	104·18	5,243	101·27	2,496	99·40	1,162	99·30	1,097
25	104·15	5,120	101·43	2,624	99·39	1,156	99·26	1,072
26	104·10	5,155	101·53	2,708	99·39	1,156		
27	104·07	5,122	101·30	2,520	99·38	1,149		
28	103·95	4,990	101·25	2,480	99·38	1,149		
29	103·83	4,858	101·27	2,496	99·38	1,149		
30	103·75	4,770	101·21	2,448	99·35	1,130		
31	103·67	4,682	101·15	2,440				

NOTE.—All marked thus [1] interpolated. Data not sufficient to compute daily discharge from March 6 to April 11. Ice conditions January 1 to April 10 and November 10 to end of year.

Daily Gauge Height and Discharge of Assiniboine River at Brandon, for 1914.

Drainage area, 34,500 square miles.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1									103·46	4,470	103·19	4,200
2									103·40	4,410	102·99	4,008
3									103·32	4,330	102·87	3,894
4									103·31	4,320	102·67	3,708
5									103·50	4,510	102·49	3,546
6									103·68	4,693	102·24	3,321
7							100·27		103·86	4,891	102·19	3,276
8							100·27		104·10	5,155	101·99	3,099
9	98·85	246					100·37		104·31	5,389	101·94	3,056
10							100·37		104·49	5,596	101·77	2,912
11							100·27		104·53	5,642	101·59	2,759
12							100·27		104·55	5,665	101·45	2,640
13					99·95	416	100·27		104·59	5,711	101·29	2,512
14							100·27		104·67	5,803	101·13	2,384
15									104·63	5,757	101·05	2,320
16									104·50	5,607	100·90	2,208
17							101·17	2,416	104·58	5,700	100·82	2,148
18							101·79	2,929	104·60	5,722	100·67	2,035
19							102·05	3,150	104·60	5,722	100·58	1,968
20							102·19	3,276	104·60	5,722	100·47	1,889
21							102·34	3,411	104·62	5,745	100·31	1,777
22							102·56	3,609	104·67	5,803	100·12	1,644
23							103·07	4,084	104·65	5,780	99·98	1,546
24							103·26	4,270	104·67	5,803	99·80	1,423
25							103·36	4,370	104·65	5,780	99·91	1,497
26							103·41	4,420	104·63	5,757	99·85	1,455
27							103·45	4,460	104·49	5,596	99·43	1,182
28							103·49	4,500	104·34	5,423	99·65	1,325
29							103·52	4,530	104·05	5,100	99·65	1,325
30	99·15	192					103·54	4,550	103·82	5,847	99·20	1,033
31									103·39	4,400		

Day.	July.		August		September.		October.		November		December.	
1	99·15	1,000	98·10	405	97·57	182	97·48	154	97·91	317	98·06	215
2	99·11	976	98·07	390	97·57	182	97·46	148	97·87	299	98·06	215
3	99·03	928	98·16	435	97·55	175	97·54	172	97·97	344	98·06	215
4	99·36	1,137	98·34	529	97·54	172	97·57	182	97·86	295	98·06	215
5	99·36	1,137	98·10	405	97·53	169	97·76	254	97·80	270	98·08	215
6	99·15	1,000	97·96	340	97·69	226	97·53	169	97·67	218	98·08	191
7	99·03	928	97·90	313	97·59	189	97·51	172	97·73	242	98·09	191
8	98·99	904	97·89	308	97·53	169	97·51	172	97·85	290	98·09	191
9	98·95	880	98·02	367	97·55	175	97·51	172	97·96	340	98·09	191
10	98·92	862	97·85	290	97·57	182	97·76	254	97·80	270	98·09	191
11	98·86	826	97·77	258	97·54	172	97·77	258	97·76	254	98·09	191
12	99·05	940	97·82	278	97·54	172	97·75	250	97·86	295	98·10	196
13	98·92	862	97·75	250	97·58	186	97·70	230	97·86	295	98·10	179
14	98·85	820	97·71	234	97·63	203	97·68	222	97·86	295	98·11	173
15	98·85	820	97·67	218	97·59	189	97·64	206			98·12	175
16	98·79	784	97·87	299	97·55	175	97·64	206			98·12	175
17	98·81	796	97·75	250	97·55	175	97·78	262			98·12	175
18	98·85	820	97·64	206	97·60	192	97·84	286			98·11	173
19	98·77	772	97·63	203	97·61	196	97·82	278			98·13	178
20	98·54	639	97·63	203	97·73	242	97·76	254			98·13	178
21	98·50	618	97·67	218	97·66	214	97·76	254			98·16	173
22	98·45	590	97·71	234	97·64	206	97·81	274			98·16	161
23	98·41	568	97·69	226	97·61	196	97·79	266			98·16	161
24	98·37	546	97·64	206	97·58	186	97·79	266			98·16	161
25	98·42	574	97·64	206	97·58	186	97·94	330			98·16	161
26	98·50	618	97·64	206	97·56	179	97·94	330			98·16	161
27	98·37	546	97·64	206	97·66	214	97·82	278			98·15	139
28	98·53	639	97·69	226	97·61	196	97·74	246			98·15	124
29	98·32	519	97·85	290	97·56	179	97·73	242			98·15	112
30	98·24	475	97·77	258	97·54	172	97·74	246			98·15	106
31	98·16	435	97·72	238			97·74	246			98·15	106

Note—Ice conditions January 1 to April 17; data not sufficient to compute daily discharge. Ice conditions November 15 to end of year; data not sufficient to compute daily discharge for November.

Monthly Discharge of Assiniboine River at Brandon, for the Year 1912.

Drainage area, 34,500 square miles.

Month.	Discharge in Second-Feet.				Run Off.	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage area.	Total in acre-feet.
1912						
July			[1]2,050	0·059	0·068	126,100
August	2,080	1,260	1,700	0·049	0·056	104,500
September	5,150	1,470	3,100	0·090	0·100	184,500
October	5,300	2,420	3,580	0·104	0·120	220,100
November	2,370	1,450	1,840	0·053	0·059	109,500
December	1,430	488	1,020	0·030	0·035	62,700
The period	5,300	488	2,220	0·064	0·438	807,400
1913						
January			[1]400	0·012	0·014	24,600
February	380	220	274	0·008	0·008	15,200
March			[1]250	0·007	0·008	15,400
April			[1]5,100	0·148	0·165	303,500
May	14,900	5,500	10,200	0·296	0·341	627,200
June	5,400	2,170	3,500	0·101	0·113	208,000
July	5,300	2,100	4,100	0·119	0·137	252,100
August	4,600	2,400	3,600	0·104	0·120	221,400
September	2,340	1,130	1,610	0·047	0·052	95,800
October			[1]1,030	0·030	0·035	63,300
The period	11,900	220	3,010	0·087	0·993	1,826,500
1914.						
January			[1]200	0·006	0·007	12,300
February				....	....	....
March			[1]400	0·012	0·014	24,600
April			[1]3,000	0·087	0·097	178,500
May	5,850	4,320	5,350	0·155	0·179	329,000
June	4,200	1,030	2,400	0·070	0·078	142,800
July	1,140	435	774	0·022	0·025	47,600
August	529	203	280	0·008	0·009	17,200
September	242	169	189	0·005	0·006	11,200
October	330	148	235	0·007	0·008	14,500
November			[1]250	0·007	0·008	14,900
December	215	106	173	0·005	0·006	10,600
The period	5,850	106	1,200	0·035	0·137	803,200

Note.—Marked thus ([1]) estimated. Data not sufficient to estimate discharge for November and December, 1913, and February, 1914

Assiniboine River at Headingly.

History.—The metering station was established on April 9, 1913, by S. S. Scovil, and has been operated since that date.

Location of Section.—The meter section is located on the downstream side of the Canadian Northern Railway bridge which crosses the Assiniboine river a quarter of a mile from the Canadian Northern Railway Headingly station. The initial point is marked on the flooring at the north end of the bridge on the downstream side, and is painted white, "Init. Pt. 0+00."

Records available.—Gauge height records are available from April 17 to November 23, 1913, and for the year 1914. Estimates of daily discharge have been prepared from April 17 to November 23, 1913, June 1 to March 1, 1914, and from April 22 to the end of 1914, except for part of November.

Drainage Area.—The area drained by the Assiniboine river above Headingly is 59,420 square miles.

Gauge.—A 9-foot vertical staff gauge is fastened to the north abutment of the bridge, and is read in summer. A winter gauge, 3-foot staff, is fastened to the ice-breaker for winter readings. Both are referred to the same arbitrary datum.

Channel.—The channel is straight both above and below the section for a considerable distance. The stream is divided into four channels by the three central piers of the bridge. The bottom of the stream is of gravel and mud, and not liable to shift. The right bank is low and wooded and liable to overflow at high stages. The left bank is high and not liable to overflow.

Discharge Measurements.—The meterings have been made from the down-stream side of the bridge in the open-water season, and at a point about 200 feet downstream and from ice under winter conditions.

Accuracy.—Between gauge heights 75·5 and 80·9 the discharge curve is well defined. Under ice conditions, between gauge heights 73·8 and 76·1, the discharge curve is fairly well defined.

DISCHARGE MEASUREMENTS of Assiniboine River at Headingly, 1913-14.

Date.		Hydrographer.	Meter No.	Width	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.				Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
April	16	G. H. Burnham	1,497	317	2,543	3·02	81·73	7,673
"	22	E. Bankson	1,169	366	2,719	3·40	82·58	9,258
May	2	E. Bankson	1,439	366	2,888	3·58	82·94	10,337
"	7	G. Ebner	1,187	395	3,516	3·83	84·52	13,464
"	12	"	1,186	372	3,526	3·86	84·69	13,610
"	19	"	1,186	370	3,118	3·35	83·6[illegible]	10,445
June	23	"	1,186	260	1,587	2·20	79·01	3,491
July	19	Alex Pirie	1,496	360	1,835	2·36	79·77	4,334
Aug.	5	W. J. Ireland	1,469	302	1,977	2·41	79·90	4,759
"	14	W. J. Ireland	1,469	301	1,952	2·44	79·71	4,526
"	18	G. Ebner	1,196	261	1,871	2·32	79·77	4,276
Sept.	16	C. O. Allen	1,435	218	1,191	1·64	77·68	1,959
"	27	E. J. Budge	1,186	235	1,079	1·44	77·18	1,551
Oct.	13	Ireland and Edmondson	1,169	238	1,007	1·19	76·83	1,201
"	28	C. O. Allen	1,435	222	917	1·04	76·33	986
Nov.	25	"	1,375	222	892	0·77	76·48	[1]687
Dec.	23	"	1,375	340	705	0·66	76·42	[1]465
1914.								
Jan.	22	E. J. Budge	1,462	282	907	0·34	76·62	[1]314
Feb.	7	C. O. Allen	1,467	285	870	0·36	76·92	[1]314
"	27	W. J. Ireland	1,462	287	813	0·38	77·10	[1]324
April	3	E. B. Patterson	1,462	312	1,363	0·78	77·24	[1]1,069
"	18	D. B. Gow	1,375	361	1,535	1·38	78·38	2,118
"	23	A. Pirie	1,197	362	1,870	2·53	79·98	4,723
May	5	C. O. Allen	1,497	310	2,056	2·81	80·49	5,784
"	23	J. A. Page	1,861	320	2,203	2·83	80·83	6,234
"	25	"	1,861	314	2,117	2·91	80·89	6,161
June	1	"	1,861	323	2,123	2·78	80·64	5,902
July	21	C. O. Allen	1,435	223	966	1·34	76·65	1,294
"	23	M. S. Madden	1,760	338	885	1·09	76·39	967
Aug.	4	W. J. Ireland	1,919	204	821	1·05	76·21	862
"	17	M. S. Madden	1,760	335	719	0·83	75·75	625
Sept.	29	"	1,911	334	727	0·60	75·49	436
Dec.	16	"	1,649	283	780	0·26	75·38	[1]202

[1]Measurement taken under ice conditions.

Daily Gauge Height and Discharge of Assiniboine River at Headingly, for 1913.

[Drainage area, 59,420 square miles.]

Day.	January		February		March		April		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.
1									82·88	9,900	81·23	6,842
2									83·38	10,910	81·16	6,720
3									83·08	10,300	81·00	6,440
4									83·28	10,705	80·90	6,265
5									83·78	11,740	80·79	6,072
6									84·25	12,735	80·78	6,055
7									84·75	13,824	80·68	5,880
8									84·85	14,044	80·58	5,710
9									84·77	13,868	80·48	5,545
10									84·80	13,934	80·38	5,380
11									84·85	14,044	80·28	5,220
12									84·79	13,912	80·18	5,060
13									84·69	13,692	80·00	4,781
14									84·55	13,384	79·98	4,750
15									84·25	12,745	79·88	4,600
16									84·05	12,307	79·78	4,455
17							81·38	7,105	83·90	11,992	79·68	4,310
18							82·38	8,915	83·84	11,866	79·48	4,025
19							82·48	9,125	83·69	11,551	79·38	3,885
20							82·68	9,510	83·56	11,279	79·28	3,745
21							82·63	9,413	83·38	10,910	79·18	3,610
22							82·58	9,315	83·20	10,540	79·08	3,475
23							82·58	9,315	83·07	10,280	78·98	3,345
24							82·58	9,315	82·88	9,900	78·88	3,220
25							82·63	9,413	82·68	9,510	78·78	3,100
26							82·68	9,510	82·48	9,125	78·78	3,100
27							82·73	9,608	82·18	8,555	78·68	2,985
28							82·71	9,569	81·98	8,185	78·68	2,985
29							83·28	10,705	81·78	7,820	78·53	2,815
30							82·88	9,900	81·58	7,460	78·56	2,848
31									81·38	7,105		

Day.	July		August		September		October		November		December	
1	78·78	3,100	80·18	5,060	78·38	2,650	76·96	1,380	76·08	780		
2	78·58	2,870	80·10	4,936	78·43	2,705	76·86	1,345	76·18	849		
3	78·31	2,597	80·06	4,864	78·33	2,597	76·84	1,290	76·38	970		
4	78·26	2,524	79·99	4,765	78·28	2,545	76·86	1,305	77·08	1,470		
5	78·18	2,440	79·92	4,665	78·28	2,545	76·86	1,305	76·48	1,035		
6	78·18	2,440	79·88	4,600	78·25	2,513	76·76	1,231	76·73	1,210		
7	78·16	2,420	79·85	4,556	78·18	2,440	76·66	1,161	76·98	1,395		
8	78·09	2,350	79·85	4,556	78·08	2,340	76·56	1,091	77·18	1,550		
9	78·08	2,340	79·78	4,455	77·98	2,240	76·64	1,147	77·20	1,566		
10	78·18	2,440	79·77	4,441	78·18	2,149	76·76	1,231	[1]77·10	1,470		
11	78·38	2,650	79·79	4,469	78·18	2,440	76·78	1,245	[1]77·00	1,320		
12	78·58	2,870	79·81	4,527	77·96	2,221	76·88	1,320	[1]77·80	1,180		
13	78·68	2,985	79·78	4,455	77·88	2,145	76·84	1,290	[1]77·70	1,110		
14	78·88	3,220	79·72	4,368	77·88	2,145	76·76	1,231	[1]77·60	1,040		
15	79·18	3,610	79·88	4,600	77·78	2,055	76·70	1,189	[1]77·50	970		
16	79·37	3,871	79·88	4,600	77·68	1,965	76·64	1,147	76·41	910		
17	79·46	3,997	79·88	4,600	77·63	1,923	76·64	1,147	[1]76·39	900		
18	79·68	4,310	79·78	4,455	77·58	1,880	76·61	1,126	[1]76·37	895		
19	79·73	4,382	79·58	4,165	77·48	1,795	76·66	1,161	[1]76·35	885		
20	79·78	4,455	79·48	4,025	77·38	1,710	76·74	1,217	[1]76·33	870		
21	80·38	5,380	79·28	3,745	77·33	1,670	76·75	1,221	[1]77·31	840		
22	80·00	4,781	79·08	3,475	77·28	1,640	76·66	1,161	77·29	800		
23	80·10	4,936	78·88	3,220	77·26	1,614	76·58	1,105	77·28	780	76·42	465
24	80·19	5,076	78·83	3,160	77·26	1,614	76·61	1,126				
25	80·28	5,220	78·73	3,042	77·26	1,614	76·75	1,224				
26	80·28	5,220	78·53	2,815	77·18	1,550	76·66	1,161				
27	80·28	5,220	78·38	2,650	77·06	1,455	76·66	1,161				
28	80·27	5,204	78·36	2,629	77·06	1,455	76·44	1,009				
29	80·28	5,220	78·38	2,650	76·96	1,383	76·36	957				
30	80·28	5,220	78·45	2,727	76·96	1,380	76·26	892				
31	80·29	5,102	78·48	2,769			76·16	828				

Notes.—Ice conditions from January 1 to April 16, data not sufficient to compute daily discharges. All gauge heights marked thus [1] interpolated. Ice conditions from November 12 to December 31, Data not sufficient to compute daily discharges from November 21 to December 31.

Daily Gauge Height and Discharge of Assiniboine River at Headingly, for 1914.

(Drainage Area, 59,420 square miles.)

Day.	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.
1	[1]76.50	420	[1]76.83	312					80.73	5,967	80.68	5,880
2	[1]76.50	420	76.86	312	77.12		77.32		80.68	5,880	80.48	5,545
3	[1]76.51	415	[1]76.88	312			77.23	1,069	80.58	5,710	80.38	5,390
4	[1]76.52	415	[1]76.89	313			77.21		80.57	5,694	80.18	5,060
5	[1]76.53	410	[1]76.90	313			77.21		80.48	5,545	79.98	4,750
6	[1]76.53	405	[1]76.91	314			77.21		80.48	5,545	79.86	4,570
7	[1]76.53	405	76.92	311			77.20		80.48	5,545	79.71	4,381
8	[1]76.53	400	[1]76.92	316			77.12		80.58	5,710	79.61	4,325
9	[1]76.51	390	76.92	318	77.14		77.12		80.66	5,817	79.54	4,159
10	[1]76.52	380	[1]76.95	320			77.13		80.67	5,861	79.41	3,955
11	[1]76.52	375	[1]76.94	315			77.17		80.69	5,897	79.29	3,739
12	76.52	370	[1]76.95	316			77.14		80.80	6,090	79.18	3,610
13	[1]76.52	390	[1]76.96	317			77.23		80.89	6,217	79.06	3,449
14	[1]76.52	350	[1]76.97	318			77.57		80.98	6,405	78.98	3,345
15	[1]76.53	345	[1]76.98	319			77.71		80.98	6,405	78.88	3,220
16	[1]76.54	343	77.00	320	77.22		77.92		81.00	6,440	78.76	3,077
17	[1]76.55	340	[1]77.00	320			78.02		81.00	6,440	78.65	2,950
18	76.56	333	[1]77.00	320			78.22		81.03	6,492	78.50	2,782
19	[1]76.57	330	[1]77.00	320			79.74		81.06	6,545	78.39	2,661
20	76.59	325	[1]77.01	321			80.22		80.98	6,405	78.35	2,618
21	[1]76.61	320	[1]77.01	321			80.47		80.98	6,405	78.24	2,492
22	76.62	315	[1]77.01	321			81.92		80.98	6,405	78.12	2,390
23	[1]76.64	316	77.02	321	77.92		79.88	[illegible]	80.96	6,370	78.07	2,330
24	[1]76.65	316	[1]77.04	322			81.13	1,980	80.89	6,247	77.98	2,240
25	[1]76.67	310	[1]77.06	323			80.08	4,995	80.89	6,247	77.88	2,145
26	76.69	305	[1]77.08	321			80.15	5,[illegible]	80.88	6,230	77.38	1,710
27	[1]76.71	307	77.10	324			81.20		80.88	6,230	77.08	1,470
28	[1]76.75	308	[1]77.10	324			80.48		80.78	6,055	77.28	1,630
29	[1]76.77	310					80.56		80.88	6,230	77.38	1,710
30	[1]76.79	310			78.73		80.58	5[illegible]	80.88	6,230	77.46	1,778
31	[1]76.81	311							80.78	6,055		

Day.	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	77.40	1,727	75.97	714	75.48	440	75.39	395	75.47	434	75.73	214
2	77.33	1,670	76.08	790	75.48	440	75.38	390	75.53	467	75.82	231
3	77.18	1,550	76.12	804	75.49	446	75.36	380	75.51	456	75.8[illegible]	234
4	77.28	1,630	76.18	840	75.47	434	75.28	340	75.48	440	75.92	240
5	77.18	1,550	76.08	790	75.47	434	75.34	370	75.47	435	75.97	250
6	77.03	1,442	75.97	714	75.50	451	75.43	415	75.45	425	76.02	259
7	76.93	1,358	75.87	654	75.58	495	75.36	380	75.41	415	76.00	264
8	76.88	1,320	75.77	600	75.48	440	75.30	350	75.43	415	75.97	269
9	76.86	1,305	75.77	600	75.47	434	75.31	365	75.48	440	75.97	275
10	76.93	1,358	75.87	654	75.48	440	75.29	345	75.50	451	75.97	269
11	76.96	1,380	75.87	654	75.48	440	75.38	390	75.48	440	75.94	244
12	77.23	1,590	75.82	627	75.56	484	75.46	430	75.27	335	75.92	240
13	77.23	1,590	75.67	545	75.48	440	75.56	484	75.32	360	75.92	231
14	76.98	1,395	75.64	528	75.50	451	75.48	440	75.18	310	75.91	220
15	76.87	1,312	75.61	511	75.48	440	75.47	434	75.28	323	75.82	213
16	76.78	1,245	75.66	539	75.43	415	75.43	415	75.18		75.81	195
17	76.68	1,175	75.77	600	75.38	390	75.45	425	75.08		75.71	178
18	76.68	1,175	75.70	561	75.38	390	75.43	415			75.68	178
19	76.73	1,210	75.69	556	75.38	390	75.49	446	75.22		75.58	161
20	76.67	1,168	75.58	495	75.37	385	75.51	456			75.58	161
21	76.66	1,161	75.52	462	75.38	390	75.46	430			75.58	161
22	76.58	1,105	75.48	440	75.43	415	75.40	400			75.58	153
23	76.39	976	75.48	440	75.38	390	75.37	385			75.58	149
24	76.36	957	75.55	478	75.38	390	75.38	390	75.52		75.67	159
25	76.38	970	75.50	451	75.51	456	75.38	390	75.52		75.67	156
26	76.35	950	75.48	440	75.49	446	75.47	434	75.57		75.73	154
27	76.28	905	75.48	440	75.49	446	75.48	440	75.52		75.76	142
28	76.29	853	75.48	440	75.51	456	75.47	434	75.67		75.73	137
29	[illegible]	[illegible]	75.48	440	75.48	440	75.47	434	75.67		75.68	109
30	76.10	792	75.48	440	75.48	440	75.47	434	75.70		75.63	98
31	76.05	762	75.50	484			75.47	434			75.58	88

NOTE.—All gauge heights marked thus [1] interpolated. Ice conditions from January 1 to April 22; data not sufficient to compute daily discharges from March 1 to April 22. Ice conditions from November 14 to December 31; data not sufficient to compute daily discharges from November 16 to November 30.

Monthly Discharge of Assiniboine River at Headingly, for the year 1913.

[Drainage Area, 59,470 square miles.]

Month.	Discharge in Second-Feet				Run-Off.	
	Maximum	Minimum.	Mean	Per square mile	Depth in inches on Drainage area	Total in acre-feet
1913						
January			500[1]	0·008	0·009	30,700
February			400[1]	0·007	0·007	22,200
March			400[1]	0·007	0·008	24,600
April			5,100[1]	0·090	0·100	303,800
May	14,000	7,100	11,200	0·189	0·218	688,700
June	6,850	2,800	4,575	0·077	0·086	272,200
July	5,400	2,340	3,825	0·064	0·074	235,200
August	5,050	2,625	4,000	0·067	0·077	246,000
September	2,700	1,380	2,020	0·034	0·038	120,200
October	1,380	828	1,170	0·019	0·022	72,000
November		......	800[1]	0·013	0·014	47,600
December		...	500[1]	0·008	0·009	30,700
The year	14,000	400	2,875	0·048	0·662	2,090,800
1914.						
January	420	305	354	0·006	0·007	21,800
February	324	212	318	0·005	0·005	17,700
March		.. ..	325[1]	0·005	0·006	20,000
April			3,400[1]	0·057	0·064	202,800
May	6,550	5,550	6,100	0·103	0·119	375,100
June	5,900	1,470	3,300	0·056	0·063	196,400
July	1,730	762	1,240	0·021	0·024	76,800
August	840	440	571	0·009	0·011	35,100
September	495	385	432	0·007	0·008	25,700
October	484	340	409	0·007	0·008	25,100
November	......	......	300[1]	0·005	0·006	17,900
December	275	88	195	0·003	0·003	12,000
The year	6,550	88	1,410	0·024	0·324	1,025,300

Note.—All marked thus ([1]) estimated.

Assiniboine River at St. James.

History.—The station was established by D. L. McLean on May 13, 1912. It was abandoned August 8, 1913, in favour of the station at Headingly.

Location of Section.—The meter section was located on the downstream side of the Canadian Pacific Railway foot-bridge across the Assiniboine, which is about 120 feet south of the Portage Avenue subway at the western city limits. The initial point is located on the north end of the hand-rail on the downstream side of the bridge.

Records available.—A record of daily gauge heights was obtained for the period May 14, 1912, to August 8, 1913, except during the winter season, when the readings were made twice a week. Estimates of daily discharge have been made for the period May 14 to October 31, 1912, and April 17 to August 8, 1913.

Drainage Area.—The area drained by the Assiniboine above the St. James station is 59,550 square miles.

Gauge.—A chain gauge was installed at this station. It was located on the lower chord of the bridge on the upstream side opposite station 2+60 on the metering section. The zero of the gauge was referred to a bench-mark of arbitrary datum, located on the southeast corner of the abutment at the north end of the bridge, and marked in white paint "B.M."

Channel.—The channel is divided into three sections at low water and four at high, by the bridge piers. The channel is straight for 300 feet above and

400 feet below the section. The bed is of gravel and is permanent. The banks are high and not liable to overflow.

Discharge Measurements.—The met rings were made from the downstream side of the bridge by means of a small Price meter.

Accuracy.—Between gauge heights 64·80 and 70·70 the discharge curve is fairly well defined.

DISCHARGE MEASUREMENTS of Assiniboine River at C.P.R. Bridge, St. James, Winnipeg, 1912-13.

Date		Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
May	14	S. S. Scovil	1186	291	1,227	4·78	67·46	5,864
"	25	G. H. Burnham	1187	356	1,460	4·81	68·04	7,021
June	11	"	1187	357	1,608	4·87	68·61	7,832
"	24	"	1187	293	1,118	4·33	66·93	4,841
July	1	"	1187	291	1,087	4·07	66·60	4,425
"	8	"	1187	285	911	3·63	65·91	3,308
"	23	"	1187	285	863	3·08	65·42	2,660
Aug.	3	W. G. Worden	1187	285	799	2·78	65·16	2,221
"	27	"	1187	280	728	2·63	64·88	1,914
Sept.	24	A. Pirie	1187	290	1,102	4·04	66·46	4,450
Oct.	8	R. H. Nelson	1187	295	1,429	4·31	67·44	6,161
"	30	"	1197	285	916	3·35	65·58	3,068
Dec.	28	H. M. Nelson	1197	285	779	1·35	66·34	[1]1,052
1913								
Jan.	17	A. Pirie	1469	263	399	1·31	65·34	[1]522
May	7	G. H. Burnham	1197	197	317	1·38	65·64	[1]437
"	3	E. Bankson	1469	360	2,242	4·49	70·68	10,056

[1] Measurement taken under ice conditions.

Daily Gauge Height and Discharge of Assiniboine River at C.P.R. Bridge, St. James, Winnipeg, for 1912.

Drainage area, 59,550 square miles.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1											[1] 68·86	8,300
2											68·81	8,200
3											68·91	8,400
4											68·97	8,500
5											69·01	8,600
6											68·91	8,400
7											68·91	8,400
8											68·71	8,100
9											68·75	8,100
10											68·71	8,100
11											68·61	7,900
12											68·51	7,700
13											68·33	7,400
14									67·46	5,900	68·13	7,100
15									67·63	6,200	67·91	6,700
16									67·61	6,200	67·75	6,400
17									67·81	6,500	67·51	6,000
18										6,600	67·37	5,800
19									67·91	6,700	67·26	5,600
20									67·91	6,700	67·11	5,350
21									67·95	6,800	67·13	5,400
22									68·01	6,900	67·13	5,400
23									68·05	6,900	66·97	5,100
24									68·07	7,000	66·95	5,100
25									68·04	6,900	66·97	5,100
26									68·21	7,200	66·95	5,100
27									68·41	7,600	66·91	5,000
28									68·41	7,600	66·81	4,850
29									68·61	7,900	66·75	4,750
30									68·81	8,200	66·65	4,600
31									68·91	8,400		

Day.	July.		August		September.		October.		November.		December	
1	66·60	4,500	65·23	2,390	64·77	1,750	67·01	5,200			67·17	
2	[1] 66·49	4,350	65·23	2,390	64·67	1,620	67·15	5,400				
3	66·41	4,200	65·13	2,250	64·61	1,540	67·27	5,600	65·85			
4	66·27	4,000	65·15	2,280	[1] 64·67	1,620	67·39	5,800				
5	66·37	4,150	65·09	2,190	64·73	1,700	67·55	6,100				
6	66·23	3,950	65·25	2,420	64·63	1,560	67·61	6,200				
7	[1] 65·96	3,500	65·19	2,330	64·75	1,720	67·51	6,000				
8	65·66	3,000	65·17	2,300	64·93	1,970	[1] 67·51	6,000				
9	[1] 65·64	3,000	65·19	2,330	64·85	1,860	67·45	5,900				
10	65·58	2,900	65·21	2,360	64·79	1,780	[1] 67·27	5,600	66·31			
11	[1] 65·51	2,800	65·21	2,360	[1] 64·85	1,860	67·01	5,200				
12	[1] 65·44	2,700	65·19	2,330	64·91	1,940	66·99	5,100				
13	[1] 65·38	2,600	65·15	2,280	65·27	2,450	66·97	5,100				
14	[1] 65·31	2,500	65·17	2,300	65·47	2,740	66·79	4,850				
15	65·24	2,400	65·19	2,330	[1] 65·64	3,000	66·70	4,700			67·55	
16	[1] 65·17	2,300	65·15	2,280	65·81	3,250	66·61	4,550				
17	[1] 65·10	2,200	65·13	2,250	66·01	3,600	66·49	4,350	65·07			
18	65·01	2,080	65·07	2,160	66·11	3,750	66·37	4,150				
19	65·01	2,080	65·05	2,140	[1] 66·23	3,950	66·33	4,100				
20	65·03	2,110	64·99	2,050	[1] 66·32	4,100	66·27	4,000				
21	65·09	2,190	64·93	1,970	66·47	4,300	66·23	3,950				
22	65·21	2,360	64·85	1,860	66·41	4,200	66·21	3,900			67·07	
23	65·41	2,650	64·87	1,890	66·41	4,200	66·05	3,650				
24	65·38	2,600	65·01	2,080	66·47	4,300	65·93	3,450	68·11			
25	65·31	2,500	64·91	1,940	66·51	4,400	65·91	3,400				
26	65·39	2,600	[1] 64·84	1,850	66·57	4,500	65·89	3,400				
27	65·27	2,450	64·77	1,750	[1] 66·68	4,650	65·85	3,300			66·50	
28	65·17	2,300	64·67	1,620	66·79	4,800	[1] 65·85	3,300			66·34	1,052
29	65·15	2,280	64·71	1,670	66·81	4,850	[1] 65·85	3,300				
30	65·15	2,250	64·81	1,810	66·95	5,100	[1] 65·85	3,300				
31	65·15	2,280	64·81	1,810			[1] 65·85	3,300				

NOTE.—All gauge heights marked thus [1] interpolated. Winter conditions from November 1 to December 31; data not sufficient to compute daily discharges.

Daily Gauge Height and Discharge of Assiniboine River at C. P. R. Bridge, St. James, Winnipeg, for 1913.

Drainage area, 59,550 square miles.

Day.	January.		February		March		April		May		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.
1									70·40	10,900	68·30	7,400
2									70·69	11,400	68·24	7,300
3			65·39		65·74		67·06		70·84	11,700	68·10	7,000
4	66·12						67·24		70·93	11,800	67·94	6,700
5							67·24		71·52	12,800	67·88	6,700
6									72·27	14,100	67·80	6,500
7									72·46	14,400	67·59	6,200
8					65·64	437			72·59	14,700	67·49	6,000
9									72·68	14,800	67·32	5,700
10			65·45		65·65				72·68	14,800	67·11	5,400
11									72·64	14,800	67·18	5,500
12									72·48	14,500	67·07	5,300
13									72·38	14,300	66·91	5,000
14							74·29		72·12	13,900	66·89	5,000
15	65·23						77·37		71·80	13,500	66·89	5,000
16							76·50		71·68	13,100	66·61	4,550
17	65·44	522	65·55		65·63		72·78	15,000	71·46	12,700	66·73	4,750
18							72·78	15,000	71·23	12,400	66·64	4,600
19							72·81	15,000	71·12	12,200	66·45	4,300
20							72·45	14,400	70·85	11,700	66·34	4,100
21							72·27	14,100	70·72	11,500	66·38	4,200
22							71·58	13,000	70·53	11,200	66·21	3,900
23							71·13	12,200	70·31	10,800	66·20	3,900
24			65·71				70·90	11,800	70·16	10,400	66·07	3,700
25							70·75	11,500	69·81	9,900	66·07	3,700
26							70·64	11,300	69·62	9,600	65·88	3,400
27	65·57				65·77		70·48	11,100	69·33	9,100	65·85	3,300
28							70·44	11,000	69·10	8,700	66·62	3,600
29							70·43	11,000	68·86	8,300	65·69	3,050
30							70·44	11,000	68·58	7,800	65·69	3,050
31					65·97				68·40	7,500		

Day.	July		August		September		October		November		December	
1	65·87	3,300	67·18	5,500								
2	65·74	3,150	67·11	5,350								
3	65·53	2,850	66·81	4,850								
4	65·49	2,750	66·91	5,000								
5	65·51	2,800	66·84	4,900								
6	65·55	2,850	67·01	5,200								
7	65·42	2,650	67·22	5,500								
8	65·42	2,650	68·31	7,400								
9	65·38	2,600										
10	65·42	2,650										
11	65·66	3,050										
12	65·65	3,000										
13	65·92	3,450										
14	66·01	3,600										
15	66·29	4,050										
16	66·49	4,350										
17	66·62	4,550										
18	66·72	4,700										
19	66·75	4,750										
20	66·88	5,000										
21	66·97	5,100										
22	67·02	5,200										
23	67·12	5,350										
24	67·27	5,600										
25	67·34	5,750										
26	67·32	5,700										
27	67·28	5,600										
28	67·30	5,700										
29	67·25	5,600										
30	67·28	5,600										
31	67·21	5,[illegible]										

Note.—All gauge heights marked thus [illegible] interpolated. Curve not well defined above gauge height 68·70 feet. Ice conditions from January 1 to April 16, data not sufficient to compute discharges.

MONTHLY DISCHARGE of Assiniboine River at C.P.R. Bridge, St. James, Winnipeg, for the year 1912.

(Drainage area, 59,550 square miles.)

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
May	8,400		[1]6,300	0·106	0·122	387,400
June	8,600	4,600	6,700	0·112	0·125	398,700
July	4,500	2,080	2,800	0·047	0·054	172,200
August	2,390	1,620	2,130	0·036	0·042	131,000
September	5,100	1,510	3,100	0·052	0·058	184,400
October	6,200	3,300	4,600	0·077	0·089	282,800
November						
December		1,052				
The period	8,600	1,052	1,250	0·072	0·490	1,556,500
1913						
March		437				
April	15,000		[1]10,000	0·168	0·187	595,000
May	14,800	7,500	11,900	0·200	0·231	731,700
June	7,400	3,050	4,950	0·083	0·093	294,550
July	5,750	2,600	4,150	0·070	0·081	255,170
August			[1]4,000	0·067	0·077	246,000
The period	15,000	437	7,000	0·117	0·672	2,123,220

NOTE.—All marked thus [1] estimated.

SHELL RIVER.

The Shell river is one of the largest tributaries of the Assiniboine, emptying into that river in tp. 23, R. 29, W.P.M. The source of the river is on the northwestern slope of the Duck mountains, which it parallels for a considerable distance, the course being almost due south for the entire length of the river. About 5 miles from the junction with the Assiniboine it turns sharply to the west and flows in that direction to its mouth.

The watershed drained is narrow, lying between the Swan and Assiniboine, except at the upper part, where it opens out to a width of about 35 miles, the total length of the basin being about 60 miles, though the river itself has a length of 90 miles.

In the upper waters the river flows through the Duck mountain forest reserve, a district in which valuable timber is to be found. The valley of the river is narrow and quite deep, varying between 100 and 350 feet. The valley itself is gravelly and boulder-strewn, but the land forming the upper benches and table land is good for agriculture.

At Assessippi, the only town located on the stream, a small flour mill was operated by water-power from 1884 to 1911, in which year the dam was washed out.

SHELL RIVER AT ASSESSIPPI.

History.—The first metering of the Shell at Assessippi was taken by W. J. Ireland on September 15, 1913, but the point at which the measurement was made was not considered suitable as a point for a permanent section. This point was at the bridge just below the dam. A second section was established by E. J. Budge on January 16, 1914, which was a quarter of a mile below the bridge; this latter section was afterwards abandoned for one which was located by C. O. Allen on June 9, 1914.

Location of Section.—The section finally located on the Shell River at Assessippi is 1¼ mile downstream from the Assessippi bridge, 2 miles below the mouth of Bear creek, 13½ miles from Russell, and 20 miles south of Roblin. The initial point is marked by a nail driven in the base of a blazed tree, which is on the right bank.

Records available.—Daily gauge heights have been obtained since June 9, 1914, and estimates of daily discharge for the same period have been made.

Drainage Area.—The area tributary to the Shell above the meter section is 930 square miles. It lies between the watersheds of the Valley river on the east and the Assiniboine on the west.

Gauge.—A 6-foot vertical staff gauge was placed 600 feet downstream from D. Martel's house, and about 1 mile above the meter section. The gauge is referred to a bench-mark, which is a nail driven into the foot of a blazed scrub oak tree standing 14 feet back from the gauge. The datum is arbitrary. On November 18 it was discovered that back-water effect was being caused between the gauge and the meter section by beaver dams. A new gauge was therefore established at the meter section, which was referred to a temporary bench-mark placed on the side of a 6-inch poplar tree, blazed, standing 100 feet above the meter station on the right bank.

Channel.—For 60 feet above the section and 150 feet below, the channel is straight; the bottom is of small rock and gravel, and is permanent. The banks are high and clear and are not liable to overflow. The current is swift.

Discharge Measurements.—Measurements are made by means of a cable carrier travelling on a cable stretched across the stream at the section. Sufficient measurements have been taken to define a discharge curve.

Accuracy.—The curve is well defined over a range in stage of 1·3 feet for open-water conditions. Discharge curve for winter conditions is not so well defined.

DISCHARGE MEASUREMENTS of Shell River at Assessippi Bridge, 1913-14.

Date	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Sept. 17	W. J. Ireland	1,469	83	93	2·30	.....	214[3]
Nov. 19	C. O. Allen	1,375	89	78	1·89	.....	149[3]
1914							
Jan. 16	E. J. Budge	1,162	31	29	1·32		39[1]
Mar. 18	C. O. Allen	1,196	25	36	2·87		104[2]
May 12	C. O. Allen	1,497	93	226	7·71		174[3]
June 9	C. O. Allen	1,760	45	89	3·21	92·33	286[3]
July 17	C. O. Allen	1,760	36	53	2·12	91·45	112[3]
Aug. 9	M. S. Madden	1,760	33	39	1·37	91·02	54[3]
Aug. 4	A. Pare	1,940	35	38	1·51	91·05	58[3]
Sept. 24	M. S. Madden	1,911	31	40	1·25	91·04	51[3]
Oct. 23	M. S. Madden	1,912	36	50	1·42	91·16	72[3]
Nov. 18	M. S. Madden	1,912	34	46	1·56	91·42	71[4]
Dec. 5	J. J. Moore	1,920	39	32	1·40	91·64	44[4]

NOTE.—[1] Below Assessippi bridge. [2] Above Assessippi bridge. [3] At Assessippi bridge. [4] Ice measurement.

DAILY GAUGE HEIGHT AND DISCHARGE of Shell River at Assessippi, for 1914.

Drainage area, 930 square miles.

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.	Feet	Sec. ft.
1												
2												
3												
4												
5												
6												
7												
8												
9											92.32	287
10											92.26	273
11											92.19	257
12											92.11	239
13											92.04	221
14											91.99	213
15											91.99	213
16											91.94	202
17											91.92	198
18											91.88	190
19											91.84	182
20											91.82	178
21											78	170
22											76	166
23											91.74	163
24											91.71	157
25											91.68	151
26											91.66	148
27											91.64	144
28											91.62	141
29											91.59	135
30											91.70	155
31												

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	91.69	153	91.12	65	91.[illegible]2	54	91.03	55	91.14	68	91.50	47
2	91.61	144	91.11	64	91.01	53	91.05	55	91.14	68	91.57	49
3	91.62	141	91.09	62	91.00	51	91.01	56	91.14	68	91.59	45
4	91.[illegible]	139	91.07	60	90.96	48	91.06	59	91.14	68	91.63	44
5	91.[illegible]	130	91.06	59	90.96	48	91.06	59	91.14	68	91.67	44
6	91.58	133	91.04	56	91.00	52	91.07	60	91.14	68	91.67	21
7	91.54	126	91.02	54	91.04	56	91.08	61	91.14	68	91.79	15
8	91.51	121	91.01	53	91.06	59	91.12	65	91.12	74	91.63	19
9	91.48	116	91.01	53	91.10	63	91.14	68	91.09	62	91.65	17
10	91.44	109	91.00	52	91.12	65	91.16	70	91.09	62	91.67	15
11	91.44	109	91.00	52	91.10	63	91.18	72	91.09	63	91.77	15
12	91.54	126	90.99	51	91.09	62	91.22	78	91.04	56	91.87	20
13	91.46	113	90.98	50	91.07	60	91.21	76	91.02	51	91.67	1[illegible]
14	91.42	106	90.96	48	91.06	59	91.19	71	90.99	51	91.57	12
15	91.41	104	90.95	47	91.05	58	91.19	71	91.14	56	91.57	12
16	91.44	109	90.94	46	91.05	58	91.20	75	91.11	56	91.67	[illegible]
17	91.42	106	90.96	48	91.04	56	91.20	75	91.29	67	91.87	[illegible]
18	91.38	100	90.95	47	91.04	56	91.20	75	91.40	71	92.27	5
19	91.36	97	90.94	46	91.04	56	91.20	75	91.40	71	92.67	5
20	91.34	95	90.95	47	91.04	56	91.19	74	91.47	69	91.57	[illegible]
21	91.32	92	91.02	44	91.04	56	91.19	74	91.47	63	91.47	2
22	91.[illegible]	89	90.98	50	91.04	56	91.18	72	91.47	69	91.67	
23	91.27	85	90.96	48	91.0[illegible]	55	91.17	71	91.47	67	91.77	
24	91.24	81	90.95	47	91.03	55	91.17	71	91.45	67	91.77	
25	91.24	81	90.98	50	91.03	55	91.16	70	91.47	6[illegible]	91.97	
26	91.21	76	91.01	53	91.03	55	91.15	69	91.47	60	92.07	
27	91.18	73	91.01	53	91.03	55	91.14	68	91.49	61	92.47	
28	91.16	73	91.04	56	91.0[illegible]	55	91.14	68	91.54	74	92.67	
29	91.17	71	91.04	56	91.03	55	91.14	68	91.53	57	92.77	
30	91.16	70	91.04	56	91.03	55	91.14	68	91.50	53	92.77	
31	91.14	68	91.03	55			91.14	68			92.77	

NOTE.—(1) Interpolated. Ice conditions November 15 to end of year.

MONTHLY DISCHARGE of Shell River at Assessippi, for 1914.

Drainage area, 930 square miles

Month	Discharge in Second-Feet				Run-Off	
	Maximum.	Minimum.	Mean	Per Square mile.	Depth in inches on Drainage area.	Total in acre-feet.
1914						
June	287	135	[1]190	0·204	0·228	11,300
July	153	68	104	0·112	0·129	6,400
August	65	44	52	0·056	0·065	3,200
September	65	48	56	0·060	0·067	3,330
October	78	55	68	0·073	0·084	4,180
November	71	51	63	0·068	0·076	3,750
December	67	[1]2	28	0·030	0·035	123
The period	287	2	80	0·086	0·684	32,283

NOTE.—All marked thus (1) estimated. Ice conditions from November 15 to end of year.

BIRDTAIL CREEK.

Birdtail creek is one of the small tributaries of the Assiniboine river. It joins the latter in Indian Reserve No. 57. The source of the river is on the south slope of the Riding mountains, and the course is generally south from the headwaters to the mouth.

The upper part of the drainage area, which is 400 square miles, is very well timbered, and lumbering has been carried on in the district. Towards the mouth the land is given up to agriculture.

There was some question of a small power development on the river, so records of the discharge have been kept. These show that the power output would be very small, and subject to interruption during the winter months.

BIRDTAIL CREEK AT BIRTLE.

History.—This station was established May 14, 1914, by C. O. Allen.

Location of Section.—The meter section is located on the downstream side of the Birtle traffic bridge on the road between the Canadian Pacific Railway station and the town of Birtle, 1 mile from the Canadian Pacific railway. The initial point is painted on the hand-rail of the bridge at the left end of the downstream side.

Records available.—The estimates of daily discharge have been deduced from May 14, 1914 to November 15, 1914, covering the open-water season. Daily gauge heights have been obtained from May 14 to December 5, 1914.

Drainage Area.—The drainage area is 400 square miles, extending from the Riding mountains southeast to the Assiniboine.

Gauge.—A vertical staff enamelled gauge is fastened to the floor of the bridge, and is referred to a bench-mark set to arbitrary datum. The bench-mark is on top of a bolt on the northwest corner of the bridge.

Channel.—The stream is confined to one channel at all stages, for 250 feet above and 100 feet below the section, the channel is straight. The current is fairly swift, and the banks are high and clear and not liable to overflow. The bottom of the stream is of mud and hard clay, not liable to shift.

Discharge Measurements.—The measurements are taken from the downstream side of the traffic bridge under open-water conditions. For winter conditions, measurements are made from the ice.

Accuracy.—The discharge curve is only fairly well defined over a range in gauge height of 3 feet, extending from 88·5 to 91·5. Between 89·0 and 89·5 the curve is not sufficiently well defined to admit of accurate estimated discharge.

DISCHARGE MEASUREMENTS of Birdtail Creek at Birtle, for 1914.

Date.		Hydrographer	Meter No	Width.	Area of Section	Mean Velocity	Gauge Height	Discharge.
1914				Feet.	Sq. ft.	Ft. per sec	Feet	Sec.-ft
Jan.	14	E. J. Budge	1,462	16·0	12·1	0·25		3·0[1]
May	14	C. O. Allen.	1,497	79·6	282·0	1·92	91·49	544·1
June	11	"	1,760	68·0	125·0	0·94	89·49	118·0
Aug.	11	M. S. Madden.	1,760	46·5	70·0	0·02	88·50	1·4
"	29	A. Pirie.	1,940	51·0	82·0	0·10	88·74	8·4
Sept.	23	M. S. Madden.	1,911	52·5	91·0	0·02	88·95	0·2
Oct.	22	"	1,912	53·5	102·0	0·11	89·06	11·0
Nov.	17	"	1,912	50·0	92·0	0·16	88·96	15·2
Dec.	7	T. J. Moore	1,920	52·0	50·0	0·12	88·91	6·0[1]

[1]Measurements taken under ice conditions.

Nelson River, Manitou Rapids. Meter section, winter conditions.

Nelson River, Manitou Rapids. Meter section, Summer conditions.

Daily Gauge Height and Discharge of Birdtail Creek at Birtle, for 1914.

[Drainage area, 400 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1											89·29	71
2											89·29	71
3											89·29	71
4											89·24	60
5											89·64	144
6											89·69	155
7											89·69	155
8											89·69	155
9											89·59	135
10											89·59	135
11											89·49	113
12											89·39	92
13											89·34	81
14									91·44	532	89·29	71
15									91·19	477	89·24	60
16									90·74	378	89·19	50
17									90·24	270	89·14	38
18									90·04	228	89·09	29
19									90·04	228	88·99	16
20									90·04	228	88·94	14
21									89·84	186	88·89	12
22									89·74	165	88·89	12
23									89·64	144	88·89	12
24									89·54	123	88·84	10
25									89·54	123	88·84	10
26									89·49	113	88·84	10
27									88·44	102	88·84	10
28									88·44	102	88·79	9
29									89·44	102	88·79	9
30									89·39	92	88·99	16
31									89·34	81		

Day.	July.		August		September		October		November		December.	
1	89·14	38	88·54	3	88·69	6	88·79	9	89·00	16	88·90	
2	89·24	60	88·54	3	88·69	6	88·79	9	89·00	16	88·90	
3	89·14	38	88·49	3	88·69	6	88·79	9	89·00	16	88·90	
4	89·09	29	88·49	3	88·69	6	88·79	9	89·00	16	88·90	
5	88·99	16	88·49	3	88·69	6	88·84	10	88·95	14	88·90	
6	88·94	14	88·49	3	88·69	6	88·84	10	88·95	14		
7	88·89	12	88·49	3	88·74	7	88·89	12	88·95	14		
8	88·89	12	88·49	3	88·74	7	88·94	14	88·95	14		
9	88·84	10	88·44	2	88·74	7	88·99	16	88·95	14		
10	88·79	9	88·44	2	88·79	9	89·04	22	88·95	14		
11	88·84	10	88·49	3	88·79	9	89·04	22	88·95	14		
12	88·84	10	88·49	3	88·79	9	89·04	22	88·90	12		
13	88·79	9	88·49	3	88·79	9	89·04	22	88·90	12		
14	88·79	9	88·44	2	88·84	10	89·09	29	88·90	12		
15	88·79	9	88·44	2	88·84	10	89·09	29	88·90	12		
16	88·84	10	89·49	3	88·84	10	89·09	29	88·95			
17	88·89	12	89·04	22	88·79	9	89·10	31	88·98			
18	88·89	12	89·04	22	88·79	9	89·10	31	88·95			
19	88·89	12	88·99	16	88·79	9	89·10	31	88·90			
20	88·84	10	88·99	16	88·84	10	89·05	23	88·90			
21	88·79	9	88·94	14	88·89	12	89·05	23	88·90			
22	88·74	7	88·94	14	88·89	12	89·07	26	88·90			
23	88·69	6	88·89	12	88·84	10	89·00	16	88·90			
24	88·69	6	88·89	12	88·79	9	89·00	16	88·90			
25	88·69	5	88·84	[illegible]	88·74	7	89·00	16	88·90			
26	88·64	5	88·84	10	88·74	7	89·00	16	88·90			
27	88·59	4	88·84	10	88·74	7	89·00	16	88·90			
28	88·59	4	88·79	9	88·74	7	89·00	16	88·90			
29	88·54	3	88·74	7	88·81	10	83·00	16	88·90			
30	88·54	3	88·74	7	88·84	10	89·00	16	88·90			
31	88·54	3	88·69	6			89·00	16				

NOTE.—Ice conditions from November 16 to December 31, data not sufficient to compute daily discharges. Above gauge height 89·50 the curve is ill-defined.

MONTHLY DISCHARGE of Birdtail Creek at Birtle, for the year 1914.

(Drainage area, 400 square miles.)

Month.	Discharge in Second-feet				Run-off.	
	Maximum	Minimum	Mean.	Per square mile	Depth in inches on Drainage area.	Total in acre-feet.
1914.						
May	532	81	[1]220	0·550	0·634	13,500
June	165	9	61	0·152	0·170	3,625
July	60	3	13	0·033	0·038	790
August	22	2	7	0·018	0·021	430
September	12	6	8	0·020	0·023	476
October	31	9	19	0·048	0·055	1,170
November		...	[1]10	0·025	0·029	595
December			[1]5	0·013	0·015	307
The period	532	2	43	0·107	0·985	20,902

NOTE.—All marked thus ([1]) estimated.

LITTLE SASKATCHEWAN RIVER.

The source of the Little Saskatchewan river is on the southern slope of the Riding mountains. It flows in a general southeasterly direction until it reaches the town of Minnedosa in tp. 15, R. 18, W.P.M., at which point it turns and flows almost southwest to its junction with the Assiniboine river in tp. 10, R. 20, W.P.M., about 8 miles west of the city of Brandon.

The drainage area is 1,640 square miles. In the upper part of the basin there are numerous small lakes; in this section the greater part of the drainage is obtained; the largest tributary, the Rolling river, enters the Little Saskatchewan about 13 miles above Minnedosa.

In the upper waters the country is covered to a considerable extent by stands of good merchantable timber, a considerable portion of which is within the forest reserve. The rest of the country drained is very well settled, the land offering splendid opportunity for agriculture.

The river valley is well defined, lying between 100 and 300 feet below the general level of the surrounding country. It varies in width between one-quarter of a mile and 1¼ miles, the course of the river in the valley bottom being very sinuous, almost doubling its length over the total length of the drainage basin.

A number of small towns are to be found along the course of the river, as Rivers, Gautier, Rapid City, Riverdale, and Minnedosa, the latter having a population of about 1,700. There are possible power sites on the river, three of which have been developed; these are at Minnedosa, Rapid City, and the Brandon Power Company's plant, about 2 miles from the mouth of the river.

LITTLE SASKATCHEWAN RIVER AT BILBEY'S BRIDGE.

History.—The station on the Little Saskatchewan at Bilbey's bridge was established on March 18, 1914, by W. J. Ireland. Previous to the establishment of this station a section was used on the downstream side of the bridge, but was abandoned, being unsuitable.

Location of Section.—The meter section is located 400 feet downstream from Bilbey's traffic bridge. It is 12 miles northwest of Minnedosa, 5 miles west of Clan William, and 1½ miles downstream from the junction of the Little Saskatchewan and Rolling rivers.

Records available.—Records of daily gauge heights have been secured from April 25, 1914. Sufficient meterings have been made to define a discharge curve, and estimates of daily discharge have been prepared for the open-water season, April 25 to November 29, 1914. Under ice conditions, estimates of daily discharge, based upon discharge measurements taken during the period, have been made for the interval November 29 to December 31.

Drainage Area.—The area tributary to the Little Saskatchewan above Bilbey's bridge is 1,120 square miles.

Gauge.—A 9-foot vertical staff enamelled gauge is fastened to a pile which is 64 feet from the north end of the bridge on the downstream side. It is referred to a bench-mark set to arbitrary datum and marked by a spike driven in the sleeper at the north end of the bridge at the downstream side.

Channel.—For 500 feet above the section and 300 feet below, the channel is straight. At all stages the river is confined to one channel; the bed of the stream is of sand and gravel, and fairly permanent; the banks are low and subject to overflow at extreme stages.

Discharge Measurements.—Discharge measurements are made by means of a cable carrier which travels on a cable stretched across the river at the section. The measurements cover a range in stage of 2·5 feet.

Accuracy.—The discharge measurements taken do not define the discharge curve very well, due to difficulty in obtaining accurate soundings at the section.

DISCHARGE MEASUREMENTS of Little Saskatchewan River at Bilbey's Bridge, 1914.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity	Gauge Height.	Discharge.
1914			Feet.	Sq. ft.	Ft. per sec.	Feet	Sec.-ft
March 18	W. J. Ireland	1,462	49	204	0·31	95·45	64[1]
April 25	M. S. Madden	1,462	73	371	1·57	95·88	583
" 30	W. J. Ireland	1,375	78	187	1·66	95·25	310
May 15	C. O. Allen	1,497	79	324	2·07	96·50	671
June 5	"	1,760	76	224	1·39	95·09	310
July 14	"	1,760	76	166	0·47	94·36	[illegible]
Aug 7	M. S. Madden	1,760	74	140	....	94·02	[illegible]
" 26	A. Pirie	1,940	75	139	0·25	94·04	35
Sept. 22	M. S. Madden	1,911	76	143	0·27	93·99	36
Oct 21	"	1,912	75	139	0·35	93·96	49
Nov. 14	"	1,912	49	179	0·19	93·96	34[1]
Dec 3	T. J. Moore	1,920	79	60	0·33	94·02	20[1]

[1]Measurement taken under ice conditions.

Daily Gauge Height and Discharge of Little Saskatchewan River at Bilbey's Bridge, for 1914.

[Drainage area, 1,120 square miles.]

Day.	January		February		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1									5·19	315	5·17	310
2									5·15	304	5·11	293
3									5·11	293	5·07	282
4									5·07	282	5·07	282
5									5·85	500	5·07	282
6									6·01	545	5·07	282
7									6·06	559	5·07	282
8									6·19	595	5·05	276
9									6·31	629	5·01	265
10									6·67	730	4·97	254
11									6·92	800	4·92	240
12									6·87	786	4·87	226
13									6·77	758	4·82	212
14									6·51	685	4·77	198
15									6·49	679	4·72	184
16									6·29	623	4·67	170
17									6·22	604	4·67	170
18									6·17	590	4·65	164
19									6·07	562	4·61	153
20									5·97	534	4·57	142
21									5·92	520	4·57	142
22									5·87	506	4·55	136
23									5·79	483	4·53	130
24									5·71	461	4·51	125
25							5·89	511	5·67	450	4·47	114
26							5·88	508	5·62	436	4·45	109
27							5·84	497	5·47	394	4·42	101
28							5·58	424	5·45	388	4·39	93
29							5·42	380	5·37	366	4·37	88
30							5·27	338	5·27	338	4·35	83
31									5·22	324	...	..

Day.	July		August		September		October		November.		December.	
1	4·31	73	4·07	40	4·07	40	3·96	33	3·95	33	3·98	19
2	4·29	69	4·07	40	4·06	39	3·94	33	3·95	33	4·02	18
3	4·27	66	4·07	40	4·05	38	3·92	32	3·95	33	4·02	18
4	4·25	62	4·07	40	4·03	36	3·92	32	3·95	33	4·07	18
5	4·23	58	4·06	39	4·01	35	3·92	32	3·95	33	4·08	18
6	4·21	55	4·03	36	3·99	34	3·92	32	3·95	33		18
7	4·19	52	4·05	38	3·99	34	3·92	32	3·95	33		18
8	4·17	50	4·07	40	4·01	35	3·92	32	3·95	33	4·12	18
9	4·15	48	4·07	40	4·05	38	3·92	32	3·95	33		17
10	4·13	45	4·07	40	4·07	40	3·92	32	3·95	33	..	16
11	4·15	48	4·07	40	4·07	40	3·95	33	3·95	33	4·17	15
12	4·17	50	4·07	40	4·07	40	3·97	33	3·95	33		15
13	4·17	50	4·07	40	4·07	40	4·01	35	3·95	33		14
14	4·17	50	4·07	40	4·07	40	4·04	37	3·95	31	4·22	14
15	4·17	50	4·07	40	4·08	40	4·07	40	3·96	30		13
16	4·17	50	4·07	40	4·09	41	3·97	33	3·96	29		13
17	4·17	50	4·07	40	4·09	41	3·97	33	3·96	28	4·32	12
18	4·17	50	4·06	40	4·08	40	3·97	33	3·96	27		12
19	4·17	50	4·07	40	4·07	40	3·97	33	3·96	26		11
20	4·17	50	4·07	40	4·07	40	3·97	33	3·96	25	4·14	11
21	4·17	50	4·07	40	4·04	37	3·97	33	3·96	25		11
22	4·16	49	4·07	40	4·02	36	3·97	33	3·97	24		12
23	4·15	48	4·07	[illegible]	3·99	34	3·97	33	3·97	24		12
24	4·12	44	4·06	39	3·97	33	3·97	33	3·97	23	4·27	12
25	4·09	41	4·05	38	3·97	33	3·97	33	3·97	23		11
26	4·07	40	4·04	37	3·97	33	3·97	33	3·97	22		10
27	4·07	40	4·07	40	3·97	33	3·97	33	3·97	22		10
28	4·07	40	4·11	43	3·97	33	3·96	33	3·97	21	4·67	9
29	4·07	40	4·15	48	3·97	33	3·95	33	3·97	21		8
30	4·07	40	4·11	43	3·97	33	3·94	33	3·97	20		7
31	4·07	40	4·07	40			3·95	33				6

MONTHLY DISCHARGE of Little Saskatchewan River at Bilbey's Bridge, for the year 1914.

[Drainage area, 1,120 square miles.]

Month	Discharge in Second Feet				Run-Off.	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage area	Total in acre feet
April			*850	0.680	0.840	50,578
May	800	282	517	0.462	0.532	31,800
June	310	81	[illegible]	0.172	0.192	11,500
July	73	40	[illegible]	0.046	0.053	3,075
August	48	36	[illegible]	0.035	0.041	2,460
September	41	33	[illegible]	0.032	0.035	2,150
October	40	32	33	0.027	0.032	2,030
November	31	20	28	0.025	0.028	1,670
December	19	6	13	0.011	0.012	799
The period	800	6	196	0.165	1.766	106,062

NOTE.—*Estimated.

LITTLE SASKATCHEWAN RIVER AT MINNEDOSA.

History.—A station was first established on the Little Saskatchewan at Minnedosa in October, 1912, by W. G. Worden, at the highway bridge within the town. This was abandoned, and later one was established by C. O. Allen at the power-house on July 13, 1914. This latter station is still in operation.

Location of Section.—On the upstream side of the traffic bridge crossing the Minnedosa Power Company's intake, and about three-quarters of a mile from the Canadian Pacific Railway station.

Records available.—A gauge height record was kept at the old station on the highway bridge from October 14 to November 2, 1912. A record of daily gauge heights has been kept at the head-and-tail water of the Minnedosa Power Company from June 2, 1914, to the end of the year.

Drainage Area.—The drainage area above Minnedosa is 1,200 square miles. The area is not significant in this case, as the station is only used to determine the discharge through the power plant.

Gauge.—The gauge in the head-race is a 6-foot vertical staff enamelled gauge fastened to the intake wall of the power plant on the left-hand side. The tail-race gauge is a 6-foot vertical staff enamelled gauge fastened to the side of the retaining wall in the tail-race on the right-hand side.

Channel.—The channel at the meter section is that formed by the intake for the power plant.

Discharge Measurements.—These are taken from the bridge across the intake.

Accuracy.—Owing to the fact that the discharge is controlled entirely by the operation of the power station, quite irrespective of gauge heights, no discharge curve has been constructed.

Discharge Measurements of Little Saskatchewan River at Minnedosa, 1912-13.

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1912				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
Oct.	1	Worden Lamb	1497	101	377	2.52	101.11	950
1913								
July	11	C. O. Allen	1700	20	156	0.58	1,617.08	91
Aug.	6	M. S. Madden	1700	20	108	0.80	[illegible].58	86
"	27	A. Pirie	1910	20	108	0.95	44.90	102
"	27		1910	20	108	0.91	44.90	99
Sept.	21	M. S. Madden	1912	20	129	0.76	45.86	99
Oct.	24		1912	20	161	0.62	47.38	102
Nov.	13		1912	20	169	0.54	47.83	91
Dec.	3	F. J. Moore	1920	18	105	0.92	45.21	97

Little Saskatchewan River at Riverdale.

History.—The station at Riverdale was established by G. J. Lamb on January 24, 1914, and was abandoned on the 30th of May, 1914, on account of the operation of the power plant at Minnedosa, causing extreme fluctuation in stages and rendering estimates of daily discharge based thereon unsatisfactory.

Location of Section.—The meter section was located at the traffic bridge in the N.W. ¼ sec., 14, tp. 14, R. 19, W. 1 M., half a mile north of Riverdale station and one-eighth of a mile west of the Canadian Pacific Railway track. The initial point was a point painted on the handrail of the bridge at the south end on the downstream side.

Records available.—Daily gauge height records were kept from January 24, 1913, to May 30, 1914, except during the winter season, when intermittent records were kept. A number of discharge measurements were taken, and a record of the estimated daily discharge based thereon is available for the open-water season.

Drainage Area.—The area tributary to the Little Saskatchewan above Riverdale is 1,250 square miles.

Gauge.—The gauge was a 6-foot vertical staff enamelled gauge fastened to a plank driven into the bed of the river and spiked to the stringer of the pile bent under the bridge.

Channel.—The channel is straight for 200 feet above and 200 feet below the section. The bed of the stream is fairly permanent, and the banks, though fairly high, are subject to overflow for extreme stages.

Discharge Measurements.—The measurements were made from the downstream side of the traffic bridge.

Accuracy.—The discharge curve is well defined over a range in stage of about 2·5 feet. Owing to the operation of the plant at Minnedosa, considerable fluctuation was caused in the stage. The station was therefore discontinued.

Discharge Measurements of Little Saskatchewan River at Riverdale, 1913-14.

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge.
1913				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
Jan.	24	G. J. Lamb	1371	77	68	0.85	103.17	57
Feb.	18	A. Pirie	1462	65	69	0.89	104.34	61
April	16	S. S. Scovil	1400	95	318	3.03	105.15	960
May	8	L. Bankson	1469	91	241	2.55	104.20	617
July	1	A. Pirie	1406	93	225	1.91	103.71	430
Aug.	8	W. J. Ireland	1469	87	151	1.01	103.18	168
Sept.	11	"	1469	88	[illegible]	0.[illegible]	102.84	89
Oct.	17	C. O. Allen	1435	81	118	[illegible]	102.88	86
Nov.	23	"	[illegible]	82	93	[illegible]	102.93	[illegible]
1914								
Jan.	12	F. J. Hodge	1462	41	21	0.35	102.20	[1]7

[1]Measurement taken under ice conditions.

Daily Gauge Height and Discharge of Little Saskatchewan River at Riverdale, for 1913.

[Drainage area, 1,250 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1							4·10	552	4·80	852	3·77	413
2							4·16	577	4·70	808	3·77	413
3							4·36	661	4·96	922	3·70	384
4							4·56	746	4·36	661	3·86	451
5							4·48	712	4·95	918	3·80	426
6			4·40		4·16		4·53	733	4·43	691	3·20	180
7							4·58	755	4·20	594	3·50	300
8							4·62	773	4·20	594	3·85	447
9							4·66	790	4·11	556	3·60	342
10							4·70	808	4·10	552	3·95	489
11							6·10	1,424	4·60	764	3·10	142
12							7·50	2,040	4·30	636	3·48	292
13			4·20		4·50		6·70	1,688	4·00	510	3·30	220
14							6·00	1,380	4·00	510	3·40	260
15							5·20	1,028	4·00	510	3·30	220
16							5·42	1,125	3·90	468	3·70	384
17							5·31	1,076	3·90	468	3·40	260
18			4·35				5·10	984	3·29	216	3·47	288
19							5·71	1,252	3·29	216	3·80	426
20			4·93		4·63		5·92	1,345	3·19	176	3·30	220
21							5·61	1,208	3·90	468	3·14	157
22							5·21	1,032	3·88	459	3·62	350
23							5·51	1,164	3·78	418	3·73	397
24	3·17						5·11	988	3·80	426	3·60	342
25							5·00	1,336	3·97	497	3·23	192
26							5·10	981	3·87	455	3·45	280
27			4·44		4·95		5·70	1,248	3·80	426	3·65	363
28							5·30	1,072	3·80	426	3·60	342
29							5·20	1,028	3·80	426	3·70	384
30	2·95						4·00	510	3·80	426	3·70	384
31									3·18	172		

Day.	July.		August.		September.		October.		November.		December.	
1	3·80	426	3·60	342	3·00	112	2·50	28	3·61			
2	3·50	300	3·40	260	2·49	27	2·60	40	3·41			
3	3·60	342	3·40	260	3·00	112	2·90	89	3·00			
4	3·46	284	3·44	276	2·69	51	2·28	11	3·10			
5	3·80	426	3·30	220	2·49	27	2·90	89	2·49		3·52	
6	3·60	342	3·20	180	2·28	11	2·80	70	3·21			
7	3·80	426	3·30	220	2·90	89	2·80	70	2·90			
8	3·47	288	3·92	476	2·70	52	2·90	89	2·90			
9	3·80	426	3·61	346	2·90	89	2·47	26	2·40			
10	3·56	325	3·83	439	2·88	85	2·90	89	3·83			
11	3·80	426	3·30	220	2·88	85	2·68	50	2·30			
12	3·48	292	3·20	180	2·24	10	2·90	89	2·90		3·04	
13	3·70	384	3·00	112	2·50	28	2·70	52	2·49			
14	3·48	292	3·20	180	2·80	70	2·90	89	3·40			
15	3·90	468	3·10	142	2·44	23	2·80	70	3·41			
16	3·29	216	3·10	142	2·45	24	2·27	11				
17	3·80	426	3·10	142	2·50	28	2·47	26				
18	3·90	468	2·89	87	2·80	70	2·80	70				
19	4·00	510	3·20	180	2·80	70	2·70	52			3·42	
20	3·90	468	3·22	188	2·45	24	2·68	50				
21	3·49	296	3·42	268	2·50	28	2·87	85	2·92			
22	3·90	468	3·83	439	2·83	76	2·68	50				
23	3·80	426	3·81	430	2·90	89	2·88	85				
24	3·66	367	3·30	220	2·80	70	2·48	26				
25	3·26	204	3·42	268	2·80	70	[illegible]	70				
26	3·60	342	3·10	142	2·50	28		11			3·38	
27	3·60	342	3·00	112	2·60	40		26				
28	3·85	447	2·89	87	2·60	40		70	3·10			
29	3·60	342	3·00	112	2·90	89		52				
30	3·46	284	3·40	260	2·40	20	[illegible]					
31	3·70	384	3·00	112			[illegible]					

DAILY GAUGE HEIGHT AND DISCHARGE of Little Saskatchewan River at Riverdale, for 1914.

[Drainage area, 1,250 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft.
1									3·70	384		
2									3·64	359		
3	2·18						5·73	1,264	3·58	334		
4							5·84	1,310	3·54	317		
5							5·90	1,336	3·60	342		
6			4·34		5·90		5·74	1,266	3·90	468		
7							5·52	1,469	4·20	594		
8							5·54	1,478	4·60	764		
9	0·00						5·70	1,248	4·80	852		
10	2·00	7·4					5·64	1,222	4·40	678		
11							5·50	1,160	4·44	569		
12	2·20						5·31	1,076	4·60	764		
13			4·12		5·24		5·32	1,081	4·70	808		
14							5·12	903	4·64	782		
15							5·14	1,002	4·50	552		
16	3·44						4·94	914	4·54	738		
17							4·96	922	4·52	729		
18							4·40	678	4·30	636		
19							4·00	510	4·32	644		
20					5·52		4·33	649	4·30	636		
21							4·17	707	4·20	594		
22							5·00	1,204	4·11	569		
23	4·10						4·10	552	4·10	552		
24							4·84	870	4·02	518		
25							5·50	1,160	4·00	510		
26							4·20	594	4·20	594		
27					5·22		4·18	586	4·00	510		
28							4·04	527	4·16	703		
29							4·00	510	4·30	636		
30	4·20						4·10	552	4·12	560		

MONTHLY DISCHARGE of Little Saskatchewan River at Riverdale, for the years 1913-14.

[Drainage area, 1,250 square miles.]

Month.	Discharge in Second-Feet				Run-Off	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
1913						
January			[1]50	0·040	0·046	3,074
February			[1]60	0·048	0·050	3,332
March			[1]60	0·048	0·056	3,689
April	2,040	510	1,034	0·827	0·923	61,530
May	922	172	523	0·418	0·482	32,158
June	489	142	325	0·260	0·290	19,339
July	510	201	369	0·295	0·340	22,700
August	476	87	227	0·181	0·209	14,000
September	112	10	55	0·044	0·049	3,275
October	264	11	65	0·052	0·060	4,000
November			[1]50	0·040	0·045	2,980
December			[1]20	0·016	0·019	1,230
The period	2,040	10	237	0·189	2·569	171,307
1914						
January			[1]20	0·016	0·019	1,230
February			[1]20	0·016	0·017	1,111
March			[1]20	0·016	0·019	1,230
April	1,336	510	[1]937	0·750	0·837	55,755
May	808	317	[1]590	0·472	0·544	36,278
The period	1,336	317	[1]317	0·254	1·436	95,604

NOTE.—[1]Estimated.

SOURIS RIVER.

The source of the Souris river is in the province of Saskatchewan, northwest of the town of Weyburn. The course of the river from its source is generally southeast, crossing the international boundary into the state of North Dakota in tp.1 –, R. 34 –, W. 2 M. After crossing the boundary it bends northeast, re-crossing the international boundary to the east of the boundary between Saskatchewan and Manitoba, and flowing in a general northeastern direction to its junction with the Assiniboine river near the city of Brando. .

The drainage area of the Souris is very large when compared with the discharge, the basin being 22,860 square miles in extent. It will be noted by reference to the following tables that the run-off from this large area is very small.

The area drained is largely settled and under cultivation, the soil being of a gravelly nature, lightly overlaid by an alluvial deposit. The land is largely open prairie, with very little timber to be found.

In the upper part the river valley is not deep, but as the mouth is approached the depth is increased until banks of from 150 feet to 200 feet are encountered.

The district drained is about the most closely settled to be found in the province and, in consequence, where the supply of water for various purposes depends upon the river, the gathering of discharge data is important.

SOURIS RIVER AT WAWANESA.

History.—The station on the Souris at Wawanesa was established on October 7 1912, by W. G. Worden.

Location of Section.—The meter section is located on the downstream side of the traffic bridge across the Souris river, one-quarter of a mile north of Wawanesa. The initial point is an arrow carved and painted on the guard-rail at the intersection of the girder and the guard-rail on the down-stream side of the bridge at the south end.

Records available. Daily gauge heights are available for the open-water seasons over the period October 7, 1912, to the end of 1914. During the winter season the gauge heights were obtained at intervals of several days. Estimates of daily discharge have been prepared for the open-water seasons during the period October 7, 1912, to the end of 1914. There was not sufficient information to estimate daily discharges during the winter season.

Drainage Area.—The drainage area of the Souris above Wawanesa is 22,500 square miles, part of which lies south of the international boundary.

Gauge.—A 6-foot vertical staff enamelled gauge is fastened to a post which is secured in the bed of the river 100 feet below the section and 12 feet from the south bank. This gauge is referred to a bench-mark set to arbitrary datum and located on a bolt-head at the southeast end of the bridge, marked W P.S. B.M.

Channel.—For 200 feet above the section and 600 feet below, the channel is straight; the bed of the river is composed of sand and gravel and not liable to shift. The right bank of the stream is moderately high and not liable to overflow. The left bank is low, marshy, and rather thickly wooded with small trees and scrub, and is liable to overflow at high stages.

Discharge Measurements.—The meterings are taken from the down-stream side of the bridge.

Accuracy. Between gauge heights 100·7 and 102·0 the discharge curve is well defined. Between 102·0 and 104·5 the curve is fairly well defined. Beyond these limits the curve is not well defined.

Discharge Measurements of Souris River at Wawanesa, 1912-14.

Date.	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity.	Gauge Height	Discharge.
1912			Feet.	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
Oct. 7	W. G. Worden	1196	85	169	0·53	101·18	90
Oct. 26	G. J. Lamb	1186	86	162	0·55	101·17	89
1913							
Jan 29	G. J. Lamb	1371	22	20	0·38	101·61	8[1]
April 15	E. Bankson	1169	94	437	2·51	103·93	1,098
May 7	E. Bankson	1169	96	476	3·01	104·59	1,434
June 30	A. Pirie	1196	86	156	0·57	101·17	89
Aug. 11	W. J. Ireland	1169	85	129	0·32	100·88	42
Sept 10	W. J. Ireland	1169	85	132	0·35	100·95	46
1914.							
Jan. 10	L. J. Budge	1162	61	35	0·12	101·00	4
April 22	M. S. Madden	1162	94	389	2·55	103·59	992
May 8	C. O. Allen	1197	93	391	2·44	103·48	954
June 4	"	1760	90	234	1·29	101·91	303
July 11	"	1760	[illegible]	200	0·97	101·19	194
Aug. 5	M. S. Madden	1760	87	163	0·70	101·32	115
" 25	A. Pirie	1940	86	149	0·54	101·21	81
Sept 19	M. S. Madden	1911	83	134	0·31	100·94	41
Oct 19	"	1912	82	114	0·15	100·82	17
Nov 11	"	1912	81	107	0·10	100·74	11
Dec. 11	T. J. Moore	1920	84	48	0·09	100·87	4[1]

[1] Measurement taken under ice conditions.

Daily Gauge Height and Discharge of Souris River at Wawanesa, for 1912.

(Drainage Area, 22,500 square miles.)

Day.	July.		August		September		October		November.		December.	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge.
	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft.
1									1·12	77		
2									1·21	96		
3									1·18	90		
4									1·24	103		
5									1·12	77		
6									1·08	69		
7							1·18	90	1·09	71	1·34	
8							1·18	90	1·10	73		
9							1·20	94	1·07	67		
10							1·20	94	1·11	75		
11							1·18	90	1·13	79		
12							1·18	90	1·13	79		
13							1·18	90	1·11	75		
14							1·19	92	1·10	73	1·44	
15							1·21	96	1·09	71		
16							1·17	88	1·45	154		
17							1·18	90	1·29	114		
18							1·17	88	1·18	90		
19							1·19	92	1·24	103		
20							1·17	88	1·22	98		
21							1·16	86	1·20	94	1·65	
22							1·17	88	1·32	121		
23							1·16	86	0·83	25		
24							1·11	81	1·30			
25							1·17	88	1·04			
26							1·17	88	1·34			
27							1·15	84	1·23			
28							1·15	84	1·31		1·51	
29							1·16	86	1·31			
30							1·17	88	1·31			
31							1·14	81				

Note.—Ice conditions November 23 to end of year. Data not sufficient to compute discharge.

Daily Gauge Height and Discharge of Souris River at Wawanesa, for 1913.

[Drainage Area, 22,500 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·65		1·76				4·57	1,485	1·97	323
2									4·58	1,490	1·90	298
3									4·59	1,495	1·86	284
4	1·49								4·54	1,470	1·75	246
5									4·51	1,455	1·85	280
6									4·51	1,455	1·80	262
7									4·50	1,450	1·70	229
8			1·31		1·76				4·48	1,440	1·67	220
9									4·46	1,430	1·64	210
10									4·41	1,405	1·62	204
11	1·30								4·35	1,375	1·55	183
12									4·27	1,335	1·53	176
13									4·20	1,300	1·50	167
14									4·11	1,255	1·50	167
15			1·18		2·90		3·92	1,160	3·97	1,185	1·50	167
16							3·92	1,160	3·74	1,070	1·49	164
17							4·03	1,215	3·53	965	1·43	148
18	1·75						4·16	1,280	3·34	878	1·37	133
19							4·29	1,345	3·16	797	1·36	130
20							4·35	1,375	2·93	695	1·31	118
21							4·42	1,410	2·73	612	1·25	105
22			1·91		3·29		4·46	1,430	2·62	568	1·18	90
23							4·51	1,455	2·54	536	1·17	88
24							4·52	1,460	2·49	516	1·16	86
25							4·55	1,475	2·43	493	1·12	77
26							4·55	1,475	2·37	470	1·09	71
27							4·54	1,470	2·27	433	1·09	71
28							4·51	1,455	2·27	433	1·23	101
29	1·61				3·01		4·51	1,455	2·22	414	1·23	101
30							4·51	1,455	2·13	381	1·17	88
31									2·06	356		

Day.	July.		August.		September.		October.		November.		December.	
1			0·87	31	0·92	40	0·93	41	0·86	30		
2	1·10	73	0·87	31	0·90	36	0·93	41	0·81	26		
3	1·09	71	0·86	30	0·92	40	0·94	43	0·88	33		
4	1·08	69	0·86	30	0·93	41	0·93	41	0·84	26		
5	1·06	65	0·85	28	0·93	41	0·88	33	0·83	25		
6	1·02	58	0·85	28	0·96	47	0·86	30	0·85	28		
7	1·02	58	0·87	31	0·95	45	0·85	28	0·85	28		
8	0·98	50	0·85	28	0·95	45	0·88	33	0·83	25		
9	0·97	49	0·85	28	0·92	40	0·89	31	0·82	23		
10	0·98	50	0·87	31	0·95	45	0·96	47	0·79	19		
11	1·02	58	0·88	33	0·95	45	0·95	45	0·83	25		
12	1·04	62	0·88	33	0·96	47	0·95	45	0·82	25		
13	1·05	64	0·88	33	0·95	45	0·98	50	0·83	25		
14	1·08	69	0·88	33	0·93	41	0·96	47	0·83	25		
15	1·03	60	0·94	43	0·93	41	0·93	41	0·83	25		
16	1·03	60	0·87		0·93	41	0·90	36	0·85	28		
17	1·02	58	0·95	45	0·94	43	0·94	43	0·88	33		
18	0·97	49	0·94	43	0·94	43	0·92	40	0·88	33		
19	0·95	45	1·01	56	0·96	47	0·91	38	0·89	34		
20	0·93	41	0·91	43	0·99	52	0·90	36	0·92	40		
21	0·92	40	1·06	65	0·95	45	0·83	25	0·86	30		
22	0·91	38	1·06	65	0·90	36	0·88	33	0·89	31		
23	0·90	36	1·03	60	0·95	45	0·90	36	0·89			
24	0·89	34	1·03	60	1·00	54	0·91	38	0·89			
25	0·90	36	1·02	58	0·99	52	0·92	40	0·98			
26	0·88	33	1·02	58	0·90	36	0·90	36	0·93			
27	0·87	31	1·01	56	0·96	47	0·91	38	0·92			
28	0·86	30	0·97	49	0·94	43	0·83	25	0·88			
29	0·86	30	0·94	43	0·91	43	0·86	30	0·95			
30	0·86	30	0·91	43	0·91	43	0·86	30	0·89			
31	0·86	30	0·91	43			0·87	31				

Note.—Ice conditions January 1 to April 14; data not sufficient to compute daily discharge. Ice conditions November 22 to end of year, data not sufficient to compute daily discharge.

Daily Gauge Height and Discharge of Souris River at Wawanesa, for 1914.

[Drainage area, 22,500 square miles.]

Day.	January.		February.		March.		April		May.		June.	
	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1							3·20		3·33	874	1·98	327
2							3·34		3·30	860	1·96	320
3							3·14		3·36	887	1·92	305
4							3·05		3·42	914	1·90	298
5							3·00		3·60	1,000	1·96	320
6							3·07		3·57	985	1·92	305
7							3·06		3·55	975	2·00	334
8							3·14		3·46	932	1·93	309
9	1·08	4					3·18		3·38	896	1·90	298
10							3·20		3·34	878	1·94	312
11							3·37		3·26	842	1·92	305
12							3·26		3·26	842	1·88	291
13									3·20	815	1·79	259
14							3·07		3·13	784	1·72	236
15							2·91		3·06	752	1·67	220
16							2·68	592	2·98	716	1·61	201
17							3·44	923	2·88	674	1·58	192
18							3·45	928	2·78	633	1·59	195
19							3·44	923	2·74	616	1·56	186
20							3·53	965	2·65	580	1·55	183
21							3·60	1,000	2·52	528	1·53	176
22							3·58	990	2·42	489	1·54	179
23							3·71	1,055	2·35	463	1·52	173
24							3·76	1,080	2·28	437	1·51	170
25							3·78	1,090	2·26	429	1·52	173
26							3·78	1,090	2·19	403	1·50	167
27							3·75	1,075	2·21	411	1·48	162
28							3·66	1,030	2·21	411		
29							3·58	990	2·20	407	1·48	162
30							3·48	941	2·12	381	1·52	173
31									2·04	348		

Day.	July.		August		September		October		November.		December.	
1	1·55	183	1·35	128	1·14	81	0·86	30	0·95	45	0·98	
2	1·54	179	1·35	128	1·12	77	0·84	26	0·92	40	0·98	
3	1·58	192	1·35	128	1·11	75	0·84	26	0·85	28	0·98	
4	1·62	204	1·36	130	1·10	73	0·84	26	0·81	22	0·98	
5	1·60	198	1·30	116	1·07	67	0·84	27	0·78	17	0·98	
6	1·60	198	1·32	121	1·06	65	0·82	23	0·76	14	0·97	
7	1·56	186	1·31	118	1·05	64	0·83	25	0·75	13	0·97	
8	1·54	179	1·25	105	1·05	64	0·89	34	0·74	11	0·96	
9	1·56	186	1·27	109	1·05	64	0·91	38	0·75	13	0·94	
10	1·59	195	1·25	105	1·03	60	0·91	38	0·81	22	0·87	
11	1·54	179	1·23	101	1·02	58	0·91	38	0·74	11	0·94	4
12	1·57	189	1·22	98	1·01	56	0·88	33	0·75	13	1·00	
13	1·53	176	1·22	98	1·00	54	0·89	34	0·82	23	1·03	
14	1·52	173	1·21	96	0·96	47	0·87	31	0·79	18	1·04	
15	1·50	167	1·18	90	0·98	50	0·88	33	0·90	36	1·03	
16	1·48	162	1·17	88	0·99	52	0·86	30	0·94	43	0·98	
17	1·47	159	1·14	81	0·98	50	0·85	28	0·98	50	0·90	
18	1·45	154	1·13	79	0·96	47	0·84	26	0·98	50	0·93	
19	1·48	162	1·11	75	0·95	45	0·82	23			0·99	
20	1·47	159	1·11	75	0·97	49	0·83	25			1·09	
21	1·43	148	1·11	75	1·03	60	0·85	28	0·99			
22	1·41	143	1·12	77	1·02	58	0·85	28				
23	1·39	138	1·13	79	1·00	54	0·82	23			1·17	
24	1·38	135	1·12	77	0·98	50	0·81	22			1·21	
25	1·39	138	1·19	92	0·96	47	0·80	20	1·09		1·21	
26	1·37	133	1·20	94	0·94	43	0·78	17	1·13		1·21	
27	1·36	130	1·20	94	0·92	40	0·78	17	1·09		1·14	
28	1·35	128	1·21	96	0·89	34	0·77	16	1·07		1·10	
29	1·33	123	1·20	94	0·89	34	0·81	22	1·05		1·03	
30	1·35	128			0·88	33	0·96	47			1·00	
31	1·37	133					0·96	47			0·98	

NOTE.—Ice conditions January 1 to April 15; data not sufficient to compute daily discharge. Ice conditions November 18 to end of year.

MONTHLY DISCHARGE of Souris River at Wawanesa, for the year 1912-14.

[Drainage area, 22,500 square miles.]

Month.	Discharge in Second Feet: Maximum	Minimum	Mean	Per square mile	Run-off: Depth in inches on Drainage area	Total in acre-feet
1912						
October	96	81	¹80	0.004	0.005	4,925
November			¹54	0.002	0.002	3,225
December						
The period	96	81	67	0.003	0.007	8,150
1913						
January			¹10	0.0004	0.0005	615
February						
March						
April	1,475		966	0.043	0.048	57,500
May	1,495	256	988	0.044	0.051	60,800
June	323	71	166	0.007	0.008	9,900
July	73	30	48	0.002	0.002	2,950
August	65	28	42	0.002	0.002	2,580
September	54	36	44	0.002	0.002	2,625
October	50	25	37	0.002	0.002	2,280
November	40		¹25	0.001	0.001	1,490
December			¹15	0.0007	0.0008	922
The period	1,495	8	257	0.0101	0.1173	111,662
1914						
January			¹5	0.0002	0.0002	307
February		¹0	¹5			
March						
April	1,090		500	0.022	0.025	29,750
May	1,100	348	683	0.030	0.035	41,900
June	334	162	239	0.011	0.012	14,200
July	204	123	163	0.007	0.008	10,000
August	130	75	98	0.004	0.005	6,050
September	81	33	55	0.002	0.002	3,275
October	47	16	28	0.001	0.001	1,720
November	50		¹20	0.0009	0.001	1,190
December			¹5	0.0002	0.0002	307
The period	1,100	0	163	0.0078	0.0891	108,[illegible]

NOTE.—Measurements marked thus ¹ estimated; data not sufficient to estimate discharge for December 1912, February and March 1913 and March 1914.

CYPRESS RIVER.

The Cypress river forms a small tributary of the Assiniboine, entering the latter in Tp. 8, R. 11, W. P. M. It has a drainage area of 185 square miles, the source being on the northwestern slope of the Pembina mountains. From source to mouth its course takes the form of a large bow, bending first west then north. The country drained is all under cultivation, but was low lying and required drainage; for this purpose a ditch was cut across the loop just referred to, and at present this carries the greater part of the water flowing in the river. During the summer and winter months there is no discharge, as practically all the discharge occurs during the spring freshet and following the rain in the fall.

Cypress River at Cypress River.

History.—This station was established on October 29, 1912, by G. J. Lamb, but was discontinued on January 11, 1913.

Location of section.—The section is located on the downstream side of the traffic bridge on the east and west road, one-half mile south and one-half mile east of Cypress river, Manitoba. The initial point is an arrow curved on top of the hand rail of the bridge at the west end on the downstream side.

Records Available.—Sufficient information is not available to admit of daily discharge estimates, but a few meterings were taken at the station.

Drainage Area.—The drainage area tributary to the Cypress river is 170 square miles above Cypress river.

Gauge.—A 6-foot vertical staff gauge was established at the station.

Channel.—The channel is straight both above and below the section for a considerable distance. The stream is confined to the channel at all stages, the bed being of a sandy nature, and permanent.

Discharge Measurements.—Discharge measurements are taken from the downstream side of the bridge.

Discharge Measurements of Cypress River at Cypress River, 1912.

Date	Hydrographer	Meter No.	Width.	Area of Section	Mean Velocity	Gauge Height.	Discharge.
1912			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 9	G. J. Lamb	1496	31	28·1	1·47	100·75	41·4
" 27	"	1186	28	15·6	0·76	101·18	12·0

PIPESTONE CREEK.

The Pipestone creek drains into Oak lake, which lies in Tp. 8, R. 25, W.P.M. It has a small drainage area which lies to the south and west of the Assiniboine river and to the north of the Souris river.

Oak lake, into which the Pipestone drains, has no visible outlet, evaporation and seepage accounts for all the inflow to the lake. The stream flows through a well cultivated district, and forms a source of water supply for domestic and farm purposes.

Pipestone Creek at Cromer.

History.—This station was established by Alex. Pirie on August 24, 1912.

Location of Section.—The meter section is located one-half mile below the Canadian Northern Railway bridge at Cromer.

Records Available.—A daily gauge height record from August 25 to October 26, 1912, has been obtained, and this, together with the discharge measurements made at the section, constitute the records for the station.

Drainage Area.—The drainage area of Pipestone creek is 1,580 square miles.

Gauge.—A vertical staff gauge was fastened to a pile at the east end of the railway bridge at Cromer.

Channel.—The stream is confined to one channel at all stages. For 100 feet above and 200 feet below the section the stream's course is straight. The bed of the stream is of gravel, the banks are high and covered with brush, but are not liable to overflow.

Discharge Measurements.—The discharge measurements are made by wading: the discharge being small it is possible to obtain the meterings by this method under nearly all stages.

DISCHARGE MEASUREMENTS of Pipestone Creek at Cromer, 1912-13.

Date.	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1912			Feet	Sq. ft	Ft. per sec.	Feet	Sec.-ft.
Aug 24	Alex. Pirie	1197	22	15	0·54	[illegible]	8
1913							
Aug 12	W. J. Ireland	1160	32	26	0·47	[illegible]	12
Sept 21	"	1160	24	15	0·84	[illegible]	11

TRIBUTARIES OF LAKE WINNIPEGOSIS.

General.—Practically all of the country west of lake Manitoba and between the Riding mountains and the Saskatchewan river drains directly or indirectly into lake Winnipegosis.

Three small lakes act as intermediate basins, and to these the greater part of the drainage first finds its way, being drained from them into the first named lake.

These lakes are: Red Deer lake, into which Red Deer river drains, and is then drained by the lower end of the same river into Dawson bay, an arm of lake Winnipegosis. Swan lake, drained by the Shoal river into the same bay which is the collecting basin for the Swan and Woody rivers. Lake Dauphin, drained by the Mossy river, and having as tributaries among others, the Valley and Ochre rivers. The Fork river is a tributary of the Mossy.

RED DEER RIVER.

The source of the Red Deer river is in Tp. 44, R. 19, west of the Second meridian, south of Melfort, Sask. It flows in a general easterly direction into Red Deer lake, an expanse of the river, and also drains that lake into lake Winnipeg.

The total drainage area of the Red Deer is 5,478 square miles, including Red Deer lake, which has an area of 100 square miles. The valley through which the river flows is deep and wide. In the upper portion the tributaries which head in small lakes and swamps are the Fir, Etoimami, Pipestone, and Barrier rivers, nearly all of which enter from the south.

The upper portion of the drainage area is well timbered, growths of spruce and poplar of merchantable size being found. The Red Deer Lumber Company carry on lumbering operations on the river, and operate a saw-mill on Red Deer lake, the logs being floated downstream to the mill.

The Canadian Northern railway crosses the river at Erwood, 30 miles west of the lake, and a spur line has been built in from Powell to touch the west end of the lake at Barrows.

RED DEER RIVER AT ERWOOD.

History.—This station was established by C. O. Allen on May 23, 1914, with the object of ascertaining the desirability of locating a meter section at this point. After two measurements were made the station was discontinued.

Location of Section.—The meter section is located on the downstream side of the Canadian Northern Railway bridge at Erwood, 10 miles east of Hudson Bay Junction. The initial point is an iron bolt marked in blue on the east end of the bridge.

Records Available.—Two discharge measurements were taken at this point.

Drainage Area.—The area tributary to the Red Deer river above the station at Erwood is 4,850 square miles.

Gauge.—A vertical staff gauge was fastened to a pile at the east end of the bridge on the downstream side.

Channel.—The channel is straight for 75 feet above the section and 150 feet below. The bed of the stream is rocky and not liable to change. The banks are high and not liable to overflow. There is a slight rapid about 1,000 feet below the station.

Discharge Measurements.—Meterings were made from the downstream side of the railroad bridge; they are two in number.

DISCHARGE MEASUREMENTS of Red Deer River at Erwood, Sask., 1914.

Date.	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity.	Gauge Height	Discharge.
1914			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
May 23	C. O. Allen	1197	158	1,510	2·98	71·72	4,494
June 25	"	1769	101	85[illegible]	0·69	68·90	594

RED DEER RIVER AT HUDSON BAY JUNCTION.

History.—The station on the Red Deer at Hudson Bay Junction was established by G. Ebner on August 12, 1913, which replaced a station established by E. Bankson on June 4, 1913, 400 feet below the ferry.

Location of Section.—The meter section is located at the ferry crossing of the Red Deer river, 500 feet below its confluence with the Elk river, and 3½ miles south of Hudson Bay Junction on the road to the Red Deer Lumber Company's camp. The initial point is marked by a nail driven in a pile 60 feet from the water's edge on the right bank at the ferry crossing.

Records Available.—Records of daily gauge height have been obtained from July 9 to October 31, 1913, and April 30 to November 27, 1914. A few gauge heights are also available, taken during the winter seasons. Estimated daily discharge cover the period July 9 to October 31, 1913, and April 30 to November 27, 1914.

Drainage Area.—The area tributary to the Red Deer above the station at Hudson Bay Junction is 4,900 square miles.

Gauge.—The gauge is a vertical staff gauge driven in the bed of the river, and braced; it is near the right bank, and 40 feet below the section; it is referred to a bench-mark which is located on the cable tower on the south or right bank, the datum of which is arbitrary.

Channel.—The channel is straight for about 500 feet above and below the section, the river is confined to one channel at all stages, the bed of the stream is covered with boulders and not liable to shift. The banks of the river are low and wooded and liable to overflow at high stages.

Discharge Measurements.—Meterings are made from a boat by means of a small Price meter.

Accuracy.—Eleven discharge measurements define the curve fairly well between gauge heights 99·8 and 103·0. Owing to the fact that the Red Deer Lumber Company operate a number of lumber dams on the upper waters of the river, the records do not give a true idea of the natural regimen of the river.

Discharge Measurements of Red Deer River at Hudson Bay Junction, 1913-14.

Date		Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge.
				Feet	Sq. ft.	Ft. per sec.	Feet	Sec. ft.
1913								
June	4	E. Bankson	1409	196	1,036	2·78	101·02	[1]2,871
July	5	G. Ebner	1196	183	927	2·53	102·91	[1]2,342
"	10	A. Pirie	1496	193	880	2·30	102·64	[1]2,034
Aug.	12	G. Ebner	1196	165	765	2·28	102·42	[2]1,747
"	30	W. J. Ireland	1409	162	604	2·05	102·12	1,420
Sept	18	"	1409	162	566	1·36	101·43	768
Oct	6	C. O. Allen	1435	155	528	1·03	101·12	546
Nov	20	A. Pirie	1496	146	407	0·64	101·05	[3]261
Dec.	16	C. O. Allen	1375	153	240	0·49	100·90	[3]118
"	16	"	1375	153	240	0·49	100·90	[3]118
1914								
Jan	22	C. O. Allen	1375	210	278	0·26	100·72	[3]69
Mar	4	D. B. Gow	1374	160	96	0·33		[3]32
"	28	C. O. Allen	1496	65	49	0·68	100·57	[3]33
April	30	"	1497	169	921	3·55	102·86	3,274
June	26	"	1760	155	570	1·31	101·20	750
July	31	W. J. Ireland.	1919	145	384	0·30	100·20	116
Sept	10	H. Boyd	1919	150	322	0·30	100·08	97
Oct	2	M. S. Madden	1911	172	340	0·18	99·79	61
"	29	"	1912	110	320	0·26	100·01	82
Nov	18	F. S. Smith	1186	164	430	0·10	100·10	[3]44

[1] Old station below Ferry.
[2] New station at Ferry from August 12 on.
[3] Ice measurement.

Daily Gauge Height and Discharge of Red Deer River near Hudson Bay Junction, for 1913.

[Drainage Area, 4,900 square miles.]

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1			103·08	2,521	102·10	1,394	101·23	623				
2			102·96	2,383	102·15	1,452	101·19	593				
3			102·81	2,211	102·12	1,417	101·15	569				
4			102·79	2,187	102·10	1,394	101·03	493				
5			102·65	2,027	102·07	1,359	101·10	535				
6			102·52	1,877	102·01	1,291	101·13	555				
7			102·46	1,808	101·97	1,247	101·13	555				
8			102·42	1,762	101·89	1,160	101·13	555				
9	102·77	2,165	102·42	1,762	101·88	1,150	101·13	555				
10	102·61	1,981	102·43	1,774	101·75	1,025	101·14	561				
11	102·71	2,096	102·46	1,808	101·79	1,061	101·16	574				
12	103·33	2,809	102·42	1,762	101·75	1,025	101·19	593				
13	104·06	3,648	102·56	1,923	101·72	998	101·15	568				
14	104·48	4,131	102·53	1,889	101·71	989	101·09	529				
15	104·78	4,476	102·73	2,119	101·56	873	101·06	511				
16	104·93	4,648	103·05	2,487	101·53	849	101·04	499			100·90	118
17	105·01	4,741	102·99	2,417	101·49	817	101·06	511				
18	104·83	4,533	103·00	2,129	101·44	780	101·03	493				
19	104·71	4,396	103·02	2,452	101·41	758	101·01	481				
20	104·50	4,154	102·99	2,417	101·41	758	101·01	481	101·05	261		
21	104·28	3,901	102·95	2,372	101·38	735	100·98	463				
22	104·13	3,728	102·92	2,337	101·38	735	101·01	481				
23	103·96	3,533	102·70	2,084	101·37	727	101·01	481				
24	103·82	3,372	102·70	2,084	101·36	720	101·04	499				
25	103·63	3,154	102·49	1,842	101·35	713	100·93	433				
26	103·77	3,315	102·38	1,716	101·35	713	101·03	493				
27	103·78	3,326	102·25	1,566	101·34	705	101·13	555				
28	99·73	3,268	102·22	1,532	101·34	697	99·93	433				
29	103·58	3,096	102·15	1,452	101·30	675	100·73	322				
30	103·42	2,912	102·09	1,383	101·27	653	101·06	511				
31	103·19	2,647	102·16	1,594			101·06	511				

Note.—Ice conditions from October 30 to December 31, data not sufficient to compute daily discharges.

Daily Gauge Height and Discharge of Red Deer River near Hudson Bay Junction, for 1914.

(Drainage Area, 4,900 square miles.)

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1									102.76	2,153	102.76	2,153
2									102.66	2,038	102.61	1,981
3									102.41	1,754	102.41	1,754
4									103.11	2,556	102.36	1,604
5									103.31	2,786	102.26	1,578
6									103.11	2,556	102.21	1,521
7									103.71	3,246	102.11	1,406
8									103.86	3,418	102.16	1,463
9									104.26	3,788	102.06	1,348
10									104.26	3,878	102.06	1,348
11									104.31	3,936	101.91	1,181
12									104.26	3,878	101.81	1,080
13									103.86	3,418	101.86	1,130
14									103.71	3,246	101.71	980
15									103.66	3,188	101.61	908
16									103.41	2,901	101.43	773
17									103.36	2,843	101.51	833
18									103.21	2,671	101.57	881
19									103.06	2,498	101.43	773
20									103.01	2,441	101.36	720
21									103.81	3,361	101.46	795
22	100.72	72							104.11	3,706	101.31	681
23									104.06	3,648	101.21	608
24									104.01	3,591	101.18	587
25									103.81	3,361	101.18	587
26									103.66	3,188	101.21	608
27									103.51	3,016	101.24	630
28					100.57	33			103.41	2,901	101.11	542
29									103.16	2,613	101.06	511
30							107.86	3,270	102.91	2,326	101.04	499
31									102.81	2,211		

NOTE.—Ice conditions from January 1 to April 15, and from November 10 to December 31, data not sufficient to compute daily discharges.

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	100.96	451	100.19	118	99.81	71	99.79	70	100.04	91		
2	100.91	421	100.11	102	99.81	71	99.79	70	100.04	91		
3	100.86	393	100.11	102	99.81	71	99.84	72	100.11	89		
4	100.83	377	100.09	98	99.86	73	99.89	75	100.14	86		
5	100.83	377	100.06	94	99.86	73	99.89	75	100.24	83		
6	100.79	354	100.01	87	99.96	81	99.94	79	100.31	80		
7	100.76	338	100.01	87	100.01	87	99.89	75	100.32	77		
8	100.73	322	100.01	87	100.01	87	99.89	75	100.32	74		
9	100.81	366	99.96	81	100.06	94	99.94	79	100.31	71		
10	100.76	338	99.93	78	100.04	91	99.99	84	100.24	68		
11	100.71	311	99.91	76	100.04	91	100.04	91	100.31	65		
12	100.71	311	99.89	75	100.04	91	100.04	91	100.32	62		
13	100.66	285	99.89	75	99.99	84	100.04	91	100.24	59		
14	100.66	285	99.86	73	99.99	84	100.04	91	100.24	56		
15	100.66	285	99.86	73	99.99	84	100.04	91	99.99	53		
16	100.71	311	99.84	72	99.99	84	99.99	84	99.91	50		
17	100.68	295	99.81	71	99.94	79	99.99	84	99.99	47	100.23	25
18	100.66	285	99.81	71	99.94	79	99.99	84	99.95	44		
19	100.61	261	99.79	70	99.94	79	99.99	84	99.99	44		
20	100.56	239	99.76	68	99.94	79	99.99	84	100.02	43		
21	100.51	219	99.76	68	99.94	79	99.99	84	100.02	43		
22	100.46	199	99.76	68	99.94	79	99.99	84	100.02	41		
23	100.41	179	99.76	68	99.94	79	99.99	84	99.99	41		
24	100.36	164	99.76	68	99.89	75	99.99	84	99.99	39		
25	100.36	164	99.76	68	99.89	75	99.99	84	99.99	39		
26	100.31	148	99.79	70	99.89	75	99.99	84	99.24	38		
27	100.26	135	99.74	67	99.84	72	99.99	84	99.24	37		
28	100.21	123	99.73	67	99.84	72	100.04	91				
29	100.26	135	99.76	68	99.92	77	100.01	87				
30	100.21	123	99.76	68	99.79	70	100.01	87				
31	100.19	118	99.76	68			100.02	88				

From November 10 to December 31, data not sufficient to compute daily discharges.

Monthly Discharge of Red Deer River near Hudson Bay Junction, for the years 1913-14.

Month	Discharge in Second Feet.				Run Off.	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage area	Total in acre feet
July			a3,480	0.710	0.819	211,000
August	2,521	1,382	2,000	0.408	0.470	122,500
September	1,152	653	962	0.196	0.219	57,200
October	623	322	517	0.106	0.122	31,800
November			a320	0.065	0.073	19,000
December			a140	0.029	0.033	8,600
The period	2,521	a115	1,238	0.252	1.736	451,100
1914						
January			a70	0.014	0.016	4,300
February			a50	0.010	0.010	2,780
March			a30	0.006	0.007	1,850
April			a1,800	0.367	0.410	107,100
May	3,925	1,750	3,000	0.612	0.706	184,900
June	2,150	190	1,050	0.214	0.239	62,600
July	451	118	268	0.055	0.063	16,500
August	118	67	78	0.016	0.018	4,800
September	91	70	80	0.016	0.018	4,775
October	91	70	84	0.017	0.020	5,100
November	91		a60	0.012	0.014	3,575
December			a25	0.005	0.006	1,549
The year	3,925	a25	550	0.112	1.526	399,820

Note.—All marked thus (a) are estimated.

SWAN RIVER.

The Swan river rises on the extreme northwestern slope of the Porcupine mountains. Its course is generally south and east until it reaches a point in Tp. 34, R. 3, W.P.M., when it turns and flows almost due northeast through the valley between Porcupine and Duck mountains into Swan lake.

The valley between the two mountains is broad and deep, but nearly all the drainage entering this section of the river is from the south, most of the tributaries heading in the Duck mountains. To the north the basin is confined by the drainage area of the Woody river, which follows a parallel course to the Swan.

The banks of the valley are an alluvial deposit of clay and gravel. The river has an average width of 150 feet, the banks ranging from 10 to 50 feet in height. The upper parts of the valley are largely covered with a timber growth, but in the lower bottom lands, mixed farming is extensively followed. The valley is well settled, the town of Swan River being the principal community.

In 1909 an investigation of the power possibilities of the river was made and a site located in the vicinity of Swan River, with a view to supplying the town with power.

Swan River at Swan River.

History.—The Swan River station was established by W. [illegible] on October 12, 1912, and has been operated since that date.

Location of Section.—The meter section is located on the [illegible] side of the new steel traffic bridge which spans the Swan river at the north end of the town of Swan River, Man. The initial point is marked on [illegible] of the south abutment at the east side.

Records Available.—Records of daily gauge height are available for part of the period October 12, 1912, to the end of 1914, blanks in the records occur during the winter seasons. Estimated daily discharges are on hand for the periods October 21 to November 16, 1912, April 12 to November 8, 1913, and April 15 to November 15, 1914.

Drainage Area.—The area drained above the station of the Swan river is 1,215 square miles.

Gauge.—A 6 foot vertical staff gauge is fastened to a plank which is spiked to the centre pier of the old bridge, which is downstream from the section.

Channel.—Above the section the channel is straight for 300 feet and also for 200 feet below. The bridge is a clear span, and the river lies in one channel at all stages. The stream-bed is of clay and subject to shifting; the current is swift. The right bank is of clay, is high and not liable to overflow. The left bank is low and wooded and liable to overflow at high stages.

Discharge Measurements.—The meterings are made from the bridge, with a small Price current-meter.

Accuracy.—Between gauge heights 99.30 and 101.80 the discharge curve is well defined, between 101.80 and 104.20 it is fairly well defined.

DISCHARGE MEASUREMENTS of Swan River at Swan River, for 1912.

Date		Hydrographer	Meter No.	Width.	Area of Section	Mean Velocity	Gauge Height	Discharge
1912				Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
Oct	21	W. G. Worden	1,196	129	404	2.51	101.73	1,013
Dec	11	G. J. Lamb	1,187	161	177	.72	100.61	[1]125
1913								
Feb	12	Alex. Pirie	1,169	165	55	1.00	100.49	[1]54
April	12	"	1,169	198			103.30	[2]4,055
"	13	"	1,186	149	782	5.27	104.11	4,115
"	[illegible]	"	1,186	149	782	5.14	104.14	4,248
June		F. Bankson	1,169	138	387	1.50	101.11	583
"	17	G. Elmer	1,186	133	321	1.25	100.69	402
July	8	Alex. Pirie	1,196	144	674	3.88	103.19	2,618
Aug	[illegible]	G. Elmer	1,196	140	342	1.25	100.82	428
"	26	W. J. Ireland	1,169	158	357	1.35	101.12	490
Sept	1	"	1,169	[illegible]	167	1.93	100.65	316
"	23	"	1,169	122	253	0.62	100.16	155
Oct	13	C. O. Allen	1,335	122	258	0.65	100.27	167
Nov	13		1,371	93	182	0.54	100.06	97
Dec	16		1,375	196	157	[illegible]	99.42	55
1914								
Jan	16	C. O. Allen	1,375	71	164	0.31	[illegible]	[illegible]
[illegible]	3	"	1,375	71	167	0.58	101.3	41
Mar	3	D. B. Gow	1,571	93	136	0.25	100.85	27
"	11	C. O. Allen	1,196	89	160	.34	101.10	56
April	27		1,197	150	591	3.07	102.15	1,816
May	24		1,197	160	503	2.07	101.63	1,044
June	7		1,760	129	248	0.52	100.08	128
"	29	"	1,760	127	246	0.45	100.00	113
July	30	W. J. Ireland	1,919	116	166	0.21	99.56	35
Aug	20	A. Pirie	1,940	111	167	0.06	99.29	10
Sept	9	H. Reed	1,929	116	174	0.21	99.66	36
Oct	1	M. S. Madden	1,911	118	17[illegible]	0.13	99.55	21
"	28	"	1,912	123	186	0.23	99.67	42
Nov	19	L. S. Smith	1,186	121	153	0.19	100.04	[7]29
Dec	10	C. O. Allen	1,912	117	132	0.23	[illegible]	[8]31

[1]Measurement taken under ice conditions. [2]Float measurement. [3]Ice (mean thickness 2.32'). [4]Ice (mean thickness [illegible]). [5]Ice (mean thickness 1.61'). [6]Ice (mean thickness 1.73'). [7]Ice (mean thickness 0.5'). [8]Ice (mean thickness [illegible]).

Daily Gauge Height and Discharge of Swan River at Swan River, for 1912.

(Drainage area, 1,215 square miles.)

Day.	July		August		September.		October		November		December	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1									101·31	728		
2									101·08	568		
3									100·91	466		
4									100·89	455		
5									100·89	455		
6									100·90	460		
7									100·91	466		
8									100·90	460		
9									100·89	455		
10									100·89	455		
11									100·88	450	100·61	
12									100·88	450		
13									100·87	445		
14									100·87	445		
15									100·87	445		
16									100·86	440		
17												
18												
19											100·41	
20												
21												
22												
23												
24							101·74	1,070				
25							101·73	1,070				
26							101·69	1,030				
27							101·60	955			100·41	
28							101·53	896				
29							101·52	887				
30							101·46	840				
31							101·43	818				

NOTE.—Ice conditions from November 17 to end of year; data not sufficient to compute daily discharges.

Daily Gauge Height and Discharge of Swan River at Swan River, for 1913.

(Drainage area, 1,215 square miles.)

Day.	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1									101·68	1,029	101·38	780
2									101·63	981	101·31	728
3									101·58	938	101·25	683
4			100·51						101·51	879	101·17	626
5							101·58		101·60	955	101·11	606
6									101·89	1,200	101·11	587
7									102·05	1,350	101·11	787
8									102·01	1,319	101·10	580
9									101·97	1,270	101·05	559
10									101·87	1,190	100·99	514
11			100·53						101·79	1,120	100·93	478
12			100·49				103·58	3,250	101·75	1,080	100·93	478
13							104·14	4,150	101·75	1,080	100·85	435
14							104·21	4,300	101·77	1,100	100·84	430
15					100·29		104·49	4,800	101·79	1,120	100·83	425
16							104·56	4,900	101·79	1,120	100·77	395
17							104·55	4,900	101·84	1,160	100·72	370
18	100·19		100·21				104·21	4,300	101·81	1,130	100·66	341
19							103·99	3,900	101·82	1,140	100·61	317
20							103·74	3,500	101·78	1,110	100·57	299
21							103·63	3,325	101·73	1,070	100·57	299
22							103·68	3,400	101·69	1,030	100·51	274
23							103·55	3,200	101·67	1,020	100·43	242
24							103·35	2,900	101·58	938	100·40	230
25							103·00	2,400	101·55	913	100·47	258
26							102·56	1,850	101·55	913	100·44	246
27							102·22	1,500	101·53	896	101·15	613
28	100·55						102·05	1,350	101·53	896	101·24	675
29							101·91	1,220	101·46	840	101·21	653
30							101·81	1,130	101·46	840	101·29	713
31									101·42	810		

Day.	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	101·57	930	101·22	660	100·69	355	100·16	153	100·32	202		
2	101·91	1,220	101·15	613	100·64	331	100·14	147	[1]100·28	189		
3	102·42	1,700	101·05	550	100·69	355	100·15	150	[1]100·23	174		
4	103·85	3,675	100·86	440	100·71	365	100·13	144	[1]100·19	162		
5	103·76	3,525	100·75	385	100·71	365	100·13	144	[1]100·14	147		
6	103·70	3,425	100·68	350	100·71	365	100·11	138	[1]100·10	135	100·30	
7	103·42	3,000	100·62	322	100·64	331	100·17	156	[1]100·05	120		
8	103·13	2,580	100·57	299	100·60	312	100·17	156	100·00	105		
9	102·86	2,210	100·59	308	100·69	355	100·19	162				
10	102·64	1,930	100·58	304	100·66	341	100·25	180			100·42	
11	102·75	2,070	100·68	350	100·63	326	100·25	180				
12	102·94	2,320	100·80	410	100·53	283	100·27	186				
13	103·15	2,600	100·83	425	100·48	262	100·28	189	100·00			
14	103·27	2,775	100·88	450	100·44	246	100·30	195			100·28	
15	103·20	2,675	101·04	544	100·38	223	100·28	189	99·93			
16	103·15	2,600	101·24	675	100·36	216	100·26	183				
17	103·05	2,475	101·37	773	100·33	206	100·27	186				
18	102·87	2,220	101·40	795	100·29	192	100·23	174				
19	102·59	1,880	101·42	810	100·28	189	100·29	165				
20	102·31	1,590	101·43	818	100·25	180	100·06	123			100·61	
21	102·09	1,380	101·48	855	100·23	174	100·08	129				
22	101·89	1,200	101·52	887	100·22	171	100·31	199	99·96			
23	101·65	998	101·41	803	100·19	162	100·26	183				
24	101·49	863	101·27	698	100·22	171	100·25	180				
25	101·36	765	101·18	632	100·26	183	100·19	162				
26	101·30	720	101·07	562	100·25	180	100·19	162				
27	101·19	639	100·92	472	100·23	174	100·13	144			101·01	
28	101·15	613	100·82	420	100·22	171	100·41	234				
29	101·15	613	100·80	410	100·21	168	100·22	171	100·18			
30	101·32	755	100·71	365	100·21	168	100·26	183				
31	101·28	705	100·64	331			100·28	189				

Note.—Ice conditions from January 1 to April 12 and from November 8 to end of year, data not sufficient to compute daily discharges. All gauge heights marked thus (1) interpolated.

Daily Gauge Height and Discharge of Swan River at Swan River, for 1914.

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1	....	....	....	....	....	....	[1]100·95	....	101·97	1,270	101·00	520
2	....	....	....	....	....	....	[1]100·93	....	101·89	1,200	100·92	472
3	101·02	....	....	....	....	....	100·90	....	101·74	1,070	100·85	435
4	....	....	....	....	....	....	100·95	....	101·71	1,050	100·80	410
5	....	....	....	....	....	....	101·14	....	101·73	1,070	100·75	385
6	....	....	....	....	....	....	101·25	....	102·90	2,260	100·72	370
7	....	....	101·16	....	100·60	....	101·82	....	104·04	3,975	100·67	346
8	....	....	....	....	....	....	101·98	....	103·98	3,875	100·63	326
9	....	....	....	....	....	....	101·63	....	103·91	3,775	100·60	312
10	101·12	....	....	....	....	....	101·64	....	103·74	3,500	100·58	304
11	101·16	....	....	....	....	....	101·44	....	103·43	3,025	100·48	262
12	....	....	....	....	....	....	101·69	....	103·07	2,500	100·42	238
13	....	....	....	....	....	....	102·53	....	102·80	2,130	100·37	220
14	....	....	101·29	....	100·66	....	102·75	....	102·53	1,810	100·31	199
15	....	....	....	....	....	....	102·64	1,940	102·29	1,570	100·27	186
16	101·36	....	....	....	....	....	102·68	1,990	102·10	1,390	100·25	180
17	101·18	....	....	....	....	....	103·15	2,600	101·93	1,240	100·22	171
18	....	....	....	....	....	....	103·24	2,750	101·83	1,150	100·18	159
19	....	....	....	....	....	....	102·65	1,930	101·71	1,050	100·15	150
20	....	....	....	....	....	....	102·97	2,360	101·63	981	100·10	135
21	....	....	100·93	....	100·72	....	102·79	2,120	101·60	955	100·03	114
22	....	....	....	....	....	....	102·65	1,950	101·08	568	100·03	114
23	....	....	....	....	....	....	102·56	1,850	101·74	1,070	100·05	120
24	101·14	....	....	....	....	....	102·51	1,790	[1]101·65	998	100·03	114
25	....	....	....	....	....	....	102·57	1,860	101·56	921	100·00	105
26	....	....	....	....	....	....	102·44	1,720	101·50	870	99·97	98
27	....	....	....	....	....	....	102·38	1,660	101·41	804	99·98	100
28	....	....	100·75	....	101·15	....	102·28	1,560	101·36	765	100·10	135
29	....	....	....	....	....	....	102·14	1,430	101·26	690	99·97	98
30	....	....	....	....	....	....	102·05	1,350	101·17	625	99·95	94
31	101·50	....	....	....	....	....			101·08	568	....	....

Day.	July.		August.		September		October.		November.		December.	
1	99·94	91	99·56	29	99·58	31	99·53	25	99·70	47	99·98	....
2	99·92	87	99·58	31	99·58	31	99·55	28	99·71	49	100·17	....
3	99·91	84	99·56	29	99·58	31	99·57	30	99·72	50	100·28	....
4	99·90	82	99·56	29	99·64	39	99·58	31	99·72	50	100·30	....
5	99·86	74	99·56	29	99·61	34	99·62	36	99·73	52	100·33	....
6	99·85	72	99·54	26	99·64	39	99·65	40	99·78	59	100·37	....
7	99·82	66	99·56	29	99·65	40	99·71	49	99·82	66	100·34	....
8	99·79	60	99·54	26	99·64	39	99·67	43	99·82	66	100·32	....
9	99·76	56	99·51	23	99·65	40	99·71	49	99·69	46	100·30	....
10	99·76	56	99·51	23	99·65	40	99·76	56	99·73	52	100·45	....
11	99·75	55	99·49	21	99·65	40	99·81	64	99·86	71	100·34	....
12	99·75	55	99·47	19	99·68	44	99·81	64	100·01	108	100·36	....
13	99·75	55	99·46	18	99·68	49	99·84	75	99·93	89	100·31	....
14	99·73	52	99·45	17	99·65	40	99·80	62	99·93	89	100·35	....
15	99·73	52	99·44	16	99·60	33	99·80	62	99·93	89	100·39	....
16	99·72	50	99·44	16	99·59	32	99·79	60	99·93		100·15	....
17	99·72	50	99·43	15	99·62	36	99·77	58	99·93		100·30	....
18	99·72	50	99·42	14	99·56	29	99·76	56	99·91		100·18	....
19	99·71	49	99·39	11	99·55	28	99·75	55	99·93		100·46	....
20	99·70	47	99·41	13	99·54	26	99·74	54	99·99		100·52	....
21	99·69	46	99·45	17	99·57	30	99·74	53	99·94		100·54	....
22	99·67	43	99·45	17	99·55	28	99·75	55	99·93		99·04	....
23	99·62	36	99·47	19	99·55	28	99·75	55	100·06		99·11	....
24	99·61	31	99·48	20	99·52	24	99·75	55	99·94		99·16	....
25	99·57	30	99·48	20	99·51	23	99·73	52	99·93		99·19	....
26	99·56	29	99·47	19	99·54	26	99·70	47	100·02		100·14	....
27	99·53	25	99·55	28	99·55	28	99·69	46	100·15		100·34	....
28	99·52	24	99·55	28	99·51	23	99·68	44	100·27		100·52	....
29	99·49	21	99·57	30	99·50	22	99·69	46	99·93		100·60	....
30	99·48	18	99·58	31	99·51	23	99·69	46	99·94		100·98	....
31	99·58	31	99·58	31		....	99·69	46			100·70	....

Note.—All gauge heights marked thus (1) interpolated. Ice conditions from January 1 to April 14, and from November 16 to December 31, data not sufficient to compute daily discharges.

Monthly Discharge of Swan River at Swan River, for 1912-14.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
1912.						
October	....	....	[1]945	0·778	0·897	58,100
November	....	....	[1]400	0·330	0·368	23,800
December	....	....	[1]100	0·082	0·095	6,150
The period	....	....	[1]482	0·397	1·360	88,050
1913.						
January	....	....	[1]70	0·058	0·067	4,300
February	....	....	[1]50	0·041	0·043	2,780
March	....	....	[1]50	0·041	0·047	3,075
April	....	....	[1]2,250	1·852	2·066	133,900
May	1,350	810	1,050	0·864	0·996	64,600
June	780	230	480	0·395	0·441	28,600
July	3,675	613	1,830	1.506	1·736	112,500
August	887	299	539	0·444	0·512	33,100
September	365	162	251	0·207	0·231	14,900
October	199	123	169	0·139	0·160	10,400
November	....	....	[1]100	0·082	0·092	5,950
December	....	....	[1]50	0·041	0·047	3,075
The year	3,675	[1]50	574	0·472	6·438	417,180
1914.						
January	....	....	[1]40	0·033	0·038	2,460
February	....	....	[1]40	0·033	0·034	2,220
March	....	....	[1]30	0·025	0·029	1,840
April	....	....	[1]1,200	0·988	1·102	71,400
May	3,975	568	1,570	1.293	1 491	96,500
June	520	94	229	0·188	0·210	13,600
July	91	18	51	0·042	0·048	3,125
August	31	11	22	0·018	0,021	1,350
September	44	22	32	0·026	0·029	1,900
October	70	25	50	0,041	0·047	3,075
November	....	....	[1]40	0·033	0·037	2,380
December	....	....	[1]20	0·016	0·018	1,230
The year	3,975	10	277	0,228	3.104	201,080

Note.—Marked thus ([1]) estimated.

MOSSY RIVER.

The Mossy river is the connecting link between lake Dauphin and lake Winnipegosis, draining the former into the latter. It heads in the extreme northern end of lake Dauphin and flows generally north for a distance of about 21 miles to the mouth.

The Fork and Fishing rivers are tributaries that have their sources on the eastern slope of the Duck mountains. All the drainage basin of the Mossy, with the exception of that supplied by these rivers, is gathered by the rivers tributary to lake Dauphin. These are the Valley, Turtle, Ochre, Wilson, and Vermilion rivers. The upper part of the basin is well timbered, while the lower part is prairie country, and used extensively for mixed farming.

The banks of the Mossy vary between 5 and 15 feet in height and are of clay overlying a bed of gravel. The river varies in width from 120 to 200 feet, and has been considerably improved by dredging.

The country adjacent to the river is very well settled, especially on the west side. The town of Winnipegosis, with a population of 600 people, is situated at the mouth of the river, and the town of Dauphin is the chief centre in the district.

In 1908 the Department of Public Works made a survey of the river with a view of lowering lake Dauphin. In connection with this project, dredging operations were carried on in the river between 1908 and 1912. A water-power project has been looked into on the river near Winnipegosis, and a reconnaissance survey for this purpose was made by a field party of the Manitoba Hydrographic Survey, in the summer of 1913.

Mossy River at Lacey's Farm.

History.—The station on the Mossy river at Lacey's Farm was established by A. Pirie on July 14, 1913, and was operated until August 10, 1914.

Location of Section.—The meter section is located in the NW. ¼ of sec. 6 Tp. 29, R. 18, W.P.M. It is one-quarter of a mile below the mouth of Fishing river, and three quarters of a mile below F. B. Lacey's farm. The initial point is a nail driven in the side of a 5 inch oak tree which is on the right hand side of the river and is blazed on the river side and marked "I.P."

Records Available.—Daily gauge height records have been obtained for the period July 14, 1913, to August 10, 1914. Estimates of daily discharge have been compiled for the same period.

Drainage Area.—The area drained by the Mossy river above this station includes lake Dauphin and the drainage areas of the streams flowing into that lake. It is 3,950 square miles.

Gauge.—The gauge is a 6-foot vertical staff enamelled gauge which is fastened to a timber driven into the bed of the stream and braced. It is placed on the right bank, and is referred to a bench-mark, which is a nail driven into the stump of a 12-in poplar, which is blazed on two sides and is 25 feet north of the initial point.

Channel.—The channel is straight for 1,800 feet above and 600 feet below the station. There are rapids both above and below the section, the latter being about 1,500 feet distant. The river occupies but one channel at all stages, the bed of the stream is of gravel and not subject to erosion. The current is swift and the banks are high and not subject to overflow.

Discharge Measurements.—The meterings are made by means of a boa and cable stretched across the river.

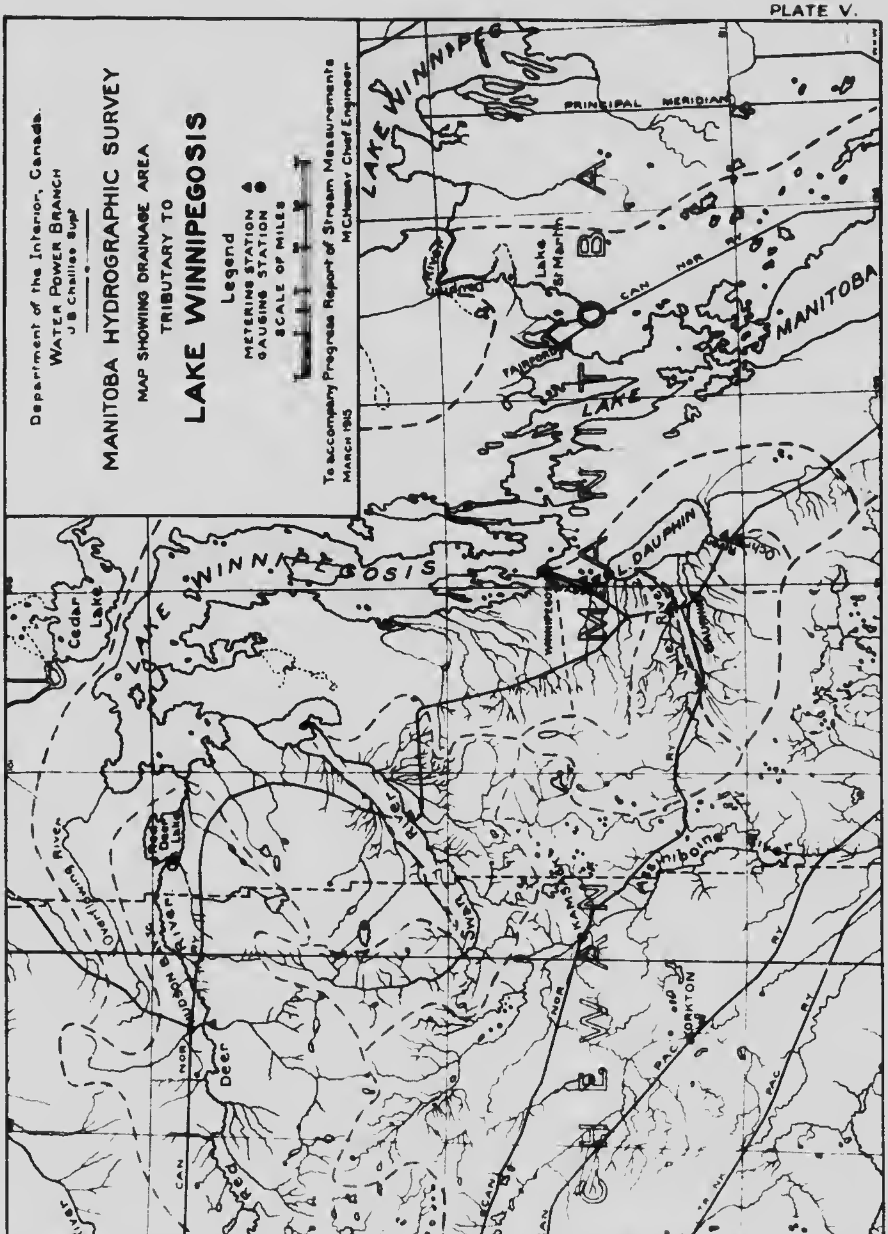
Accuracy.—The discharge curve is fairly well defined over a range in gauge height between 87·00 and 89·8.

Discharge Measurements of Mossy River below Fishing River, 1913-14.

Date		Hydrographer	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1913				Feet	Sq ft	Ft per sec	Feet	Sec.-ft
July	14	A Pirie	1496	132	592	2·80	89·80	1,658
Aug.	11	D B Gow	1187	128	485	2·64	88·97	1,280
"	19	D B Gow	1187	140	651	1·83	88·77	[1]1,191
"	23	W J Ireland	1469	116	452	2·54	88·82	1,151
Nov	11	C O Allen	1374	103	289	2·33	87·73	673
Dec	18	C O Allen	1375	99	309	2·03	87·46	627
1914								
Jan	13	C O Allen	1375	100	299	1·80	87·56	540
Mar	21	C O Allen	1496	89	283	1·65	87·03	467
April	23	C O Allen	1497	92	285	1·89	87·11	540
May	27	C O Allen	1497	110	341	2·14	87·84	727
July	1	C O Allen	1760	98	303	1·97	87·37	598

[1] Two miles below regular station.

PLATE V.


Department of the Interior, Canada.
Water Power Branch
J B Challies Supt
MANITOBA HYDROGRAPHIC SURVEY
MAP SHOWING DRAINAGE AREA
TRIBUTARY TO
LAKE WINNIPEGOSIS
Legend
METERING STATION
GAUGING STATION
SCALE OF MILES
To accompany Progress Report of Stream Measurements
MARCH 1915
Chief Engineer
LAKE WINNIPEG
PRINCIPAL MERIDIAN
MANITOBA
LAKE MANITOBA
LAKE WINNIPEGOSIS
Cedar Lake
L. DAUPHIN
Red Deer Lake
Overflowing River
Swan River
Red Deer
Assiniboine River
YORKTON
SASKATCHEWAN
Carrot River
Saskatchewan
Qu'Appelle River

DAILY GAUGE HEIGHT AND DISCHARGE of Mossy River below Fishing River, for 1913.

[Drainage area, 3,950 square miles.]

Day.	July.		August.		September.		October		November.		December.	
	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height.	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge	Gauge Height	Dis-charge.
	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft.
1			89·34	1,430	88·67	1,090	88·19	868	87·24	536	[1]87·65	660
2			89·34	1,430	88·67	1,090	88·19	868	87·27	544	[1]87·65	660
3	....	.....	89·34	1,430	88·64	1,080	88·14	847	87·49	607	87·66	664
4	....	.....	89·44	1,480	88·64	1,080	88·01	792	87·49	607	[1]87·66	664
5	....	.....	89·24	1,380	88·64	1,080	88·04	805	87·49	607	[1]87·66	664
6	....	.....	89·24	1,380	88·65	1,080	88·04	805	87·49	607	[1]87·66	664
7	....	.....	89·14	1,330	88·64	1,080	87·99	784	87·54	623	[1]87·66	664
8	....	.....	89·04	1,280	88·64	1,080	87·99	784	87·54	623	[1]87·66	664
9	....	.	89·04	1,280	88·44	978	87·99	784	[1]87·60	642	[1]87·66	664
10	....	.....	88·94	1,230	88·34	933	87·44	592	[1]87·67	667	87·66	664
11	....	.....	88·94	1,230	88·34	933	87·74	692	87·73	689	[1]87·66	664
12	.....	.....	88·94	1,230	88·35	938	87·79	710	[1]87·73	689	[1]87·66	664
13	....	.	88·94	1,230	88·37	947	87·78	707	[1]87·72	685	87·66	664
14	89·84	1,680	88·94	1,230	88·39	955	87·73	689	[1]87·70	678	[1]87·69	674
15	89·74	1,630	88·84	1,180	88·34	933	87·77	703	[1]87·70	678	[1]87·72	685
16	89·74	1,630	88·84	1,180	88·33	929	87·77	703	[1]87·70	678	[1]87·75	696
17	89·64	1,580	88·81	1,160	88·24	889	87·84	728	[1]87·69	674	87·78	707
18	89·64	1,580	88·80	1,160	88·29	911	87·84	728	[1]87·69	674	[1]87·76	700
19	89·64	1,580	88·77	1,140	86·77	433	87·84	728	[1]87·68	671	[1]87·75	696
20	89·54	1,530	88·81	1,160	87·29	549	87·84	728	87·68	671	87·73	689
21	89·54	1,530	88·80	1,160	88·04	805	87·79	710	[1]87·68	671	[1]87·70	678
22	89·44	1,480	88·81	1,160	88·14	847	87·84	728	[1]87·68	671	[1]87·68	671
23	89·44	1,480	88·81	1,160	88·34	933	87·84	728	87·68	671	[1]87·65	660
24	89·44	1,480	88·79	1,150	88·34	933	87·84	728	[1]87·67	667	87·63	653
25	89·44	1,480	88·79	1,150	88·24	889	87·84	728	[1]87·66	664	[1]87·63	653
26	89·44	1,480	88·79	1,150	88·19	868	87·84	728	[1]87·64	656	[1]87·63	653
27	89·34	1,430	88·79	1,150	88·21	876	87·04	487	87·63	653	87·63	653
28	89·34	1,430	88·77	1,140	88·14	847	87·04	487	[1]87·63	653	[1]87·58	636
29	89·54	1,530	88·77	1,140	88·14	847	87·24	536	[1]87·64	656	[1]87·53	620
30	89·34	1,430	88·77	1,140	88·14	847	87·27	544	[1]87·64	656	[1]87·48	604
31	89·34	1,430	88·64	1,080	.....	.	87·27	544	.	...	[1]87·44	592

NOTE.—Discharge curve not well defined above gauge height 89·00. Gauge heights marked thus ([1]) interpolated.

Daily Gauge Height and Discharge of Mossy River below Fishing River, for 1914.

[Drainage area, 3,950 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet.	Sec.-ft	Feet	Sec.-ft.
1	[1]87·40	580	[1]87·45	595	[1]87·26	541	87·11	503	87·07	493	88·22	881
2	87·38	574	[1]87·43	589	[1]87·23	533	87·09	498	87·09	498	88·24	889
3	[1]87·36	569	87·41	583	87·19	522	87·09	498	87·09	498	88·24	889
4	[1]87·35	566	[1]87·41	583	[1]87·20	525	87·12	505	87·09	498	88·25	893
5	[1]87·34	563	[1]87·41	583	[1]87·22	530	87·01	480	87·10	500	88·39	955
6	87·33	560	[1]87·41	583	87·24	536	86·99	476	87·10	500	88·38	951
7	[1]87·33	560	87·41	583	[1]87·24	536	86·99	476	87·17	518	88·14	847
8	[1]87·33	560	[1]87·43	589	[1]87·24	536	86·94	465	87·30	552	88·09	826
9	87·33	560	[1]87·45	595	[1]87·24	536	86·92	460	87·39	577	88·09	826
10	[1]87·40	580	87·46	598	87·24	536	86·94	465	87·39	577	88·04	805
11	[1]87·47	601	[1]87·48	604	[1]87·23	533	86·99	476	87·40	580	87·87	739
12	87·53	620	[1]87·50	610	[1]87·22	530	86·99	476	87·49	607	87·79	710
13	[1]87·53	620	[1]87·53	620	[1]87·20	525	87·04	487	87·54	623	87·79	710
14	[1]87·52	616	87·56	629	87·19	522	87·09	498	87·51	613	87·75	696
15	[1]87·51	613	[1]87·44	592	[1]87·17	517	87·10	500	87·69	674	87·75	696
16	87·51	613	[1]87·32	558	[1]87·15	513	87·10	500	87·89	746	87·69	674
17	[1]87·50	610	87·19	522	[1]87·13	508	87·10	500	87·89	746	87·69	674
18	[1]87·48	604	[1]87·19	522	[1]87·10	500	87·10	500	87·89	746	87·49	607
19	[1]87·47	601	[1]87·19	522	[1]87·08	496	87·09	498	87·89	746	87·54	623
20	87·46	598	[1]87·19	522	[1]87·05	489	87·09	498	87·79	710	87·49	607
21	[1]87·45	595	[1]87·19	522	87·03	485	87·09	498	87·89	746	87·50	610
22	[1]87·44	592	[1]87·20	525	[1]87·05	489	87·04	487	87·89	746	87·49	607
23	[1]87·42	586	[1]87·22	530	[1]87·07	493	87·04	487	88·09	826	87·49	607
24	87·41	583	87·24	536	87·09	498	87·09	498	88·09	826	87·44	592
25	[1]87·43	589	[1]87·25	539	[1]87·09	498	87·09	498	88·08	822	87·47	601
26	[1]87·46	598	[1]87·27	544	[1]87·09	498	87·09	498	87·89	746	87·44	592
27	[1]87·48	604	[1]87·28	547	[1]87·09	498	87·09	498	88·84	1,175	87·44	592
28	87·51	613	87·29	549	87·09	498	87·04	487	88·47	992	87·44	592
29	[1]87·49	607			[1]87·09	498	87·04	487	88·39	955	87·39	577
30	[1]87·48	604			[1]87·10	500	87·07	493	88·20	872	87·37	572
31	87·46	598			[1]87·10	500	...		88·21	876	..	

Day.	July.		August.	
	Feet	Sec.-ft	Feet.	Sec.-ft.
1	87·33	560	87·08	496
2	87·33	560	87·08	496
3	87·33	560	87·04	487
4	87·29	549	87·06	491
5	87·29	549	86·89	454
6	87·31	555	87·04	487
7	87·32	558	87·05	489
8	87·29	549	86·99	476
9	87·29	549	87·04	487
10	87·29	549	87·04	487
11	87·30	552		
12	87·29	549		
13	87·27	544		
14	87·29	544		
15	87·29	549		
16	86·70	420		
17	87·09	498		
18	87·14	510		
19	87·14	510		
20	87·09	498		
21	87·09	498		
22	87·09	498		
23	87·09	498		
24	87·10	500		
25	87·10	500		
26	87·07	493		
27	87·07	493		
28	87·08	496		
29	87·07	493		
30	87·07	493		
31	87·07	493		

Note.—Data insufficient to estimate mean discharge for August. Gauge heights marked thus ([1]) interpolated.

MONTHLY DISCHARGE of Mossy River below Fishing River, for the year 1913.

Month.	Discharge in Second-Feet.				Run-Off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
July			[1]1,520	0·385	0·444	93,500
August	1,480	1,080	1,230	0·311	0·359	75,600
September	1,080	433	923	0·234	0·261	54,900
October	868	487	709	0·180	0·208	43,600
November	689	536	649	0·164	0·183	38,600
December	707	592	663	0·168	0·194	40,800
The period	1,480	433	949	0·240	1·649	347,000
January	620	560	[1]592	0·150	0·173	36,400
February	620	522	[1]567	0·144	0·150	31,500
March	541	485	[1]513	0·130	0·150	31,500
April	505	460	490	0·124	0·138	29,200
May	1,175	493	696	0·176	0·203	42,800
June	955	572	715	0·181	0·202	42,500
July	560	420	522	0·132	0·152	32,100
The period	1,175	420	585	0·148	1·168	246,000

NOTE.—Discharges marked thus ([1]) estimated.

MOSSY RIVER AT WILSON'S FARM.

History.—This station was established on July 28, 1914, by W. J. Ireland and superseded the one at Lacey's farm, owing to the difficulty in securing a gauge reader at that point.

Location of section.—The meter section is located on Wilson's farm, 2½ miles northeast of Fork river. It is marked by a blazed poplar tree which stands on the left bank just below the metering section. The initial point is located by a nail driven in the post supporting the cable of the section on the left hand bank.

Records Available.—Daily gauge height records have been kept from July 3, 1914, to the end of the same year. Estimates of daily discharge have been computed for the period July 3 to November 16, 1914. There is not sufficient data to compute the discharge under ice conditions which obtain for the remainder of the year.

Drainage Area.—The drainage area is 3,950 square miles.

Gauge.—The gauge is a 6-foot vertical staff enamelled gauge fastened to a plank driven in the bed of the stream and braced to the left shore, it is 800 feet below the metering station and just inside of the boundary fence of the section.

Channel.—The channel is straight for 150 feet above and 300 feet below the section. The river is confined to a single channel under all stages. The bed of the river is of gravel and permanent. The banks are high and covered with scrub but not liable to overflow.

Discharge Measurements.—Meterings are made by means of a cable carrier running on a cable stretched across the river.

Accuracy.—The discharge curve is fairly well defined over the range in stage covered by the meterings.

Discharge Measurements of Mossy River below Fork River, 1914.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 28	W. J. Ireland	1,919	97	379	1·34	92·01	507
August 19	Alex. Pirie	1,940	88	309	1·04	91·28	322
Sept. 7	H. Boyd	1,919	88	292	0·96	91·19	281
Oct. 3	M. S. Madden	1,911	86	281	0·78	90·85	219
Oct. 31	M. S. Madden	1,912	86	289	0·81	90·94	235
Nov. 23	F. S. Smith	1,186	88	247	0·62	91·05	[1]151
Dec. 9	C. O. Allen	1,912	88	264	0·66	91·16	[1]177

[1]Measurement taken under ice conditions.

Daily Gauge Height and Discharge of Mossy River below Fork River, for 1914.

[Drainage Area, 3,950 square miles.]

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			91·71	425	91·11	267	91·14	274	90·89	226	91·41	
2			91·72	428	90·74	201	90·82	214	91·42	344	91·39	
3	92·06	523	91·61	397	90·77	206	90·85	220	90·72	198	91·41	
4	92·14	545	91·68	416	91·20	287	90·72	198	90·72	198	91·41	
5	92·22	568	91·43	346	91·30	312	91·14	274	90·91	230	91·41	
6	92·15	548	91·22	292	91·22	292	90·98	242	91·18	283	91·41	
7	92·13	542	91·67	414	91·12	269	91·02	250	90·28	138	91·36	
8	92·53	654	91·63	402	91·23	295	90·96	239	90·92	232	91·30	
9	92·00	506	91·42	344	91·66	411	90·94	235	91·06	257	91·12	
10	92·02	512	91·23	295	91·24	297	90·75	203	90·81	213	91·45	
11	92·03	514	91·47	358	91·18	283	90·39	151	90·91	233	91·42	
12	91·80	450	91·54	377	91·19	285	90·85	220	91·61	397	91·46	
13	91·82	456	91·14	274	92·17	554	91·02	250	91·33	320	90·89	
14	91·99	503	91·27	305	91·62	400	91·17	280	91·41	341	91·03	
15	92·01	509	91·69	419	91·24	297	91·00	246	91·40	388	91·27	
16	91·75	436	91·32	317	91·06	257	91·27	305	91·40	388	91·36	
17	91·63	402	91·33	320	91·03	252	91·25	300	91·27		91·29	
18	91·92	484	91·30	312	91·23	294	91·23	295	91·18		91·41	
19	91·95	492	91·32	317	91·33	320	91·00	246	91·20		91·49	
20	91·94	489	91·30	312	91·07	259	91·08	261	91·06		91·61	
21	92·06	523	91·28	307	90·71	197	90·97	241	91·07		91·61	
22	91·81	453	91·32	317	90·51	167	91·03	248	91·03		91·49	
23	91·88	472	91·17	280	90·05	112	90·94	235	91·05		91·61	
24	91·97	498	91·23	295	90·78	208	90·83	216	91·08		91·60	
25	91·82	456	91·22	292	91·14	274	90·89	226	90·12		91·59	
26	91·78	444	91·21	290	91·00	246	90·60	180	90·16		91·59	
27	91·88	472	91·41	341	91·07	259	90·94	235	91·24		91·56	
28	92·12	540	91·69	419	90·99	244	90·89	226	91·30		91·58	
29	91·95	492	91·26	302	90·92	232	90·98	242	91·40		91·54	
30	91·65	408	91·22	292	91·12	269	90·94	235	91·41		91·53	
31	91·77	442	91·02	250			90·94	235			91·54	

Note.—Ice conditions from November 16 to end of year, data insufficient to compute daily discharges.

MONTHLY DISCHARGE of Mossy River below Fork River, for the year 1914.

(Drainage Area 3,950 square miles.)

Month.	Discharge in Second-Feet.				Run-Off	
	Maximum	Minimum	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
July	[1]654	[1]402	[1]494	0·125	0·135	28,400
August	428	250	337	0·085	0·098	20,700
September	554	112	275	0·070	0·078	16,400
October	405	180	239	0·061	0·070	14,700
November			[1]220	0·056	0·061	13,100
December			[1]170	0·043	0·050	10,500
The period	654	112	289	0·073	0·494	103,800

NOTE.—Marked thus ([1]) estimated. Ice conditions from November 16 to end of year.

FORK RIVER.

Fork River is a tributary of the Mossy, and joins the latter just below the town of Fork River in Tp. 29, R. 18, W. P. M. The source of the river is on the eastern slope of the Duck mountains. It flows almost due east to its junction with the Mossy.

The total drainage area is about 210 square miles, the country drained being partially settled and partially wooded especially in the head waters. The banks are well defined and not subject to overflow, in places reaching a height of 20 to 30 feet.

FORK RIVER AT FORK RIVER.

History.—The station on the Fork river at Fork River was established on July 15, 1913, by Alex. Pirie.

Location of Section.—The section is located on the downstream side of the traffic bridge which crosses the Fork river in the town of the same name. The initial point is marked on the hand-rail at the south end of the bridge on the downstream side.

Records Available.—Three discharge measurements were taken at this point.

Drainage Area.—The area tributary to the Fork river above the station is 200 square miles.

Gauge.—No gauge was installed at this point, but the stage of the water was referred to a temporary bench-mark, consisting of a bolt on the downstream side of the traffic bridge at the east end.

Channel.—The river is confined to one channel at all stages. It is straight for 300 feet above and 150 feet below the section. The bed of the stream is of gravel and clay, and is permanent. The banks are high and not liable to overflow.

Discharge Measurements.—Three discharge measurements have been taken at this site, the measurements being made from the downstream side of the bridge.

DISCHARGE MEASUREMENTS of Fork River at Fork River 1913-14

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1913			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
July 15	A. Pirie	1,496	68	293	3.69	W. L. 91.625	1,081
1914							
April 24	C. O. Allen	1,497	59	117	1.07	-0.0[illegible] [1]	125
May 27	C. O. Allen	1,497	59	105	0.67	-11.9[illegible] [2]	70

[1] Below top of pile L. bank.
[2] Below top of rail of bridge.

VALLEY RIVER.

The Valley river is a tributary of lake Dauphin; it rises on the western slope of the Duck mountains, flows south along the foot of the western slope of these mountains, then turns east and flows between the Duck and Riding mountains and continues this generally easterly course to its mouth. There are two tributaries to the Valley which are of fair size, these are Short creek, which rises on the slope of Riding mountains, and the Drifting river, which joins the Valley 3 miles west of Valley River station on the Canadian Northern Railway.

The valley between the Riding and Duck mountains, through which the river flows and from which it takes its name, is about 100 feet deep and from 700 to 2,500 feet wide. The river at ordinary summer stages has a width of between 100 and 200 feet. The river-bed is composed of gravel and boulders, the banks being of clay which overlies a gravel and boulder bed.

The upper part of the drainage area is practically all within the Duck Mountain forest reserve, where considerable stands of spruce, jack pine, and poplar are to be found. In the immediate vicinity of the river little clearing has been done, though in the lower part of the valley, and somewhat back from the river, farming is carried on to a considerable extent.

VALLEY RIVER AT VALLEY RIVER.

History.—This station was established on October 25, 1912, by W. G. Worden, and has been in operation since that time.

Location of Section.—The metering section is located on the downstream side of the Canadian Northern Railway bridge, crossing the Valley river 1,500 feet north of the railroad station in that town, and 150 feet upstream from the traffic bridge. The initial point is an arrow carved and painted on the downstream side of the bridge at the south end.

Records Available.—Records of daily gauge heights have been secured for the greater part of the period October 25, 1912, to the end of 1914. Estimates of daily discharge have been computed for the following periods: October 25 to November 17, 1912; April 4 to November 16, 1913; and April 25 to November 16, 1914. There is not sufficient information to arrive at estimates of daily discharge under winter conditions.

Drainage Area.—The area tributary to the Valley river above the station is 1,028 square miles.

Gauge.—A 12-foot vertical staff enamelled gauge is fastened to a 2-inch by 4-inch scantling which is spiked to the bridge abutment, 246 feet from the initial point on the metering section. The zero of the gauge is referred to a bench-mark set to arbitrary datum and located on the top of a bolt on the northwest side of the traffic bridge just below the Canadian Northern Railway bridge.

Channel.—During low stages the water is confined to one channel, but under high-water conditions there are two. The channel is straight for 400 feet above and 600 feet below the section. The bed of the stream is of gravel and sand, and permanent. The right bank is low, wooded, and liable to overflow. The left bank is high and not liable to overflow.

Discharge Measurements.—Meterings are taken from the downstream side of the bridge and cover a range in gauge height of 6·6 feet.

Accuracy.—The discharge curve is well defined between gauge heights 99·5 and 101·7, between gauge heights 101·7 and 105·0 the discharge curve is not well defined.

Discharge Measurements of Valley River at Valley River, 1912-14.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 25	W. G. Worden	1,196	57	157	2·04	101·64	321
1913							
Feb. 13	A. Pirie	1,462	65	80	0·25	101·30	20
Apr. 14	A. Pirie	1,186	157	609	3·78	104·87	2,300
Apr. 14	A. Pirie	1,186	157	608	4·10	104·87	2,244
Apr. 14	A. Pirie	1,186	154	586	3·71	104·73	2,182
June 6	E. Bankson	1,469	56	147	2·01	101·50	296
June 17	G. Ebner	1,186	54	127	1·48	101·13	188
July 7	A. Pirie	1,496	193	778	3·86	106·10	3,006
July 11	A. Pirie	1,496	119	525	4·11	104·65	2,163
Aug. 14	G. Ebner	1,196	53	128	1·64	101·10	209
Aug. 22	W. J. Ireland	1,469	60	163	2·46	101·69	399
Sept. 17	W. J. Ireland	1,469	52	99	1·09	100·51	107
Oct. 14	C. O. Allen	1,435	51	85	0·82	100·32	69
Nov. 14	C. O. Allen	1,374	19	69	0·47	100·01	32[1]
Dec. 20	C. O. Allen	1,375	51	46	0·26	99·95	12[2]
1914							
Jan. 15	C. O. Allen	1,375	30	8	0·42	100·14	[2]4
Mar. 2	D. B. Gow		No flow				[2]0
Mar. 31	C. O. Allen	1,496	29	9	0·33	100·35	[2]3
Apr. 25	C. O. Allen	1,497	56	153	2·36	101·59	367
Apr. 25	C. O. Allen	1,497	54	155	2·39	101·57	372
Apr. 25	C. O. Allen	1,497	54	155	2·41	101·56	375
May 26	C. O. Allen	1,497	58	170	2·25	101·52	392
July 3	C. O. Allen	1,760	51	114	1·30	100·72	148
July 29	W. J. Ireland	1,919	45	60	0·39	99·78	23
Aug. 19	A. Pirie	1,940	51	58	0·16	99·54	9
Sept. 8	H. Boyd	1,919	42	42	0·29	99·64	12
Oct. 3	M. S. Madden	1,911	43	53	0·15	99·53	8
Oct. 31	M. S. Madden	1,912	46	60	0·26	99·68	16
Nov. 21	F. S. Smith	1,186	36	32	0·34	99·61	[2]11
Dec. 8	C. O. Allen	1,912	44	36	0·24	99·49	[2]9

[1]Open water at section

[2]Measurement taken under ice conditions

DAILY GAUGE HEIGHT AND DISCHARGE of Valley River at Valley River, for 1912.

[Drainage area, 1,028 square miles.]

Day.	October.		November.	
	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1			1·29	262
2			1·24	248
3			1·20	236
4			1·31	268
5			1·36	285
6			1·34	278
7			1·24	248
8			1·20	236
9			1·17	228
10			1·06	201
11			1·11	213
12			1·21	239
13			1·17	228
14			1·11	213
15			1·04	196
16			0·98	183
17			0·88	162
18			0·84	
19			0·84	
20			0·87	
21			1·02	
22			1·06	
23			1·03	
24			0·96	
25	1·64	400	0·93	
26	1·63	395	0·89	
27	1·58	371	0·79	
28	1·49	332	0·83	
29	1·42	306	0·82	
30	1·39	295	0·79	
31	1·37	288		

NOTE.—Ice conditions November 17 to end of year; data insufficient to compute discharges.

Daily Gauge Height and Discharge of Valley River at Valley River, for 1913.

[Drainage area, 1,028 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft
1									2·61	965	1·01	189
2									2·41	847	1·01	189
3							2·24		2·44	865	1·01	189
4							4·02	1,800	2·37	823	1·15	223
5							4·72	2,210	2·41	847	1·51	340
6					1·31		5·00	2,380	2·31	788	1·63	395
7							4·84	2,280	2·73	1,040	1·53	349
8							4·11	1,850	2·73	1,040	0·94	174
9							3·22	1,330	2·76	1,050	0·94	174
10							3·14	1,280	2·63	977	0·94	174
11							4·47	2,060	2·64	983	1·74	453
12							4·27	1,940	2·50	900	1·63	395
13			1·30	20			5·70	2,890	2·16	699	1·51	340
14					1·31		4·71	2,200	2·36	817	1·43	309
15							4·61	2,150	2·41	847	1·21	239
16							4·37	2,000	2·41	847	1·21	239
17							4·41	2,030	2·44	865	1·13	218
18							4·12	1,860	2·23	741	1·28	259
19							4·31	1,970	2·59	953	1·03	194
20							4·21	1,910	2·30	782	1·00	187
21					1·31		4·01	1,790	2·20	723	0·94	174
22							3·88	1,710	1·31	268	0·90	166
23							3·77	1,650	1·11	213	0·88	162
24							3·41	1,440	1·01	189	1·43	309
25							3·01	1,200	1·01	189	1·41	302
							2·61	965	1·01	189	1·20	236
			1·32		1·31		2·21	729	1·01	189	1·20	236
28							1·81	493	1·01	189	1·33	275
29							2·63	977	1·01	189	1·38	291
30							2·51	906	1·01	189	1·30	265
31									1·01	189		

Day.	July.		August.		September.		October.		November.		December.	
1	101·44	313	101·81	493	100·75	137	100·25	63	100·23	61		
2	1·71	436	1·91	552	0·58	108	0·24	62	0·27	65		
3	1·81	493	1·61	385	0·50	109	0·24	62	0·15	52	100·25	
4	3·61	1,560	1·61	385	0·59	109	0·22	59	0·20	57		
5	6·89	3,500	1·41	302	0·57	106	0·20	57	0·20	57		
6	6·57	3,300	1·61	385	1·37	288	0·22	59	0·20	57		
7	6·10	3,025	1·51	340	1·12	215	0·20	57	[1]0·18	55		
8	4·91	2,320	1·46	321	0·97	181	0·19	56	[1]0·15	52		
9	4·31	1,970	1·31	268	0·90	166	0·17	54	[1]0·13	50		
10	4·21	1,910	1·21	239	0·82	150	0·24	62	[1]0·11	48	0·35	
11	4·65	2,170	1·11	213	0·78	142	0·28	67	[1]0·09	46		
12	5·31	2,560	1·06	201	0·61	113	0·25	63	[1]0·06	43		
13	7·01	3,550	1·01	189	99·81	24	0·30	69	[1]0·04	42		
14	6·90	3,500	0·92	170	100·60	111	0·32	72	0·01	39		
15	[1]5·65	2,750	0·92	170	0·60	111	0·39	81	0·05	43		
16	4·41	2,030	0·92	170	0·54	102	0·33	73	[1]0·03	41		
17	4·01	1,790	1·00	187	0·50	96	0·33	73			0·35	
18	3·51	1,500	0·91	168	0·49	95	0·33	73				
19	3·11	1,260	1·81	493	0·46	90	0·38	79	99·95			
20	2·81	1,080	1·76	464	0·41	83	0·33	73			99·95	12
21	2·51	906	1·71	436	0·30	69	0·30	69				
22	2·26	758	1·69	425	0·25	63	0·41	83				
23	2·01	611	1·52	345	0·21	58	0·39	81				
24	2·71	436	1·40	298	0·30	69	0·45	89				
25	2·51	340	1·30	265	0·29	68	0·39	81				
26	1·31	268	1·20	236	0·28	67	0·26	64				
27	1·11	213	0·90	166	0·29	68	0·12	49	99·95			
28	0·91	168	99·85	27	0·29	68	99·90	30				
29	0·71	130	101·13	218	0·30	69	100·10	47				
30	0·51	98	0·92	170	0·30	69	0·20	57				
31	0·31	70	0·85	156			0·21	58				

NOTE.—Ice conditions January 1 to April 1, and November 16 to end of year; data insufficient to compute daily discharge. Open water rating curve not defined between gauge heights 101·7 and 104·6. Gauge heights marked thus ([1]) interpolated.

Daily Gauge Height and Discharge of Valley River at Valley River, for 1914.

[Drainage area, 1,028 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1									1·54	354	1·24	248
2						0			1·24	248	1·04	196
3									1·24	248	0·94	174
4									1·59	376	3·94	1,750
5									1·94	570	2·64	983
6									2·84	1,100	2·34	806
7									3·79	1,660	2·04	629
8									4·74	2,220	1·74	453
9									4·94	2,340	1·64	400
10									4·84	2,280	1·44	313
11									4·79	2,250	1·34	278
12									4·74	2,220	1·24	248
13									4·14	1,870	1·14	220
14									3·84	1,690	1·04	196
15	0·14	4							3·64	1,570	0·94	174
16									3·49	1,480	0·84	154
17									3·34	1,400	0·74	135
18									2·94	1,160	0·64	118
19									2·84	1,100	0·64	118
20									2·44	865	0·54	102
21									2·74	1,040	0·54	102
22									2·54	924	0·54	102
23									2·34	806	0·49	95
24									2·24	747	0·44	88
25							1·54	354	1·74	453	0·44	88
26							1·64	400	1·39	295	0·39	81
27							2·14	688	1·84	511	0·34	74
28							1·14	688	2·04	629	0·34	74
29							1·04	629	2·04	629	0·34	74
30							1·69	425	1·94	570	0·29	68
31					0·35	3			1·94	570		

	July.		August.		September.		October.		November.		December	
1	101·04	196	99·90	30	99·56	10	99·40	5	99·78	22	99·49	
2	0·94	174	99·80	23	99·80	23	99·45	7	99·70	17	99·54	
3	0·64	118	99·70	17	99·80	23	99·52	9	99·70	17	99·39	
4	0·54	102	99·60	12	99·75	20	99·55	10	99·70	17	99·49	
5	0·44	88	99·60	12	99·70	17	99·60	12	99·70	17	99·59	
6	0·64	118	99·50	8	99·65	15	99·57	11	99·72	18	99·64	
7	0·34	74	99·50	8	99·60	12	99·55	10	99·72	18	99·54	
8	0·24	62	99·90	30	99·65	15	99·63	14	99·80	23	99·49	
9	0·14	51	99·90	30	99·70	17	99·70	17	99·80	23	99·49	
10	0·04	42	99·80	23	99·90	30	99·75	20	99·78	22	99·49	
11	0·04	42	99·70	17	100·10	47	99·80	23	99·75	20	99·49	
12	0·14	51	99·60	12	99·93	32	99·85	27	99·70	17	99·29	
13	0·14	51	99·60	12	99·80	23	99·94	33	99·72	18	99·29	
14	0·04	42	99·50	8	99·73	19	99·92	32	99·75	20	99·29	
15	99·94	33	99·40	5	99·70	17	99·92	32	99·78	22	99·19	
16	100·64	118	99·40	5	99·65	15	99·90	30	99·80	23	98·99	
17	0·84	154	99·40	5	99·60	12	99·90	30	99·80		98·99	
18	0·44	88	99·40	5	99·60	12	99·88	29	99·80		99·04	
19	0·34	74	99·54	10	99·65	15	99·85	27	99·80		99·09	
20	0·24	62	99·50	8	99·61	14	99·81	25	99·80			
21	0·14	51	99·43	6	99·60	12	99·85	27	99·60			
22	0·04	42	99·40	5	99·55	10	99·90	30	99·70			
23	99·99	37	99·40	5	99·53	9	99·80	23	99·49			
24	99·94	33	99·35	4	99·50	8	99·78	22	99·49			
25	99·84	26	99·30	3	99·50	8	99·76	21	99·54			
26	99·84	26	99·70	17	99·50	8	99·75	20	99·51			
27	99·74	19	99·65	15	99·48	7	99·73	19	99·54			
28	99·64	14	99·57	11	99·45	7	99·70	17	99·61			
29	100·10	47	99·55	10	99·43	6	99·70	17	99·62			
30	99·90	30	99·50	8	99·40	5	99·70	17	99·61			
31	[illegible]	38	[illegible]	5			99·69	17				

Note.—Ice conditions January 1 to April 22, and Nov 16 to end of year; Data insufficient to compute daily discharge. Open water rating curve not defined between gauge heights 101·7 and 104·6

Monthly Discharge of Valley River at Valley River, for the years 1912-14.

[Drainage area, 1,028 square miles.]

Month.	Discharge in Second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area.	Total in acre-feet.
1912						
October			[1]340	0·331	0·382	20,900
November			[1]200	0·194	0·216	11,900
December						
The period			[1]270	0·262	0·598	32,800
1913						
February			[1]20	0·019	0·020	1,110
March						
April	2,890	493	[1]1,600	1·556	1·736	95,200
May	1,050	189	658	0·640	0·738	40,500
June	453	162	255	0·248	0·277	15,200
July	3,550	70	1,450	1·411	1·627	89,200
August	552	27	285	0·277	0·319	17,500
September	288	24	107	0·104	0·116	6,400
October	89	30	65	0·063	0·073	4,000
November			[1]40	0·039	0·044	2,380
December			[1]40	0·039	0·045	615
The period	3,550	[1]10	452	0·440	4·995	272,105
1914						
January			[1]4	0·004	0·005	246
February			[1]0			
March			[1]2	0·002	0·002	123
April			[1]185	0·180	0·201	11,000
May	2,340	248	1,080	1·051	1·212	66,400
June	1,750	68	285	0·277	0·309	17,000
July	196	14	68	0·066	0·076	4,180
August	30	3	12	0·012	0·014	738
September	47	5	16	0·016	0·018	952
October	33	5	20	0·019	0·022	1,230
November			[1]12	0·012	0·013	714
December			[1]8	0·008	0·009	492
The year	2,340	[1]0	141	0·159	1·881	103,075

Note.—Discharges marked thus ([1]) estimated; Data insufficient to estimate discharge for December, 1912, Jaauary and March, 1913.

Ochre River.

The Ochre river is a small tributary of lake Dauphin. It rises on the northeastern slope of Riding mountain, and flows northeast to the lake, its mouth being in Tp. 20, R. 17, west of the First meridian. The total drainage area of the river is approximately 270 square miles, of which 250 square miles lies above the metering station at Ochre river.

OCHRE RIVER AT OCHRE RIVER.

History.—This station was established by W. G. Worden on October 8, 1912, and has been operated since that date.

Location of Section.—The metering section on the Ochre river is located on the downstream side of the traffic bridge, which is one-quarter of a mile north of the railway station and one-quarter of a mile below the Canadian Northern Railway bridge. The initial point is marked on the guard rail 7 feet from the south end on the downstream side.

Records Available.—Records of daily gauge height have been obtained for the period October 18, 1912, to the 1st of December, 1914, with omissions during the winter periods. Estimates of daily discharge have been obtained for the same period.

Drainage Area.—The drainage area of the Ochre river above Ochre river is 250 square miles.

Gauge.—A 9-foot vertical staff enamelled gauge is fastened to a timber which is spiked to a pile of the bridge at the south end on the downstream side. This gauge is referred to a bench-mark set at arbitrary datum, and which is the head of a nail driven into a 12-inch poplar stump opposite station 1+55, and is blazed on two sides.

Channel.—The channel just above the section is divided by a pile bent which supports the bridge. For 50 feet above and 300 feet below the station the channel is straight. The bed of the stream is of sand and gravel with a vegetable growth. The banks are low and wooded and liable to overflow at high stages.

Discharge Measurements.—The discharge measurements are taken from the downstream side of the bridge under open-water conditions. During the winter season they are made from the ice.

Accuracy.—Between gauge heights 99·5 and 101·3 the curve is well defined, between 101·3 and 107·3 the curve is not well defined. Under ice conditions a fairly well defined curve for the range in gauge height 99·2 to 100·4 has been obtained.

DISCHARGE MEASUREMENTS of Ochre River at Ochre River, 1912-14.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 18	W. G. Worden	1,196	38	61	2·67	101·22	162
1913.							
Feb. 14	A. Pirie	1,462	29	16	1·30	100·90	21[1]
April 15	"	1,186	139	501	2·54	107·31	1,274
" 15	"	1,186	105	398	2·87	106·14	1,143
" 15	"	1,186	99	340	2·81	105·52	956
June 18	G. Ebner	1,186	29	31	1·24	100·38	39
July 5	A. Pirie	1,496	71	70	2·38	101·15	165
Aug. 15	G. Ebner	1,196	21	14	0·77	99·94	10
Oct. 15	C. O. Allen	1,435	34	22	1·00	99·98	22
1914							
Jan. 10	C. O. Allen	1,375	39	4	0·70	100·80	3[1]
April 1	"	1,496	38	10	0·72	104·65	7[1]
" 21	"	1,497	75	65	2·91	103·97	189[1]
May 29	"	1,497	35	40	1·61	100·28	65
June 30	"	1,760	30	19	1·12	99·95	21
Aug. 1	W. J. Ireland	1,920	20	10	1·33	99·58	3
Sept. 12	H. Boyd	1,920	21	11	1·38	99·68	4
Oct. 5	M. S. Madden	1,911	28	16	1·12	99·63	18
Oct. 30	"	1,912	16	18	1·35	99·71	6[2]
Nov. 20	F. S. Smith	1,186	18	6	1·63	99·88	4[3]

[1]Measurement taken under ice conditions.
[2]200 feet above regular station.
[3]Measurement taken under ice conditions—130 feet below regular station.

DAILY GAUGE HEIGHT AND DISCHARGE of Ochre River at Ochre River, for 1912.

[Drainage area, 250 square miles.]

Day.	July.		August.		September.		October.		November.		December.	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1									1·17	159	0·75	102
2									1·21	164		
3									1·22	166		
4									1·19	162		
5									1·15	156		
6									1,09	148		
7									1·06	143	0·90	95
8									1·05	142		
9									1·04	141		
10									1·04	141		
11									1·06	143		
12									1·06	143		
13									1·06	143		
14									1·06	143		
15									1·06	143	1·01	95
16									1·05	142	1·01	95
17									1·03	139	1·01	95
18							1·26	171	1·03	139		
19							1·43	196	1·03	139		
20							1,38	188	1·01	136		
21							1·28	174	0·95	128	1·01	95
22							1·21	164	0·90	121		
23							1·16	157	0·90	121		
24							1 12	152	0·85	115		
25							1·04	141	0·83	112		
26							1·00	135	0·80	108		
27							1·00	135	0·75	102		
28							1·00	135	0·75	102	1·10	95
29							1·00	135	0·75	102		
30							1·04	141	0·75	102		
31							1·13	153				

Daily Gauge Height and Discharge of Ochre River at Ochre River, for 1913.

[Drainage area, 250 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft
1					0·90	3	1·00	10	0·80	108	0·68	93
2							1·10	50	0·80	108	0·68	93
3							1·30	100	0·80	108	0·68	93
4	1·10	81					1·50	210	0·80	108	0·54	76
5							1·80	230	0·80	108	0·54	76
6							2·50	360	0·80	108	0·68	93
7							2·50	364	0·80	108	0·68	93
8					0·90	2	2·30	332	0·72	98	0·70	95
9							2·10	300	0·70	95	0·70	95
10							1·75	244	0·68	93	0·40	59
11	1·10	81					1·50	206	0·69	94	0·38	57
12							2·30	332	0·70	95	0·34	52
13							3·60	554	0·80	108	0·40	59
14			0·90	21			5·40	903	0·79	107	0·40	59
15							5·40	903	0·79	107	0·38	57
16							5·35	893	0·80	108	0·38	57
17							4·37	698	0·80	108	0·38	57
18	1·10	81					3·67	567	0·80	108	0·40	59
19					0·90	1	3·01	448	0·79	107	0·40	59
20							2·60	380	0·90	121	0·30	48
21							2·29	330	0·80	108	0·30	48
22			0·90	20			2·09	298	0·80	108	0·30	48
23							1·85	260	0·80	108	0·30	48
24							1·62	224	0·78	105	1·20	163
25	1·10	70					1·40	191	0·78	105	1·30	177
26							1·15	156	0·79	107	1·00	135
27					0·90	1	1·00	135	0·80	108	1·00	135
28							1·00	135	0·80	108	0·80	108
29							1·11	150	0·80	108	0·70	95
30							1·80	108	0·80	108	0·70	95
31								......	0·80	108	......	......

Day.	July.		August.		September.		October.		November.		December.	
1	100·80	108	100·10	28	99·77	8	99·84	11	99·80	9		
2	0·80	108	0·10	28	99·77	8	99·84	11	99·90	14		
3	1·10	149	0·00	20	99·80	9	99·80	9	99·90	14		
4	1·10	149	0·00	20	99·82	10	99·75	7	100·00	20		
5	0·90	121	0·00	20	99·80	9	99·80	9	0·00	20		
6	0·90	121	0·00	20	99·80	9	99·80	9	0·00	20		
7	0·80	108	0·00	20	99·77	8	99·82	10	0·00	20		
8	0·70	95	0·00	20	99·75	7	99·84	11	0·00	20		
9	0·60	83	0·00	20	99·75	7	99·90	14	0·00	20		
10	0·60	83	0·00	20	99·75	7	99·92	15	99·90	14		
11	1·10	149	0·00	20	99·73	6	100·00	20	99·90	14		
12	1·60	221	0·00	20	99·73	6	0·00	20	99·90	14		
13	2·70	396	0·00	20	99·73	6	0·00	20	99·90	14		
14	2·00	284	0·00	20	99·73	6	99·96	18	100·00	20		
15	1·50	206	99·94	16	99·73	6	0·00	20	0·00	20		
16	1·10	149	99·98	19	99·73	6	99·84	11	0·00	17		
17	0·70	95	99·96	18	99·73	6	99·80	9	0·00	14		
18	0·70	95	99·96	18	99·73	6	99·80	9	0·00	14		
19	0·70	95	100·00	20	99·70	5	99·90	14	0·00	14		
20	0·70	95	0·10	28	99·70	5	99·90	14	0·00	14		
21	0·60	83	0·10	28	99·70	5	99·90	14	0·00	12		
22	0·30	48	0·00	20	99·70	5	100·00	20	0·00	9		
23	0·30	48	99·96	18	99·73	6	0·00	20	0·00	9		
24	0·30	48	99·94	16	99·75	7	99·90	14	0·00	9		
25	0·20	37	99·92	15	99·75	7	99·90	14	0·00	9		
26	0·20	37	99·92	15	99·73	6	100·00	20	0·00	8		
27	0·20	37	99·92	15	99·82	10	0·00	20	0·00	8		
28	0·20	37	99·87	13	99·80	9	99·90	14	0·00	8		
29	0·10	28	99·85	12	99·84	11	99·80	9	0·00	8		
30	0·10	28	99·84	11	99·84	11	99·80	9	0·00	7		
31	0·10	28	99·80	9			99·80	9				

Note.—Ice conditions January 1 to April 6 and November 16 to end of year.

Daily Gauge Height and Discharge of Ochre River at Ochre River, for 1914.

[Drainage area, 250 square miles.]

Day.	January. Gauge Height	January. Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April. Gauge Height	April. Discharge.	May. Gauge Height	May. Discharge.	June. Gauge Height	June. Discharge.
	Feet.	Sec.-ft.	Feet	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1							104·50	7	102·60	380	100·13	31
2							4·70	7	2·40	348	0·13	31
3							4·50	7	0·50	71	0·10	28
4							4·50	7	0·10	28	0·10	28
5							4·50	7	1·10	149	0·10	28
6							4·40	6	6·30	1,091	0·10	28
7							4·20	6	6·20	1,070	0·10	28
8							3·90	6	6·30	1,091	0·10	28
9							4·10	6	3·40	518	0·10	28
10	100·80	3					4·20	7	2·40	348	0·00	20
11							4·20	7	1·80	252	0·00	20
12							4·20	7	1·40	191	0·00	20
13							4·20	7	1·20	163	0·00	23
14							4·20	7	0·90	121	99·90	14
15							4·20	40	0·80	108	99·88	13
16							4·60	70	0·70	95	99·87	13
17							5·30	90	0·70	95	99·87	13
18							4·60	120	0·70	95	99·87	13
19							4·00	140	0·70	95	99·79	9
20							3·90	160	0·70	95	99·78	8
21							3·96	189	0·60	83	99·78	8
22							3·60	240	0·60	83	99·77	8
23							3·20	340	0·60	83	99·75	7
24							3·10	464	0·50	71	99·74	7
25							3·10	464	0·40	59	99·70	6
26							3·00	446	0·40	59	99·70	5
27							2·70	396	0·40	59	99·70	5
28							2·70	396	0·40	59	99·68	5
29							2·90	429	0·28	46	99·67	4
30							2·90	429	0·28	46	100·35	53
31									0·27	45	....	....

Day.	July.		August		September		October.		November.		December.	
1	100·15	32	99·58	3	99·53	2	99·62	3	99·73	6	99·88	2
2	100·04	23	99·55	2	99·53	2	99·62	3	99·73	6	99·88	2
3	100·04	23	99·54	2	99·51	2	99·62	3	99·75	7	99·88	1
4	100·04	23	99·53	2	99·51	2	99·66	4	99·75	7	99·88	1
5	99·94	16	99·47	2	99·53	2	99·72	6	99·78	8	99·88	1
6	99·94	16	99·47	2	99·63	4	99·73	6	99·78	8		
7	100·04	23	99·46	2	99·71	5	99·73	6	99·78	8		
8	99·94	16	99·46	2	99·71	5	99·75	7	99·78	8		
9	99·84	11	99·45	2	99·71	5	99·83	11	99·78	8		
10	99·84	11	99·45	2	99·72	6	99·92	15	99·77	8		
11	99·74	7	99·45	2	99·73	6	100·04	23	99·78	8		
12	100·00	20	99·45	2	99·65	4	100·02	22	99·78	8		
13	100·15	32	99·45	2	99·64	4	99·98	19	99·78	8		
14	100·04	23	99·45	2	99·64	4	99·96	18	99·78	8		
15	99·94	16	99·45	2	99·63	4	99·83	11	99·83	11		
16	99·94	16	99·43	1	99·61	3	99·81	9	99·88	9		
17	99·94	16	99·43	1	99·60	3	99·81	9	99·91	7		
18	99·94	16	99·43	1	99·58	3	99·79	9	99·93	5		
19	99·94	16	99·43	1	99·58	3	99·78	8	99·93	5		
20	99·94	16	99·43	1	99·55	2	99·77	8	99·88	4		
21	99·84	11	99·43	1	99·55	2	99·77	8	99·88	3		
22	99·84	11	99·43	1	99·58	3	99·75	7	99·88	3		
23	99·84	11	99·43	1	99·61	3	99·74	7	99·93	2		
24	99·64	4	99·43	1	99·61	3	99·73	6	99·98	3		
25	99·54	2	99·43	1	99·60	3	99·73	6	100·01	3		
26	99·63	4	99·55	2	99·60	3	99·73	6	100·01	3		
27	99·63	4	99·55	2	99·63	4	99·73	6	100·02	2		
28	99·63	4	99·55	2	99·65	4	99·76	7	99·93	2		
29	99·63	4	99·55	2	99·63	4	99·73	6	99·93	2		
30	99·63	4	99·53	2	99·61	3	99·73	6	99·88	2		
31	99·63	4	99·53	2			99·73	6				

NOTE.—Ice conditions January 1 to April 23, and November 16 to end of year.

MONTHLY DISCHARGE of Ochre River at Ochre River, for the years 1912–14.

[Drainage Area, 250 square miles.]

Month	Discharge in Second-Feet.				Run-Off	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area	Total in acre-feet.
1912.						
October	......	......	[1]155	0·620	0·715	9,531
November	166	102	135	0·540	0·602	8,033
December	......	......	[1]95	0·380	0·438	5,841
The period	166	[1]95	127	0·513	1·732	23,097
1913						
January	......	......	77[1]	0·308	0·355	4,735
February	......	......	32[1]	0·128	0·133	1,777
March	......	......	2[1]	0·008	0·009	123
April	903	10	335	1·344	1·500	19,993
May	121	93	106	0·424	0·489	6,518
June	177	48	83	0·332	0·370	4,939
July	396	28	109	0·436	0·503	6,702
August	28	9	19	0·076	0·088	1,168
September	11	5	7	0·028	0·031	417
October	20	7	14	0·056	0·065	861
November	20	7	14	0·056	0·062	833
December	......	......	5[1]	0·020	0·023	307
The year	903	1[1]	67	0·268	3·628	48,373
1914						
January	......	......	2[1]	0·008	0·009	223
February	......	......	0[1]		......	......
March	......	......	1[1]	0·004	0·005	61
April	464	6	150	0·600	0·669	8 926
May	1,091	28	229	0·916	1·056	14,081
June	31	4	17	0·068	0·076	1,012
July	32	2	14	0·056	0·065	861
August	3	1	2	0·008	0·009	123
September	6	2	3	0·012	0·014	179
October	23	3	9	0·036	0·042	553
November	11[1]	2[1]	6[1]	0·024	0·027	357
December	......	......	1[1]	0·004	0·005	61
The year	1,091	0[1]	40	0·158	1·977	26,337

NOTE.—[1] Estimated

Ice conditions from December 3 to end of year 1912; and from January 1 to April 6, and November 16 to end of year 1913; and January 1 to April 23, and November 16 to end of year 1914.

PLATE VI.

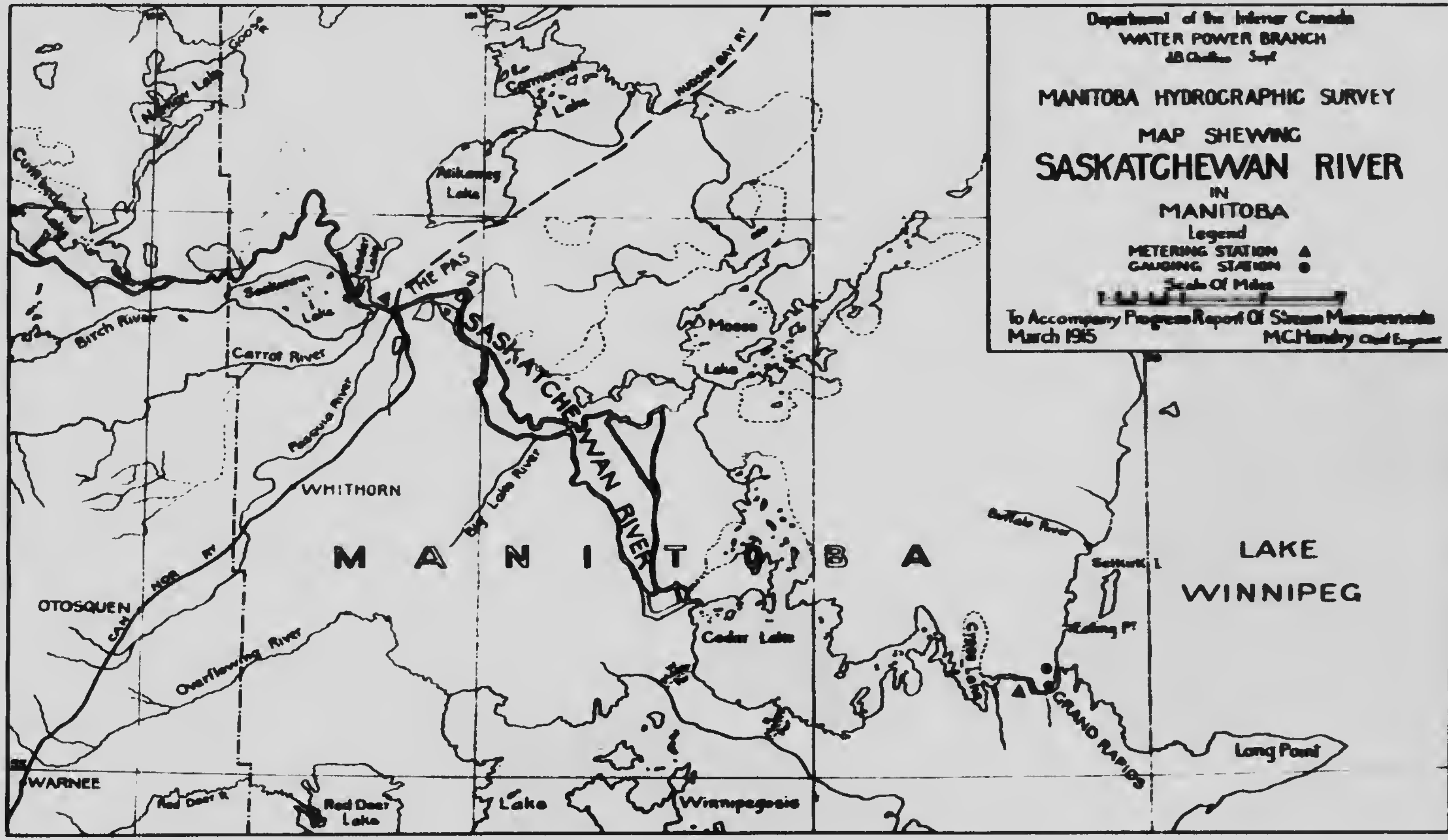
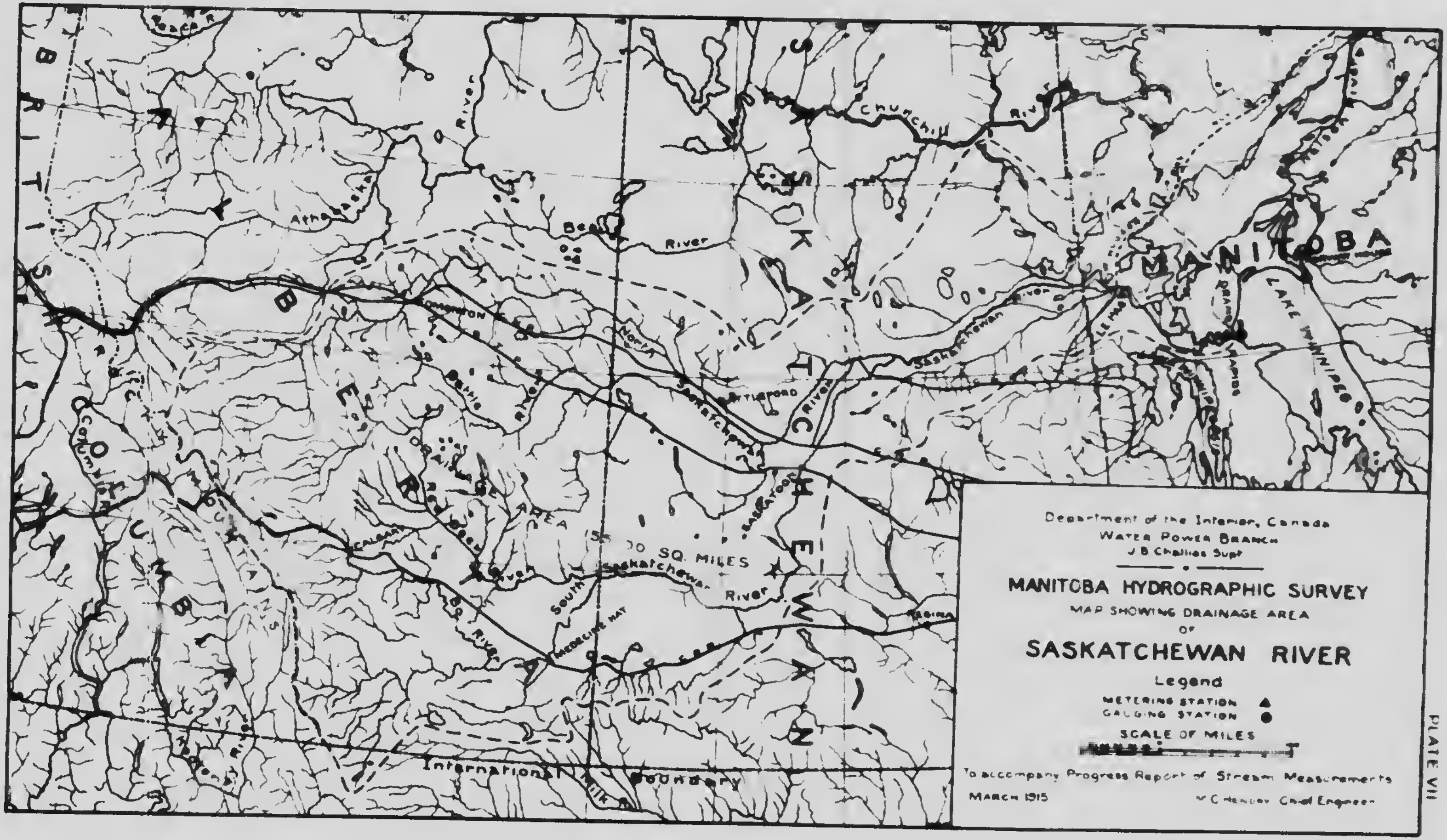

Department of the Interior Canada
WATER POWER BRANCH
MANITOBA HYDROGRAPHIC SURVEY
MAP SHEWING
SASKATCHEWAN RIVER
IN
MANITOBA
Legend
METERING STATION
GAUGING STATION
Scale Of Miles
To Accompany Progress Report Of Stream Measurements
March 1915
M.C.Hendry
LAKE
WINNIPEG
Long Point
GRAND RAPIDS
Cross Lake
Cedar Lake
Buffalo River
MANITOBA
SASKATCHEWAN RIVER
THE PAS
Moose
Lake
Atikameg
Lake
Cormorant
Lake
HUDSON BAY RY
Birch River
Carrot River
Pasquia River
WHITHORN
Big Lake River
OTOSQUEN
Overflowing River
WARNEE
Red Deer R
Red Deer
Lake
Lake
Winnipegosis
Saskeram
Lake
Cumberland
Lake

PLATE VII



Department of the Interior, Canada
Water Power Branch
J. B. Challies Supt
MANITOBA HYDROGRAPHIC SURVEY
MAP SHOWING DRAINAGE AREA
OF
SASKATCHEWAN RIVER
Legend
METERING STATION
GAUGING STATION
SCALE OF MILES
To accompany Progress Report of Stream Measurements
MARCH 1915
M. C. Hendry Chief Engineer
MANITOBA
SASKATCHEWAN
ALBERTA
BRITISH COLUMBIA
LAKE WINNIPEG
Churchill River
Athabaska
Beaver River
North Saskatchewan
South Saskatchewan River
Red Deer River
Bow River
Battle
Saskatoon
Medicine Hat
Regina
Columbia
International Boundary
Milk R.
MOUNTAINS
DRAINAGE AREA
SQ. MILES

TRIBUTARIES OF LAKE WINNIPEG FROM THE WEST.

General.—The rivers coming under this head are the Saskatchewan and the Fairford, though they are included in that part known for administration purposes as the District West of Lake Winnipegosis.

The Saskatchewan is very important from a navigation, reclamation, and power standpoint. The Fairford is also important, and to some extent for the above reasons. Its chief importance is that it forms the only outlet of lake Manitoba and through it all the other lakes, lake Winnipegosis, lake Dauphin, Swan lake, and Red Deer lake are drained.

SASKATCHEWAN RIVER.

The Saskatchewan [illegible] is one of the principal tributaries of lake Winnipeg; it flows [illegible] lake [illegible] northern end, and drains a large territory to the west of the lake [illegible] total drainage area is 155,000 square miles, extending [illegible] Rocky mountains eastward to lake Winnipeg. There [illegible] of the river, known as the north and South Saskatchewan [illegible] which heads in the North Rockies southwest of [illegible] east to its junction with the South branch [illegible] Prince Albert. The tributaries entering the river from the [illegible] northern limit of the basin follows the river itself closely. [illegible] formed by the junction of the Bow and Old Man rivers, [illegible] junction of these two the Red Deer enters.

In the province of Manitoba the country adjacent to the river is low lying and swampy, a considerable portion of the land being liable to flooding during high water. Near the [illegible] the river enlarges into two lake-like expanses known as Cedar lake and Cross lake, from the latter lake the river flows into lake Winnipeg. Cross Lake rapids, Red Rock rapids, and Grand rapids occurring in this stretch of the river.

In Manitoba the river has an average width of 1,000 feet, though above Grand Rapids a minimum width of 500 feet occurs. The river bottom above Cedar lake is composed of clay and gravel; below that point limestone ridges occur and the bottom is covered with boulders. Valuable timber is to be found along the river at various points, but, generally speaking, as the lake is approached the growth becomes stunted, being for the most part second-growth.

Above Grand rapids the river is navigable at certain stages, and steamers have been operated as far upstream as Edmonton. At present all navigation below Pas is confined to gasoline launches and similar small craft.

Considerable work in the way of reconnaissance and detailed surveys for various purposes has been done by the Dominion Water Power Branch in this part of the river, and in order to further the work, two metering stations have been established by the Manitoba Hydrographic Survey, one at Pas and the other at the head of Grand rapids.

SASKATCHEWAN RIVER AT PAS.

History.—The station on the Saskatchewan river at Pas was first established by W. G. Worden on October 21, 1912. On May 27, 1913, a new section at Pas was established by E. Bankson, and this station has been in operation since that date.

Location of section.—The first station was located about a quarter of a mile below the site of the Hudson Bay Railway bridge at Pas. On May 27, 1913, this section was moved upstream to the downstream side of the Hudson

Bay Railway bridge at Pas. The initial point is located on the hand-rail near the south end of the bridge on the downstream side, and is vertically above the river face of the south abutment. It is painted white and marked "0+00 I.P."

Records Available.—Records of daily gauge height were kept at various intervals from the early part of 1911 till the end of 1914. From October 21, 1912, to the end of 1914, the gauge heights are rather more continuous. Estimates of daily discharge have been computed for the periods covered by daily gauge heights from October 21, 1912, to the end of 1914.

Drainage Area.—The drainage area tributary to the Saskatchewan above Pas comprises the greater portion of Western Canada lying between parallels 49 and 54 north latitude and between the Rocky mountains and lake Winnipeg. The total area is 149,500 square miles.

Gauge.—A 9-foot vertical staff enamelled gauge has been fastened to the downstream side of the first pier from the south bank and 10 feet above the metering section. The gauge is referred to Department Public Works, No. 79, which is a cross on a copper plug set on the west side of the south abutment of the Hudson Bay Railway bridge, and is about 3 feet from the ground level. It is marked D.P.W. B.M. No. 79.

Channel.—The river is divided by the bridge piers into six channels at low water and eight channels at high water. For 1,300 feet above and 2,700 feet below the section the channel is straight. The bed of the river is covered with gravel and small boulders but at the section the stream bottom is somewhat shifting. The right bank is high and not liable to overflow, the left bank is low and liable to overflow at high stages.

Discharge Measurements.—The discharge measurements were taken from a boat on the first section established. Since May, 1913, the meterings have been taken from the downstream side of the Hudson Bay Railway bridge.

Accuracy.—The discharge curve for the station is well defined between gauge heights 818·5 and 822·7, between 822·7 and 828·0 the discharge curve exhibits all the characteristics which are peculiar to certain large rivers, in that the discharge for the same gauge height varies according as the river is on a rising or a falling stage. Above gauge height 827·0 and below 818·5 the discharge curve is fairly well defined.

Discharge Measurements of Saskatchewan River at Pas, 1912-13-14.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912			Feet.	Sq. ft.	Ft. per sec	Feet.	Sec.-ft.
Oct. 21-22	W. G. Worden	1,196	914	18,093	2·16	23·94	39,046
Dec. 14	G. J. Lamb	1,187	834	12,848	0·68	18·56	8,772[1]
1913							
Feb 8-9	A. Pirie	1,469	771	9,563	0·53	15·97	5,105[1]
April 9	"	1,186	775	10,548	0·72	17·52	7,562[1]
May 31	E. Bankson	1,469	761	14,233	3·25	24·50	46,389
June 4	G. Ebner	1,186	750	13,331	3·31	24·41	44,124
" 10	"	1,186	750	13,899	3·38	24·83	46,979
" 12	"	1,186	760	14,041	3·51	25·18	49,285
" 14	"	1,186	739	14,197	3·63	25·39	51,534
July 10	"	1,196	758	15,445	3·69	27·02	56,886
" 12	"	1,196	760	15,587	3·70	27·19	57,743
" 15	"	1,196	756	15,848	3·79	27·41	60,114
" 18	"	1,196	756	16,000	3·93	27·62	62,883
" 21	"	1,196	880	16,066	3·97	27·80	63,900
" 23	"	1,196	779	16,107	3·86	27·84	62,120
" 25	"	1,196	756	16,309	3·93	27·95	64,199
" 28	"	1,196	770	16,342	3·91	28·00	63,869
" 30	"	1,196	756	16,332	3·85	27·98	63,025
Aug 1	"	1,196	756	16,311	3·82	27·89	62,385
" 4	"	1,196	756	16,146	3·84	27·69	62,029
" 6	"	1,196	756	16,043	3·75	27·54	60,357
" 28	W. J. Ireland	1,469	774	15,229	3·62	26·45	55,101
Sept 20	"	1,196	729	13,422	3·03	24·02	40,707
Oct 9	C. O. Allen	1,435	648	11,040	2·48	21·11	27,378
" 23	"	1,435	648	11,171	2·13	21·39	23,794
Nov 18	A. Pirie	1,496	830	12,938	0·92	18·74	11,890
Dec 13	C. O. Allen	1,375	836	11,186	0·74	17·16	8,277[1]
" 13	"	1,375	836	11,186	0·74	17·16	8,277[1]
" 14	"	1,375	836	11,186	0·72	17·13	8,054[1]
1914							
Jan 20	C. O. Allen	1,375	790	9,647	0·60	16·04	5,788[1]
" 20	"	1,375	800	9,642	0·55	16·03	5,303[1]
Mar 6	D. B. Gow	1,374	780	8,339	0·51		4,253[1]
" 26	C. O. Allen	1,496	780	9,007	0·54	16·09	4,905[1]
May 21	"	1,496	759	16,121	2·72	23·81	43,930
June 5	F. S. Smith	1,375	764	15,903	2·55	23·76	40,552
" 8	"	1,375	760	15,797	2·66	23·72	41,982
" 9	"	1,375	858	15,700	2·67	23·63	41,903
" 10	"	1,375	758	15,586	2·61	23·58	41,032
" 11	"	1,375	758	15,726	2·58	23·54	40,572
" 12	"	1,375	758	15,648	2·62	23·49	41,044
" 13	"	1,375	755	15,473	2·58	23·39	39,900
" 15	"	1,375	755	15,482	2·60	23·35	40,272
" 16	"	1,375	764	16,005	2·86	24·05	45,754
" 17	"	1,375	764	16,231	2·91	24·35	47,232
" 18	"	1,375	768	16,464	2·91	24·61	47,910
July 8	"	1,186	780	18,039	3·25	26·84	58,672
" 9	"	1,186	780	18,039	3·33	26·84	60,071
" 10	"	1,186	780	18,103	3·34	26·92	60,523
" 11	"	1,186	780	18,124	3·28	26·94	59,596
" 13	"	1,186	780	18,164	3·33	27·00	60,401
" 15	"	1,186	780	18,157	3·23	26·99	58,750
" 17	"	1,186	780	17,926	3·22	26·95	57,841
" 18	"	1,186	780	17,912	3·23	26·93	58,064
" 21	"	1,186	780	17,932	3·26	26·96	58,806
" 22	"	1,186	780	17,943	3·25	26·98	58,304
" 23	"	1,186	770	17,888	3·22	26·90	57,628
" 24	"	1,186	780	17,865	3·20	26·86	57,205
" 25	"	1,186	780	17,858	3·22	26·86	57,507
" 27	"	1,186	780	17,837	3·19	26·82	57,032
" 29	"	1,186	780	17,795	3·20	26·71	56,978
" 30	"	1,186	779	17,724	3·22	26·63	57,152
" 31	"	1,186	778	17,652	3·15	26·53	55,617
Aug 1	"	1,186	777	17,591	3·12	26·43	54,957
" 1	"	1,186	773	17,363	3·07	26·16	53,246
" 4	"	1,186	773	17,189	3·00	26·01	51,477
" 6	"	1,186	771	16,892	2·89	25·63	48,945
" 7	"	1,186	769	16,750	2·86	25·45	47,915
" 8	"	1,186	764	16,618	2·86	25·18	47,600
" 10	"	1,186	763	16,456	2·84	24·98	46,733
" 12	"	1,186	759	16,221	2·74	24·58	44,549
" 13	"	1,186	757	15,945	2·71	24·22	43,489
" 14	"	1,186	755	15,838	2·68	24·07	42,507
" 15	"	1,186	753	15,614	2·62	23·80	40,911

Note.—Add [illegible] to all gauge heights to reduce to datum of station.
[1] Measurements taken under ice conditions.

Discharge Measurements of Saskatchewan River at Pas, 1914.—*Concluded.*

Date.		Hydrographer.	Meter No	Width.	Area of Section	Mean Velocity.	Gauge Height	Discharge
1914				Feet	Sq. ft.	Ft. per sec	Feet	Sec.-ft.
"	17	F. S. Smith	1,186	752	15,346	2·58	23·44	39,625
"	18	"	1,186	751	15,186	2·48	23·23	37,644
"	19	"	1,186	749	15,021	2·46	23·01	36,969
"	20	"	1,186	747	14,857	2·43	22·78	36,161
"	21	"	1,186	746	14,728	2·32	22·61	34,202
"	22	"	1,186	744	14,575	2·33	22·38	34,055
"	25	"	1,186	742	14,199	2·23	21·79	31,653
"	26	"	1,186	741	13,989	2·15	21·58	30,020
"	27	"	1,186	739	13,842	2·08	21·35	28,843
"	28	"	1,186	738	13,620	2·10	21·13	28,623
"	31	"	1,186	736	13,402	2·05	20·85	27,504
Sept.	1	"	1,186	736	13,402	2·06	20·83	27,650
"	2	"	1,186	736	13,312	2·04	20·79	27,218
"	3	"	1,186	736	13,329	2·05	20·76	27,315
"	4	"	1,186	734	13,255	2·03	20·62	26,946
"	7	"	1,186	741	13,423	2·04	20·84	27,373
"	9	"	1,186	739	13,079	2·00	20·63	26,202
"	10	"	1,186	738	13,091	2·01	20·53	26,330
"	11	"	1,186	735	13,047	1·99	20·48	26,055
"	12	"	1,186	735	13,010	2·02	20·44	26,286
"	14	"	1,186	738	13,092	1·99	20·57	26,170
"	15	"	1,186	733	12,825	1·88	20·18	24,199
Sept.	17	"	1,186	732	12,715	1·86	20·02	23,656
	18	"	1,186	732	12,715	1·90	20·03	24,257
"	19	"	1,186	733	12,825	1·95	20·18	25,032
"	21	"	1,186	732	12,715	1·87	20·06	23,850
"	23	"	1,186	733	12,731	1·91	20·01	24,319
"	24	"	1,186	733	12,769	1·89	20·03	23,975
"	25	"	1,186	733	12,734	1·85	19·98	23,662
"	26	"	1,186	733	12,662	1·81	19·91	22,906
"	28	"	1,186	728	12,403	1·80	19·67	22,384
"	29	"	1,186	728	12,431	1·84	19·56	22,928
"	30	"	1,186	726	12,284	1·77	19·42	21,789
Oct.	1	"	1,186	725	12,246	1·80	19·34	21,998
"	2	"	1,186	725	12,211	1·73	19·29	21,087
"	5	"	1,186	734	12,326	1·78	19·44	21,974
"	7	"	1,186	729	11,987	1·68	19·02	20,110
"	8	"	1,186	726	11,838	1·62	18·79	19,192
"	10	"	1,186	726	11,909	1·61	18·88	19,181
"	12	"	1,186	726	11,810	1·67	18·90	19,777
"	13	"	1,186	726	11,837	1·60	18·76	18,922
"	14	"	1,186	724	11,691	1·59	18·58	18,577
"	15	"	1,186	724	11,692	1·60	18·60	18,716
"	16	"	1,186	724	11,717	1·66	18·65	19,396
"	19	"	1,186	727	11,890	1·67	18·84	19,849
"	20	"	1,186	728	11,896	1·67	18·84	19,778
"	21	"	1,186	728	11,967	1·70	18·92	20,365
"	23	"	1,186	732	12,235	1·84	19·29	22,462
"	23	"	1,186	732	12,264	1·82	19·34	22,181
"	24	"	1,186	732	12,243	1·79	19·31	21,914
"	26	"	1,186	732	12,340	1·84	19·42	22,671
"	27	"	1,186	732	12,264	1·81	19·32	22,175
"	28	"	1,186	730	12,187	1·79	19·24	21,746
"	29	"	1,186	732	12,173	1·78	19·37	21,631
"	30	"	1,186	732	12,335	1·78	19·43	21,807
"	31	"	1,186	732	12,335	1·78	19·45	21,961
Nov.	3	"	1,186	735	12,685	1·91	19·96	24,291
"	5	"	1,186	737	12,783	1·90	20·16	24,280
"	6	"	1,186	737	12,875	1·93	20·20	24,916
"	7	"	1,186	735	12,914	1·95	20·27	25,295
"	9	"	1,186	737	12,730	1·90	20·04	24,265
"	10	"	1,186	735	12,650	1·92	19·93	24,348

[1] Measurements taken under ice conditions.
Note.—Add 800·00 to all gauge heights to reduce to datum of station.

Daily Gauge Height and Discharge of Saskatchewan River at Pas, for 1913.

[Drainage Area, 149,500 square miles.]

Day.	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1							27·34	60,100	24·49	45,000
2							27·34	60,100	24·44	44,700
3							27·34	60,100	24·34	44,200
4							27·24	59,600	24·44	44,700
5							27·28	59,800	24·39	44,500
6							27·29	59,800	24·34	44,200
7							27·24	59,600	24·34	44,200
8							27·44	60,600	24·54	45,300
9	15·97	5,700			17·52	7,550	27·64	61,700	24·64	45,800
10							27·84	62,700	24·84	46,800
11							26·24	54,300	24·84	46,800
12							26·34	54,800	25·04	47,900
13					22·24	33,100	26·54	55,900	25·24	49,000
14					22·34	33,600	26·64	56,400	25·39	49,800
15					22·44	34,100	26·74	56,900	25·44	50,000
16					24·29	43,900	26·54	55,900	25·54	50,600
17					25·24	49,000	26·34	54,800	25·64	51,100
18					25·94	52,700	25·24	49,000	25·74	51,600
19					26·24	54,300	25·29	49,200	25·94	52,700
20					27·24	59,600	25·27	49,100	26·04	53,200
21					26·69	56,600	25·34	49,500	26·04	53,200
22					26·54	55,900	25·24	49,000	26·04	53,200
23					26·64	56,400	25·04	47,900	26·94	58,000
24					26·74	56,900	24·64	45,800	26·84	57,400
25					26·94	58,000	24·54	45,300	26·74	56,900
26					27·04	58,500	24·59	45,500	26·64	56,400
27					27·24	59,600	24·54	45,300	26·54	55,900
28					27·24	59,600	24·44	44,700	26·54	55,900
29					27·49	61,400	24·54	45,300	26·54	55,900
30					27·37	60,200	24·54	45,300	26·54	55,900
31							24·54	45,300		

Day.	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	26·54	55,900	27·89	63,000	26·39	55,100	21·97	31,600				
2	26·54	55,900	27·84	62,700	26·28	54,500	21·88	31,200				
3	26·64	56,400	27·74	62,200	26·14	53,700	21·79	30,700				
4	26·74	56,900	27·69	61,900	26·04	53,200	21·70	30,200				
5	26·84	57,400	27·64	61,700	25·94	52,700	21·61	29,700				
6	26·84	57,400	27·54	61,200	25·90	52,500	21·52	29,200				
7	26·89	57,700	27·54	61,200	25·90	52,500	21·43	28,800				
8	26·87	57,600	27·44	60,600	25·74	51,600	21·34	28,300				
9	26·94	58,000	27·34	60,100	25·54	50,600	21·16	27,300				
10	26·94	58,000	27·24	59,600	25·36	49,300	20·99	26,400				
11	27·04	58,500	27·29	59,900	25·24	49,000	20·99	26,400				
12	27·14	59,000	27·29	59,900	25·04	47,900	20·84	24,500				
13	27·44	60,600	27·04	58,500	24·94	47,400	20·74	25,100			17·16	8,300
14	27·34	60,100	26·94	58,000	24·79	46,600	20·46	23,400			17·13	8,050
15	27·44	60,600	26·94	58,000	24·64	45,800	20·24	22,500				
16	27·44	60,600	26·94	58,000	24·34	44,200						
17	27·54	61,200	26·84	57,400	24·21	43,500						
18	27·64	61,700	26·74	56,900	24·08	42,800			18·74	11,900		
19	27·64	61,700	26·64	56,400	24·14	43,100						
20	27·74	62,200	26·54	55,900	24·00	42,900						
21	27·84	62,700	26·44	55,300	23·58	40,200						
22	27·84	62,700	26·44	55,300	23·46	39,500						
23	27·84	62,700	26·39	55,100	23·38	39,100	21·39	23,800				
24	27·84	62,700	26·44	55,300	23·29	38,600						
25	27·94	63,300	26·44	55,300	23·18	38,000						
26	27·99	63,500	26·44	55,300	22·85	36,300						
27	27·99	63,500	26·43	55,300	22·78	35,900						
28	27·99	63,500	26·47	55,500	22·24	33,100						
29	28·04	63,800	26·44	55,300	22·15	32,600						
30	27·94	63,300	26·44	55,300	22·06	32,100						
31	27·94	63,300	26·34	54,800								

DAILY GAUGE HEIGHT AND DISCHARGE of Saskatchewan River at Pas, for 1914.

[Drainage Area, 149,500 square miles.]

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge
	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1									25·94	53,400	23·91	41,900
2							16·34		26·44	56,300	23·92	41,900
3									26·74	58,100	23·92	41,900
4									25·44	50,500	23·91	41,900
5							16·44		25·14	48,800	23·76	41,000
6						4,300			24·74	46,500	23·80	41,300
7									24·64	45,900	23·81	41,300
8									24·44	44,800	23·72	40,800
9							16·44		24·34	44,200	23·69	40,700
10									24·29	44,000	23·54	39,900
11									24·24	43,700	23·54	39,900
12							16·94		24·19	43,400	23·44	39,300
13									24·14	43,100	23·34	38,800
14									24·09	42,900	23·34	38,800
15									24·05	42,600	23·54	39,900
16							17·54		24·01	42,400	24·24	43,700
17									23·97	42,200	24·39	44,500
18							18·14	17,000	23·95	42,000	24·64	45,900
19									23·89	41,800	24·84	47,100
20	16·04	5,800							23·86	41,600	24·99	47,900
21									23·84	41,500	25·19	49,100
22							20·64	26,600	23·82	41,400	25·29	49,600
23									23·76	41,000	25·34	50,000
24									23·92	41,900	25·39	50,200
25							22·14	32,900	23·91	41,900	25·54	51,100
26					16·09	4,900			23·93	42,000	25·64	51,700
27									23·92	41,900	25·54	51,100
28							25·14	48,800	23·92	41,900	25·74	52,300
29									23·94	42,000	26·04	54,000
30							25·64	51,700	23·91	41,900	26·14	54,600
31									23·92	41,900		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	26·19	54,900	26·34	55,700	20·84	27,400	19·84	23,500	19·61	22,600	17·93	9,450
2	26·34	55,700	26·24	55,200	20·79	27,200	19·79	23,300	19·74	23,100	17·80	9,250
3	26·54	56,900	26·14	54,600	20·69	26,800	19·54	22,300	19·99	24,100	17·66	9,100
4	26·74	58,100	25·24	49,400	20·59	26,400	19·34	21,500	20·12	24,500	17·64	9,000
5	26·84	58,700	25·39	50,200	20·64	26,600	19·44	21,900	20·16	24,700	17·62	8,950
6	26·84	58,700	25·24	49,400	20·79	27,200	19·39	21,700	20·20	24,900	17·67	9,050
7	26·94	59,300	25·44	50,500	20·84	27,400	18·98	20,100	20·29	25,200	17·73	9,150
8	26·89	59,000	25·34	50,000	20·69	26,800	19·19	20,900	20·28	25,200	17·78	9,100
9	26·84	58,700	25·24	49,400	20·59	26,400	19·04	20,400	20·03	24,200	17·82	9,300
10	26·84	58,700	24·94	47,700	20·49	26,000	18·94	20,000	19·92	23,800	17·76	9,150
11	26·89	59,000	24·60	45,700	20·44	25,800	18·84	19,600	19·68	22,800	17·69	9,100
12	26·94	59,300	24·54	45,400	20·64	26,600	18·79	19,400	18·71	13,900	17·72	9,100
13	26·94	59,300	24·14	43,100	20·54	26,200	18·69	19,000	18·75	13,900	17·73	9,150
14	26·94	59,300	24·02	42,500	20·58	26,400	18·54	18,500	20·19	13,900	17·78	9,250
15	26·99	59,600	23·74	40,900	20·24	25,000	18·59	18,600	20·76	13,900	17·80	9,250
16	26·94	59,300	23·59	40,100	19·84	23,500	18·59	18,600	20·60	13,900	17·84	9,350
17	26·89	59,000	23·34	38,800	20·04	24,200	18·74	19,200	20·46	13,900	17·79	9,250
18	26·89	59,000	23·14	37,800	20·04	24,200	18·74	19,200	20·65	13,500	17·88	9,450
19	26·84	58,700	22·94	36,800	20·04	24,200	18·74	19,200	19·67	13,900	17·89	9,350
20	26·94	59,300	22·64	35,300	20·04	24,200	18·84	19,600	19·50	13,700	17·74	[illegible]
21	26·84	58,700	22·44	34,300	20·04	24,200	18·92	19,900	19·32	13,500	17·60	9,100
22	26·79	58,400	22·24	33,400	20·04	24,200	18·95	20,000	19·23	12,400	17·61	8,900
23	26·84	58,700	22·00	32,700	19·99	24,000	19·33	21,500	19·29	12,300	17·40	8,600
24	26·84	58,700	21·84	31,600	19·94	23,800	19·29	21,300	19·05	11,900	17·18	8,250
25	26·84	58,700	21·64	30,800	19·84	23,500	19·35	21,500	18·88	11,700	16·89	7,750
26	26·84	58,700	21·44	29,900	19·84	23,500	19·44	21,900	18·78	11,500	16·63	[illegible]
27	26·79	58,400	21·24	29,100	19·94	23,800	19·30	21,400	18·69	11,300	16·64	7,450
28	26·64	57,500	21·09	28,500	19·84	23,500	19·24	21,100	18·55	10,500	16·19	7,250
29	26·74	58,100	21·04	28,300	19·84	23,500	19·37	21,600	18·15	10,000	16·[illegible]	7,000
30	26·59	57,200	20·94	27,800	19·94	23,800	19·42	21,800	18·05	9,800	16·23	6,900
31	26·49	56,600	20·84	27,400			19·45	21,900			15·90	6,500

MONTHLY DISCHARGE of Saskatchewan River at Pas, for the years 1913-14.

[Drainage Area, 149,500 square miles.]

Month	Discharge in Second-Feet.				Run-off.	
	Maximum.	Minimum.	Mean	Per square mile.	Depth in inches on Drainage Area.	Total in acre feet.
1913.						
January	..	.....	[1]5,500	0·037	0·043	338,200
February	.	.. ..	[1]5,500	0·037	0·039	305,500
March			[1]6,500	0·043	0·050	399,700
April			[1]34,200	0·229	0·256	2,035,000
May	62,700	45,300	53,800	0·355	0·409	3,270,400
June	58,000	44,200	50,400	0·337	0·376	2,995,500
July	63,800	55,900	60,400	0·404	0·466	3,714,100
August	63,000	54,800	58,100	0·388	0·448	3,571,100
September	55,100	32,100	44,800	0·300	0·335	2,665,800
October			[1]25,000	0·170	0·196	1,537,200
November			[1]14,000	0·094	0·105	833,100
December			[1]8,000	0·054	0·062	491,900
The year			30,516	0·204	2·785	22,157,500
1914						
January			[1]6,000	0·040	0·046	368,900
February			[1]5,000	0·034	0·035	277,700
March			[1]4,500	0·030	0·035	276,700
April			[1]25,000	0·167	0·186	1,487,600
May	58,100	41,100	44,400	0·297	0·342	2,730,000
June	54,600	38,800	45,100	0·301	0·336	2,681,200
July	59,000	54,900	58,394	0·391	0·451	3,592,100
August	55,700	27,400	40,400	0·270	0·311	2,484,100
September	27,400	23,500	25,210	0·169	0·189	1,501,300
October	23,500	18,500	20,658	0·138	0·159	1,270,300
November	25,200	9,600	17,200	0·115	0·128	1,023,500
December	9,450	6,550	8,700	0·058	0·067	534,900
The year			25,047	0·167	2·285	18,228,300

NOTE. [1]Estimated.

SASKATCHEWAN RIVER AT THE HEAD OF GRAND RAPIDS.

History.—This station was established by E. B. Patterson on July 31, 1912, and has been in continuous operation since that date.

Location of Section.—The meter section on the South Saskatchewan river at the head of Grand rapids is located 640 feet below the Hudson's Bay Company's wharf, situated at the upper end of their tramway and 3,200 feet above the head of Grand rapids. The initial point is a hub at the top of the left bank. It is referenced to the end of a traverse line running from the Hudson's Bay Company's tramway.

Records Available.—Records of daily gauge height extend over the period August 3, 1912, to November 6, 1913, during the openwater season. From November 7, 1913, to September 5, 1914, a record of continuous gauge heights has been taken. Estimates of daily discharge have been prepared for the following periods: August 1 to November 30, 1912; May 19 to November 11, 1913; and April 23 to September 5, 1914. Difficulty has been experienced in securing gauge height records during the winter months.

Drainage Area.—The drainage area of the Saskatchewan river above the head of Grand rapids is 155,100 square miles.

Gauge.—A 9-foot vertical staff enamelled gauge has been placed at the end of the section and fastened to a crib which acts as a retaining wall for the bank. Prior to this gauge being placed, one was secured to the dock of the Hudson's Bay Company, about 500 feet above the section, and it is to this gauge that the records given are referred.

Channel.—For 800 feet above and 500 feet below the section the channel is straight. The hydraulic gradient for this section is quite perceptible. The river is confined to one channel at all stages, the bed of the stream is of sand and gravel and fairly permanent. The banks are high, covered with scrub, and are not liable to overflow.

Discharge Measurements.—Discharge measurements are made from a 20-foot skiff which is located on the section by means of a tagged line stretched across the river.

Accuracy.—The discharge curve is only fairly well defined between the extreme limits of gauge heights, which are 786·0 to 789·4. Owing to the hydraulic gradient the section may be considered an open-water one, as very little ice forms at this point during the winter season.

Discharge Measurements of Saskatchewan River at Grand Rapids, 1912-13.

Date	Hydrographer.	Meter No.	Width.	Area of Section	Mean Velocity	Gauge Height	Discharge.
1912			Feet	Sq. ft	Ft. per sec	Feet.	Sec.-ft
Aug 8	L. B. Patterson	285	1,055	15,061	3·47	788·18	52,262
Sept 18	"	3	1,056	15,853	4·01	788·96	63,570
" 23	"	3	1,058	15,957	3·98	789·06	63,510
1913							
Aug 27	A. Pine	1,496	1,054	15,422	3·71	788·33	57,206
" 29	"	1,497	1,054	15,485	3·57	788·38	55,266
" 30	"	1,497	1,054	15,427	3·55	788·31	54,718
Nov 10	"	1,495	1,016	11,872	1·66	786·01	19,727
" 11	"	1,496	1,012	11,963	1·71	785·97	20,548

Daily Gauge Height and Discharge of Saskatchewan River at Head Grand Rapids, for 1912.

(Drainage Area, 155,100 square miles.)

Day.	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft	Feet	Sec.-ft.
1			7·84	47,600	8·79	61,900	8·99	64,800	7·25	38,800		
2			7·86	47,900	8·84	62,600	9·00	65,000	7·24	38,600		
3			7·88	48,200	8·80	62,000	9·00	65,000	7·23	38,500		
4			7·91	48,500	8·74	61,100	9·01	65,100	7·23	38,500		
5			7·95	49,000	8·77	61,600	9·01	65,100	7·15	37,200		
6			8·00	50,000	8·89	63,400	9·02	65,500	7·07	36,000		
7			8·04	50,600	9·11	66,700	9·02	65,300	6·99	34,900		
8			8·13	52,000	9·09	66,400	9·10	66,500	6·91	33,600		
9			8·21	53,200	9·07	66,100	9·18	67,700	6·84	32,400		
10			8·13	52,000	9·03	65,900	9·26	68,900	6·75	31,300		
11			8·05	50,800	8·99	64,900	9·34	70,200	6·67	30,000		
12			7·97	49,600	8·99	64,900	9·42	71,300	6·60	29,000		
13			7·89	48,400	9·07	66,100	9·50	72,500	6·53	28,000		
14			7·82	47,300	8·96	64,400	9·61	74,000	6·47	27,000		
15			7·82	47,300	8·98	64,700	9·59	73,800	6·41	26,200		
16			7·82	47,300	8·99	64,900	9·58	73,700	6·35	25,200		
17			7·83	47,500	8·94	64,100	9·57	73,500	6·28	24,200		
18			7·83	47,500	8·96	64,400	9·56	73,400	6·28	24,200		
19			7·83	47,500	8·98	64,700	9·54	73,100	6·27	24,100		
20			7·81	47,200	9·01	65,100	9·52	72,800	6·27	24,100		
21			7·80	47,000	8·99	64,900	9·50	72,500	6·26	23,900		
22			7·79	46,900	9·01	65,100	9·18	67,700	6·25	23,700		
23			8·03	50,500	9·10	66,500	8·87	63,100	6·24	23,600		
24			8·27	54,100	9·06	65,900	8·56	58,400	6·23	23,400		
25			8·51	57,700	8·96	64,400	8·25	53,700	6·22	23,300		
26			8·74	61,100	8·97	64,500	7·94	49,100	6·03	20,500		
27			8·75	61,300	8·97	64,500	7·63	44,500	5·84	17,600		
28			8·76	61,400	8·98	64,700	7·29	40,400	5·65	14,800		
29			8·77	61,600	8·98	64,700	7·28	39,200	5·45	11,700		
30			8·78	61,700	8·99	64,800	7·27	39,100	5·45	11,700		
31			8·79	61,900			7·26	38,900				

NOTE.—Gauge heights marked thus [1] interpolated.

Daily Gauge Height and Discharge of Saskatchewan River at Head Grand Rapids, for 1913.

[Drainage Area, 155,100 square miles.]

Day.	January. Gauge Height	January. Discharge	February. Gauge Height	February. Discharge	March. Gauge Height	March. Discharge	April. Gauge Height	April. Discharge	May. Gauge Height	May. Discharge	June. Gauge Height	June. Discharge
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1											17·90	48,500
2											17·89	48,300
3											17·86	47,900
4											17·84	48,400
5											17·80	47,000
6											17·77	46,600
7											17·74	46,100
8											17·71	45,700
9											7·69	45,400
10											17·69	45,300
11											17·69	45,400
12											17·69	45,300
13											17·69	45,400
14											17·69	45,300
15											17·69	45,400
16											7·69	45,300
17											17·69	45,400
18											17·69	45,300
19									[illegible]	[illegible]	17·69	45,400
20									17·13	[illegible]	17·69	45,300
21									[illegible]	[illegible]	17·69	45,400
22									17·41	41,200	17·69	45,300
23									[illegible]	[illegible]	7·69	45,400
24									17·69	45,200	17·69	45,300
25									[illegible]	47,100	17·69	45,400
26									[illegible]	[illegible]	17·69	45,300
27									17·98	49,700	7·69	45,100
28									17·96	49,400	7·69	45,300
29									[illegible]	49,200	7·69	45,400
30									17·93	[illegible]	7·69	45,300
31									[illegible]	48,800		

Day.	July. Gauge Height	July. Discharge	August. Gauge Height	August. Discharge	September. Gauge Height	September. Discharge	October. Gauge Height	October. Discharge	November. Gauge Height	November. Discharge	December. Gauge Height	December. Discharge
1	17·72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·51	
2	[illegible]	46,500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		25,000	4·48	
3	17·78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24,900	[illegible]	
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6·24	[illegible]	4·44	
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·41	
6	17·87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22,300	4·46	
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21,200	4·51	
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5·14	
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·91	
11	[illegible]	47,500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5·96	19,400	4·97	
12	[illegible]	47,300	[illegible]	55,700	[illegible]	[illegible]	[illegible]	[illegible]	5·01		[illegible]	
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5·06		4·74	
14	17·79	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·95		4·60	
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·78		4·64	
16	17·93	49,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·76		4·62	
17	18·00	[illegible]	[illegible]	[illegible]	17·74	[illegible]	[illegible]	[illegible]	4·81		4·68	
18	18·07	[illegible]	[illegible]	54,400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		4·71	
19	18·14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·64		5·14	
20	18·21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·62		[illegible]	
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		5·74	
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·57		[illegible]	
24	[illegible]	[illegible]	18·41	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
25	[illegible]	[illegible]	18·43	[illegible]	17·50	[illegible]	[illegible]	29,200	4·58		6·51	
26	18·37	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5·31		[illegible]	
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4·64		6·07	
28	[illegible]	[illegible]	[illegible]	55,300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		6·01	
29	18·38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		7·06	
31	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]			7·16	

NOTE.—Ice conditions from November 12 to end of year; data insufficient to compute daily discharge. Gauge heights marked thus (*) interpolated.

Daily Gauge Height and Discharge of Saskatchewan River at Head Grand Rapids, for 1914.

[Drainage Area, 155,100 square miles.]

Day.	January.		February.		March.		April.		May		June.	
	Gauge Height	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet	Sec.-ft.	Feet	Sec.-ft	Feet	Sec.-ft	Feet.	Sec.-ft.
1	7·04		7·60		7·64		7·74		7·88	48,200	6·80	32,000
2	7·08		7·56		7·71		7·71		7·85	47,800	6·84	32,600
3	7·01		7·62		7·67		7·78		7·90	48,500	6·81	32,200
4	7·11		7·58		7·74		7·81		7·48	42,200	6·66	29,900
5	7·31		7·67		7·78		7·76		6·95	34,200	6·55	28,300
6	7·34		7·71		7·71		7·68		6·41	26,200	6·60	29,000
7	7·31		7·64		7·74		7·74		6·44	26,600	6·81	32,200
8	7·33		7·56		7·68		7·81		6·40	26,000	6·84	32,600
9	7·61		7·70		7·73		7·76		6·33	24,900	6·88	33,200
10	7·64		7·62		7·78		7·73		6·31	24,700	6·92	33,800
11	7·62		7·56		7·74		7·74		6·49	27,300	7·04	35,600
12	7·63		7·51		7·81		7·71		6·61	29,500	7·10	36,500
13	7·68		7·54		7·76		7·76		6·44	26,600	7·06	35,900
14	7·60		7·52		7·82		7·70		6·48	27,200	6·81	32,200
15	7·56		7·58		7·73		7·78		6·51	27,700	6·86	32,900
16	7·64		7·55		7·71		7·98		6·54	28,100	6·92	33,800
17	7·56		7·60		7·74		7·93		6·52	27,800	6·88	33,200
18	7·58		7·68		7·70		7·82		6·50	27,500	6·81	32,100
19	7·44		7·64		7·78		7·78		6·37	25,600	6·69	30,400
20	7·51		7·55		7·68		7·74		7·05	35,700	6·84	32,600
21	7·54		7·60		7·81		7·88		7·01	35,200	6·78	31,700
22	7·48		7·71		7·70		7·71		6·99	34,800	6·81	32,100
23	7·64		7·66		7·74		7·84	47,600	7·04	35,600	6·79	31,900
24	7·61		7·70		7·78		7·80	47,000	7·21	38,200	6·84	32,600
25	7·67		7·71		7·71		7·76	46,400	6·60	29,000	6·87	33,000
26	7·62		7·76		7·66		7·78	46,700	6·67	30,000	6·82	32,300
27	7·54		7·80		7·70		7·81	47,200	6·84	32,600	6·90	33,500
28	7·44		7·74		7·75		7·80	47,000	6·87	33,000	6·84	32,600
29	7·58				7·68		7·75	46,200	6·81	32,200	6·91	33,600
30	7·65				7·71		7·82	47,300	6·88	33,200	7·04	35,600
31	7·71				7·80				6·85	32,700		

Note.—Ice conditions from January 1 to April 24, data insufficient to compute daily discharges.

Day	July		August		September		October		November		December	
1	7·06	35,900	7·84	47,600	6·38	25,700						
2	7·22	38,300	7·79	46,900	6·32	24,800						
3	7·15	37,200	7·86	47,900	6·34	25,100						
4	7·01	35,200	7·74	46,100	6·30	24,500						
5	7·08	36,200	8·31	54,600	6·22	23,300						
6	7·65	44,700	8·04	50,600								
7	7·41	41,200	7·82	47,300								
8	7·18	37,700	7·71	45,700								
9	7·54	43,100	7·66	44,900								
10	7·51	42,600	7·70	45,500								
11	7·48	42,200	7·54	41,100								
12	7·52	42,800	7·56	41,400								
13	7·44	41,600	7·80	47,000								
14	7·48	42,[illegible]00	7·74	46,100								
15	7·76	46,600	7·60	44,000								
16	7·68	45,200	7·62	44,300								
17	7·74	46,100	7·[illegible]	41,000								
18	7·68	45,200	7·23	40,000								
19	7·58	43,400	7·30	39,500								
20	7·44	41,600	7·32	39,800								
21	7·36	40,400	7·24	38,600								
22	7·38	40,700	7·18	37,700								
23	7·43	41,400	7·03	35,400								
24	7·55	43,300	6·91	33,700								
25	7·63	44,500	6·84	32,600								
26	7·44	41,600	6·81	32,100								
27	7·46	41,900	6·83	32,500								
28	7·43	41,600	6·75	31,200								
29	7·81	47,100	6·71	30,700								
30	7·88	[illegible],200	6·49	27,300								
31	7·86	[illegible]	6·14	26,600								

MONTHLY DISCHARGE of Saskatchewan River near Head of Grand Rapids, for the years 1912-14.

[Drainage Area, 155,100 square miles.]

Month.	Discharge in Second-feet.				Run-off.	
	Maximum	Minimum	Mean	Per square mile	Depth in inches on Drainage Area.	Total in acre feet.
1912.						
August	61,900	46,900	51,800	0·334	0·385	3,185,100
September	66,700	61,100	64,500	0·416	0·464	3,838,600
October	74,000	38,900	63,000	0·406	0·468	3,873,700
November	38,800	11,700	27,200	0·175	0·195	1,618,500
December					......	.
The period	74,000	11,700	51,600	0·333	1·512	12,515,300
1913						
May			[1]41,900	0·289	0·333	2,760,800
June	48,500	45,300	45,900	0·296	0·330	2,730,000
July	55,900	45,800	50,700	0·327	0·377	3,117,400
August	56,800	54,400	55,200	0·356	0·410	3,394,100
September	55,000	40,200	46,800	0,302	0·337	2,784,800
October	59,800	26,000	33,100	0·213	0·246	2,035,200
November	...		[1]20,000	0·129	0·144	1,190,100
December			[1]12,000	0·008	0·010	737,900
The period	56,800	26,000	38,600	0·240	2·187	18,750,300
1914						
May	48,500	24,700	32,200	0·207	0·239	1,979,900
June	36,500	28,500	32,700	0·211	0·235	1,945,800
July	48,200	35,200	42,200	0·272	0·314	2,594,800
August	54,600	26,600	40,800	0·263	0·303	2,508,700
The period	54,600	24,700	37,000	0,238	1·091	9,029,200

NOTE.—[1]Estimated.

FAIRFORD RIVER.

The Fairford river forms the outlet of lake Manitoba. It empties into lake St. Martin, which in turn is drained by the Dauphin river. The Fairford river is quite short, a lake-like expanse known as lake Pinemuta occurring between lake Manitoba and lake St. Martin.

Lake Manitoba, which has an area of 1,711 square miles, forms the basin into which drains practically all the territory lying between the Assiniboine and the Saskatchewan rivers and east of the Riding, Duck, and Porcupine mountains. The soil is generally clay, and suitable to agriculture. A considerable proportion of the area is timbered, and in certain sections rock outcrops occur. Numerous lakes are also to be found; among these are lake Winnipegosis, lake Dauphin, Red Deer lake, Swan lake, and many other varying in size from mere ponds to lakes of the size mentioned.

The banks of the Fairford river vary from 3 to 10 feet in height. At the upper or lake Manitoba end they are well defined, gradually flattening out below Fairford until they open out into wide low-lying marshy ground in the vicinity of lake Pinemuta. Below this lake they are somewhat higher, but again change until they merge with the low swampy shores of lake St. Martin.

The Fairford river varies in width from 500 to 900 feet and at two points, one about one-half mile below the outlet of lake Manitoba, flows over a low limestone ridge or bar.

Some surveys of the river have been made by the Department of Public Works with a view to improving it for navigation purposes. In addition to this a water-power reconnaissance survey was made in 1913 by the Manitoba Hydrographic Survey.

Fairford River at Fairford.

History.—This station was established by G. H. Burnham on June 27, 1912, and has been in continuous operation since that date.

Location of Section.—The metering section is located on the downstream side of the Canadian Northern Railway bridge which crosses the Fairford river at Fairford and is 2½ miles below lake Manitoba. The initial point is located on the north abutment of the bridge on the downstream side.

Records Available.—Records of daily gauge height have been obtained from June 27, 1912, to the end of December, 1914. A number of meterings have been taken during the same period. Owing to the change in slope due to rising and falling of lake Manitoba, caused by the wind, it has not been possible to define a discharge curve for the station.

Drainage Area.—The area tributary to the Fairford river above this station includes the total drainage area of lake Manitoba and lake Winnipegosis, and is 31,900 square miles.

Gauge.—A 6-foot vertical staff enamelled gauge is fastened to the first bridge pier from the left bank and is referred to Canadian Northern Railway datum.

Channel.—The channel is straight for 400 feet above and 500 feet below the section. It is divided by the fifteen bridge piers into sixteen sections at all stages. In 1914 the bridge was replaced by a steel structure resting upon the piers which divide the channel into four sections, the old pile bents being removed. The bed of the stream is gravel, and not subject to shifting. The banks are high though subject to overflow at high stages.

Discharge Measurements.—The meterings are made from the downstream side of the Canadian Northern Railway bridge, the station being an open-water station the year round.

Accuracy.—Owing to the wind effect on lake Manitoba, and the consequent range in stage and its effect upon the slope of the river, it has not been possible to obtain a discharge curve for this section.

Discharge Measurements of Fairford River at Fairford, 1914

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1912			Feet	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
June 28	G. H. Burnham	1187	220	1,919	[illegible]	847.82	7,8[illegible]
July 31	"	1187	184	1,716	4.01	847.48	6,867
Aug. 29	Alex. Pirie	1197	185	1,720	4.88	847.60	8,411
Oct. 11	R. H. Nelson	1187	182	1,616	4.39	847.52	7,08[illegible]
Dec. 6	G. J. Lamb	1187	222	1,900	4.52	849.6[illegible]	[illegible]
1913							
April 24	F. Ransom	1069	224	1,572	4.68	847.33	7,345
May 15	G. Elmer	1186	[illegible]	1,647	4.57	847.56	7,527
Aug. 11	C. O. Allen	286	233	1,824	4.10	847.56	7,475
Oct. [illegible]		1155	220	1,880	3.03	847.40	5,681
1914							
Jan. 6	C. O. Allen	1375	[illegible]	1,917	3.19	847.52	6,120
28	E. J. Byrnes	1169	[illegible]	1,880	3.16	847.67	5,951
Mar. 1	H. B. Gow	1374	[illegible]	1,866	2.88	847.12	5,650
April 2	"	1374	246	1,851	3.18	847.02	5,822
Aug. 6	J. A. Page	[illegible]	[illegible]	1,696	3.28	846.87	5,550
7		[illegible]	[illegible]	1,740	2.94	846.80	5,115
8		[illegible]	[illegible]	1,848	3.48	847.16	6,1[illegible]
10		[illegible]	[illegible]	1,771	2.87	846.63	[illegible]
Sept. 15	M. S. Madden	[illegible]	288	1,917	3.16	847.07	[illegible]
Dec. 19		1169	[illegible]	1,740	[illegible]	846.50	[illegible]
21		1169	[illegible]	1,740	[illegible]	846.56	[illegible]

TRIBUTARIES OF LAKE WINNIPEG FROM THE EAST.

General.—The rivers of importance entering lake Winnipeg from the east are: Brokenhead, Winnipeg, Manigotagan, Bloodvein, Pigeon, Berens. They drain the territory to the west of the watershed of the Great lakes and Hudson bay. Practically all of this country is unsurveyed, so that it is not possible to delimit accurately their actual drainage basins. Practically all the drainage area lies in the Laurentian formation, small lakes and ponds abound, and a considerable portion of the surface is covered by muskeg. The rivers are generally in the nature of a series of pools or small lake-like expanses, connected by short narrow channels which are interrupted by falls and rapids. Small stands of merchantable timber are to be found throughout the district, being composed of spruce, jack pine, poplar, and birch.

Of the above rivers the Winnipeg is dealt with separately, and of the remainder, continuous records of discharge are available for the Brokenhead and Manigotagan; for the Berens and Pigeon rivers, individual meterings have been obtained.

BROKENHEAD RIVER.

The drainage basin of the Brokenhead river is in the narrow strip of country between the basin of the Winnipeg and Whitemouth rivers on the east, and the Red river on the west. It flows northwesterly and empties into lake Winnipeg

The drainage area is 910 square miles, the basin being 22 miles in width at the widest point, and approximately 75 miles long. The greater portion is low lying and swampy, though at the lower end part has been placed under cultivation by the aid of drainage work. The whole area is capable of being placed in a producing state if drainage methods are employed.

The banks are low, and the stream-bed is of clay with boulders occurring in some sections.

BROKENHEAD RIVER AT SINNOT.

History.—The station on the Brokenhead at Sinnot was established by G. H. Burnham on May 30, 1912.

Location of Section.—The section is located on the downstream side of the traffic bridge, and is 900 feet northeast of the Canadian Pacific Railway station at Sinnot. The initial point is marked by a group of nails driven into the floor of the bridge on the downstream side, and vertically above the face of the south abutment.

Records Available.—Records of daily gauge height have been secured for the periods June 8 to November 30, 1912, April 29 to November 30, 1913, and April 13 to December 31, 1914. A number of meterings have also been secured and estimates of daily discharge have been prepared for the above periods.

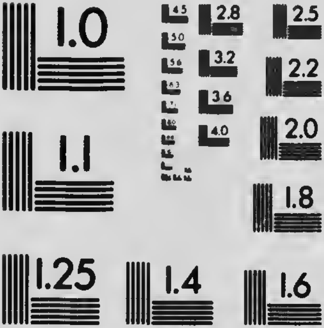
Drainage Area.—The drainage area tributary to the Brokenhead above Sinnot is 530 square miles.

Gauge.—A vertical staff enamelled gauge is fastened to a pile of the bridge opposite station 12·5 on the meter section. The gauge is referred to a bench-mark, consisting of a nail driven into the blazed face of a tree and referenced, 59 feet southwest from the initial point.

Channel.—For 300 feet above and 300 feet below the meter section the channel is straight. The river is confined to one channel at all stages, but is divided into four sections by the three pile bents supporting the bridge. The bed of the stream is of gravel and boulders and permanent. The banks are fairly high and comparatively free from overflow.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



Discharge Measurements.—The discharge measurements are made from the downstream side of the traffic bridge.

Accuracy.—For the open-water season the discharge curve is well defined between gauge heights 91·2 and 92·5, between gauge heights 92·5 and 94·2 the curve is fairly well defined. For winter conditions a fairly well defined curve has been obtained for the range in gauge height 89·8 to 91·0.

DISCHARGE MEASUREMENTS of Brokenhead River near Sinnot, 1914.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 30	G. H. Burnham...	1,187	88	382	1·74	94·14	665
June 20	"	1,187	88	198	0·95	92·29	188
July 15	"	1,187	88	201	0·86	92·16	173
Aug. 9	W. G. Worden	1,187	86	136	0·42	91·56	58
Sept. 3	"	1,187	87	166	0·52	91·89	86
Oct. 15	R. H. Nelson	1,187	76	341	1·39	93·53	474
1913.							
April 19	A. Pirie	1,186	89	298	150	93·32	447
May 9	G. Ebner	1,186	85	228	116	92·48	264
Aug. 15	W. J. Ireland	1,469	83	224	98	92·57	219
Sept. 27	C. O. Allen	1,435	80	155	56	91·72	87
1914.							
Jan. 20	E. J. Budge	1,462	41			92·07	[1] .....
Mar. 17	W. J. Ireland	1,462	....	..		..	[1] .....
May 21	A. Pirie	1,939	83	203	0·96	29·26	195
July 27	M. S. Madden	1,760	88	350	1·33	93·49	473
Aug. 18	J. A. Page	1,920	76	110	0·46	91·16	51
Sept. 4	H. Boyd	1,919	81	140	0·49	91·43	69
Oct. 7	M. S. Madden	1,911	81	157	0·57	91·65	90
Nov. 3	M. S. Madden	1,912	84·5	210	0·95	92·32	200
Dec. 1	C. O. Allen	1,912	70	99	0·43	91·63	[2] 42
Dec. 28	M. S. Madden	1,462	70	59	0·20	91·00	[2] 12

[1] No. flow.
[2] Measurements taken under ice conditions

Daily Gauge Height and Discharge of Brokenhead River near Sinnot, for 1912.

[Drainage Area, 530 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge	Gauge Height	Discharge.	Gauge Height	Discharge.	Gauge Height	Discharge.	Gauge Height	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft	Feet.	Sec.-ft.
1												
2												
3												
4												
5												
6												
7												
8											3·87	575
9											3·75	546
10											3·58	505
11											3·40	462
12											3·23	421
13											3·08	385
14											2·95	354
15											2·81	320
16											2·67	287
17											2·59	268
18											2·49	244
19											2·41	224
20											2·33	205
21											2·15	163
22											2·14	160
23											2·03	138
24											1·94	122
25											1·70	90
26											1·74	95
27											1·64	84
28											1·55	76
29											1·36	63
30											1·35	62
31												

Day.	July.		August.		September.		October.		November.		December.	
1	1·27	58	2·04	139	1·75	96	4·36	692	3·05	378		
2	1·20	54	1·94	122	1·82	105	4·30	678	3·14	400		
3	1·15	52	1·84	108	1·86	110	4·20	654	3·14	400		
4	1·09	50	1·76	97	2·26	188	4·07	623	3·05	378	2·07	
5	1·05	49	1·66	86	2·25	186	3·95	594	3·01	368		
6	1·06	49	1·66	86	2·19	172	3·90	582	2·95	354		
7	1·09	50	1·63	83	2·15	162	3·86	572	2·94	352		
8	1·18	53	1·58	78	2·18	169	3·85	570	2·95	354		
9	1·15	52	1·56	77	2·25	186	3·83	565	2·95	354		
10	1·26	57	1·56	77	2·20	174	3·78	553	3·03	373	1·25	
11	1·30	59	1·55	76	2·19	172	3·75	546	3·05	378		
12	2·95	354	1·54	75	2·18	169	3·74	544	3·03	373		
13	2·49	244	1·56	77	2·19	172	3·67	527	2·98	361		
14	2·10	151	1·55	76	2·87	335	3·64	520	2·95	354		
15	2·18	169	1·50	72	3·01	368	3·55	498	2·93	349		
16	2·07	145	1·46	69	3·19	412	3·50	486	2·89	340		
17	2·20	174	1·43	67	3·46	476	3·44	472	2·84	328		
18	2·09	149	1·40	65	3·34	448	3·35	450	2·80	318	1·05	
19	2·03	138	1·35	62	3·54	496	3·32	443	2·75	306		
20	1·98	129	1·33	61	3·63	517	3·25	426	2·73	301		
21	1·90	116	1·30	59	4·33	685	3·17	407	2·55	258		
22	1·87	111	1·25	56	4·35	690	3·06	380	2·43	229		
23	1·89	115	1·25	56	4·45	714	3·04	376	2·15	163		
24	1·10	151	1·35	62	4·62	755	2·99	364	2·25	186		
25	1·09	149	1·34	61	4·62	755	2·94	352	2·94	174	0·95	
26	2·05	142	1·36	63	4·64	760	2·89	340	2·95	174		
27	2·26	182	1·40	65	4·63	757	2·84	328	2·85	160		
28	2·36	212	1·47	70	4·55	738	2·80	318	2·84	150		
29	2·31	200	1·54	75	4·50	726	2·75	306	2·80	150		
30	2·19	172	2·33	205	4·45	741	2·75	306	2·75	132		
31	2·14	160	1·75	96			2·85	330			0·85	

Note.—Ice cover November 24 to end of year; data insufficient to compute discharge for December.

Daily Gauge Height and Discharge of Brokenhead River near Sinnot, for 1913.

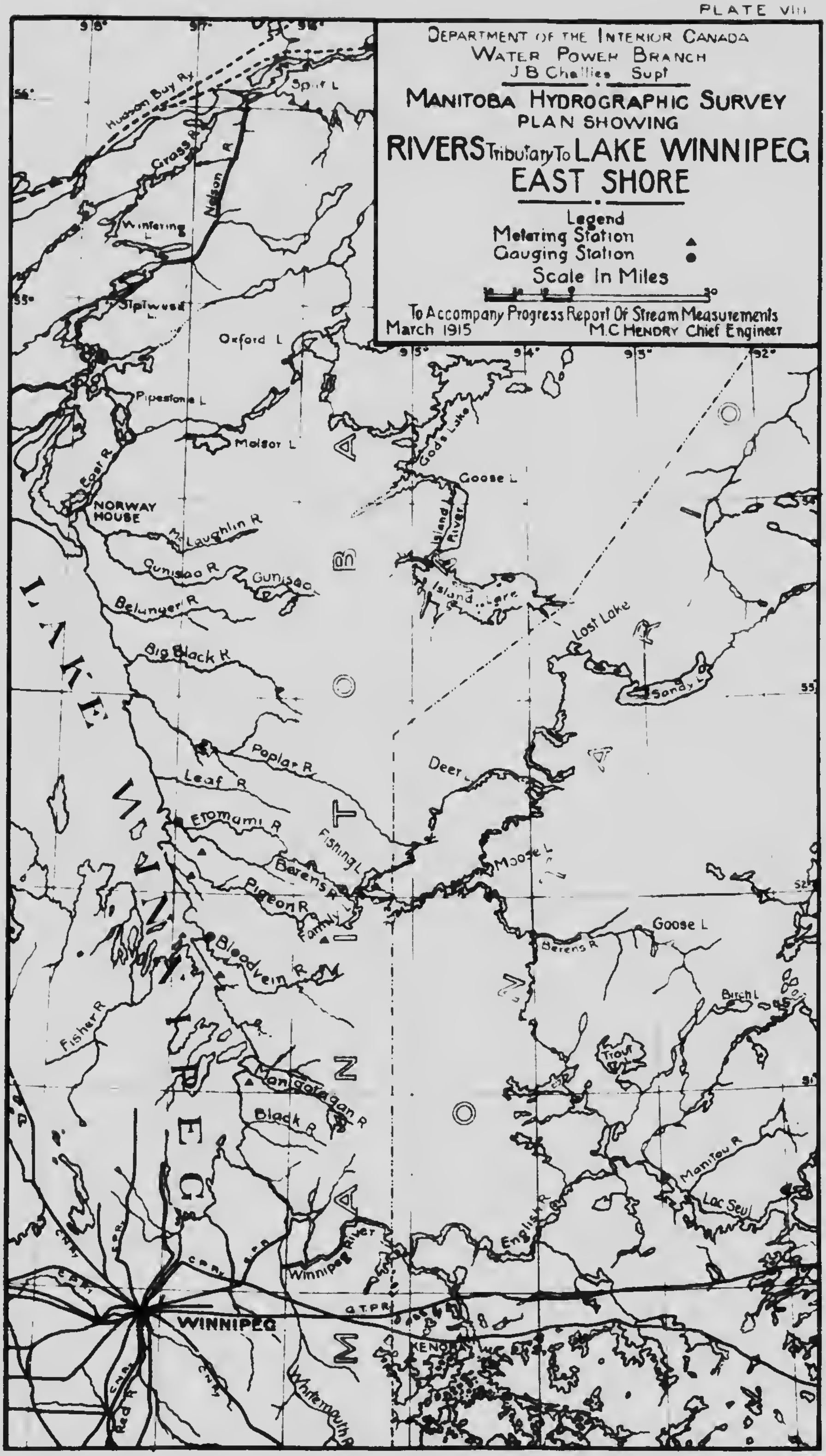
[Drainage area, 530 square miles.]

Day.	January.		February.		March.		April.		May.		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge
	Feet	Sec.-ft	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1									2·99	364	1·84	108
2									2·92	347	1·87	112
3									2·87	335	1·84	108
4									2·83	325	1·82	105
5									2·75	306	1·79	101
6									2·74	304	2·04	140
7									2·64	280	2·18	169
8									59	268	2·24	184
9									2·50	246	2·07	145
10									2·44	232	2·03	138
11									2·42	227	1·92	119
12									2·42	227	1·79	101
13									2·41	224	1·72	92
14									2·41	224	1·69	89
15									2·37	215	1·6·	84
16									2·34	208	1·58	78
17									2·30	198	1·54	75
18									2·28	193	1·44	68
19									2·23	181	1·40	65
20									2·18	169	1·24	56
21									2·14	160	1·14	52
22									2·09	149	1·34	61
23									2·08	147	1·28	58
24									2·04	140	1·20	54
25									2·02	136	1·14	52
26									1·99	130	1·13	51
27									1·94	122	1·04	48
28									1·93	121	1·24	56
29							3·14	400	1·90	116	2·52	251
30							3·06	380	1·87	112	3·14	400
31									1·85	109		

	July.		August.		September.		October.		November.	
1	3·29	436	1·03	48	2·83	325	1·57	78	1·85	109
2	3·34	448	1·01	47	2·80	318	1·52	74	1·84	108
3	3·32	444	0·94	46	2·69	292	1·50	72	1·82	105
4	3·14	400	0·93	46	2·60	270	1·47	70	1·82	105
5	3·02	371	0·91	45	2·34	208	1·42	66	1·81	103
6	2·79	316	0·90	45	2·24	184	1·40	65	1·80	102
7	2·64	280	0·87	44	2·24	184	1·42	66	1·80	102
8	2·54	256	0·84	44	2·14	160	1·52	74	1·78	100
9	2·24	184	0·82	43	2·13	158	1·67	87	1·77	98
10	2·12	156	0·94	46	2·18	169	1·78	100	1·77	98
11	2·29	196	0·93	46	2·34	208	1·97	127	1·75	96
12	2·28	193	0·88	45	2·38	217	2·12	156	1·74	95
13	2·34	208	0·84	44	2·43	229	2·22	179	1·74	95
14	2·44	232	0·83	44	2·39	220	2·32	203	1·73	90
15	2·31	200	1·88	113	2·34	208	2·32	203	1·72	90
16	2·24	184	2·84	328	2·30	198	2·27	191	1·72	90
17	2·22	179	2·99	364	2·24	184	2·22	179	1·70	90
18	2·18	169	3·04	376	2·17	167	2·20	174	1·68	85
19	2·04	140	3·09	388	2·04	140	2·12	156	1·67	85
20	1·89	115	3·04	376	1·94	122	2·10	151	1·66	80
21	1·80	102	2·94	352	1·94	122	2·06	143	1·64	75
22	1·74	95	2·88	337	1·92	119	2·02	136	1·62	70
23	1·64	84	2·87	335	1·87	112	1·96	126	1·60	70
24	1·62	82	2·87	335	1·84	108	1·92	119	1·59	70
25	1·52	74	2·86	332	1·79	101	1·90	116	1·57	65
26	1·43	67	2·85	330	1·77	98	1·90	116	1·56	65
27	1·34	61	2·84	328	1·72	92	1·89	115	1·55	65
28	1·24	56	2·83	325	1·68	88	1·88	113	1·53	60
29	1·14	52	2·82	323	1·65	85	1·88	113	1·52	60
30	1·09	50	2·84	328	1·62	82	1·87	112	1·52	60
31	1·04	48	2·84	328			1·86	110		

Note.—Ice conditions January 1 to April 27, and November 10 to end of year; data insufficient to compute discharge for December. River frozen to bottom, January 14.

PLATE VIII


DEPARTMENT OF THE INTERIOR CANADA
WATER POWER BRANCH
J B Challies Supt
MANITOBA HYDROGRAPHIC SURVEY
PLAN SHOWING
RIVERS Tributary To LAKE WINNIPEG
EAST SHORE
Legend
Metering Station
Gauging Station
Scale In Miles
To Accompany Progress Report Of Stream Measurements
March 1915
M.C HENDRY Chief Engineer
Hudson Bay Ry
Split L
Grass R
Nelson R
Wintering L
Sipiwesk L
Oxford L
Pipestone L
Molson L
Gods Lake
Goose L
Island L River
Island Lake
Echo R
NORWAY HOUSE
McLaughlin R
Gunisao R
Gunisao L
Belunger R
Big Black R
Lost Lake
Sandy L
LAKE WINNIPEG
Poplar R
Leaf R
Deer L
Etomami R
Fishing L
Berens R
Moose L
Pigeon R
Family L
Goose L
Berens R
Bloodvein R
Birch L
Fisher R
Trout L
Manigotagan R
Black R
Manitou R
Lac Seul
English R
Winnipeg River
WINNIPEG
G.T.P.R
C.P.R.
C.N.R.
KENORA
Red R
Whitemouth R
MANITOBA

Daily Gauge Height and Discharge of Brokenhead River near Sinnot, for 1914.

[Drainage area, 530 square miles.]

Day.	January.		February.		March.		April.		May.		June.	
	Gauge Height.	Discharge	Gauge Height.	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.	Gauge Height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet	Sec.-ft.
1	...	...	...	...	...	...	...	...	2·66	284	2·46	236
2	...	...	...	...	...	...	3·87	...	2·59	268	2·36	212
3	...	...	...	...	...	...	4·02	...	2·58	265	3·26	428
4	...	...	...	...	...	...	3·97	...	2·57	263	3·76	548
5	...	...	...	...	...	...	3·87	...	2·57	263	3·86	572
6	...	...	...	...	...	...	3·87	...	2·72	299	3·90	582
7	...	...	...	...	...	...	...	...	2·79	316	3·94	592
8	...	...	...	...	...	...	...	...	2·82	323	3·95	594
9	...	...	...	...	...	...	...	...	2·78	313	4·00	606
10	...	...	...	...	...	...	...	...	2·67	287	5·26	908
11	...	...	...	...	...	...	...	...	2·65	282	4·79	796
12	...	...	...	...	...	...	3·92	...	2·62	275	4·66	764
13	...	...	...	...	...	...	4·07	40	2·57	263	4·39	699
14	...	...	...	...	...	...	4·12	80	2·43	229	4·36	693
15	...	...	...	...	...	...	4·17	120	2·37	215	4·16	644
16	...	...	...	...	...	...	4·25	160	2·29	196	3·95	594
17	...	...	...	...	...	...	4·30	200	2·27	191	3·68	529
18	...	...	...	...	...	...	4·32	240	2·29	196	3·65	522
19	...	...	...	...	...	...	4·37	280	2·25	186	3·37	455
20	2·07	...	...	...	...	...	4·47	320	2·27	191	3·29	435
21	...	...	...	...	...	...	4·55	360	2·96	188	3·16	404
22	...	...	...	...	...	...	4·92	400	2·22	180	3·07	383
23	...	...	...	...	...	...	3·37	455	2·16	165	2·96	356
24	...	...	...	...	...	...	3·07	383	2·07	145	2·84	328
25	...	...	...	...	...	...	3·02	371	2·11	153	2·70	294
26	...	...	...	...	...	...	2·97	359	2·36	212	2·61	272
27	...	...	...	...	...	...	2·95	354	2·46	236	2·46	236
28	...	...	...	...	...	...	2·87	335	2·44	232	2·36	212
29	...	...	...	...	...	...	2·79	316	2·46	236	2·26	188
30	...	...	...	...	...	...	2·72	299	2·47	239	2·17	167
31	...	...			...	...			2·51	248		...

	July.		August.		September.		October.		November.		December.	
1	2·05	142	2·58	258	1·62	82	1·74	95	2·34	208	1·61	41
2	1·96	126	2·36	212	1·55	76	1·69	89	2·32	203	1·63	44
3	1·91	118	2·22	179	1·53	74	1·64	84	2·33	205	1·63	44
4	1·85	109	2·07	145	1·44	68	1·62	82	2·28	193	1·64	44
5	1·76	97	1·99	130	1·39	64	1·60	80	2·25	186	1·65	44
6	1·69	89	1·87	112	1·42	66	1·62	82	2·20	174	1·67	41
7	1·65	85	1·76	97	1·34	61	1·64	84	2·15	163	1·68	41
8	1·56	77	1·68	88	1·33	61	1·72	92	2·09	149	1·69	41
9	1·45	69	1·58	78	1·44	68	1·74	95	2·06	143	1·68	41
10	1·44	68	1·49	71	1·40	65	1·79	101	2·04	140	1·64	38
11	1·36	63	1·41	66	1·40	65	2·14	160	2·01	134	1·63	38
12	1·86	110	1·30	59	1·41	66	2·49	244	2·05	141	1·56	33
13	3·96	596	1·26	57	1·42	66	2·82	323	2·15	163	1·55	33
14	3·83	565	1·25	57	1·43	67	2·99	364	2·24	184	1·45	28
15	4·75	786	1·24	56	1·44	68	3·04	376	2·45	234	1·43	28
16	5·36	932	1·21	55	1·54	75	2·99	364	2·35	210	1·37	26
17	5·76	1,028	1·20	54	1·62	82	2·94	352	2·34	208	1·34	24
18	5·82	1,043	1·18	53	1·64	84	2·93	349	2·33	205	1·30	22
19	5·56	980	1·16	52	1·72	92	2·92	347	2·09	132	1·27	20
20	5·41	944	1·15	52	1·64	84	2·90	342	1·95	109	1·25	20
21	5·19	892	1·14	52	1·62	82	2·79	316	1·85	96	1·23	20
22	5·08	865	1·14	52	1·74	95	2·76	308	1·75	76	1·20	18
23	4·76	788	1·23	56	1·76	97	2·72	299	1·71	72	1·17	17
24	4·41	704	1·19	54	1·87	112	2·64	280	1·70	65	1·15	17
25	4·14	640	1·23	56	1·99	131	2·59	268	1·68	65	1·10	15
26	3·81	560	1·36	63	2·02	136	2·55	258	1·65	62	1·08	15
27	3·61	512	1·44	68	1·94	122	2·53	253	1·65	54	1·05	14
28	3·35	450	1·53	74	1·89	115	2·51	248	1·61	52	1·05	14
29	3·11	392	1·65	85	1·84	108	2·48	241	1·65	49	1·02	13
30	2·87	335	1·64	84	1·80	102	2·43	229	1·63	44	0·98	13
31	2·71	296	1·63	83			2·42	227			0·93	13

Note —Ice conditions, January 1 to April 23, and November 18 to end of year

MONTHLY DISCHARGE of Brokenhead River near Sinnot, for a period of the year 1914.

(Drainage area, 530 square miles.)

Month.	Discharge in Second Feet				Run-off	
	Maximum.	Minimum.	Mean.	Per square mile	Depth in inches on Drainage Area.	Total in acre feet.
1912.						
June		62[1]	260[1]	0·490	0·547	15,471
July	354	49	127	0·240	0·277	7,809
August	205	56	81	0·153	0·176	4,980
September	760	96	414	0·781	0·871	24,635
October	692	306	478	0·902	1·040	29,391
November	400	132[1]	300[1]	0·566	0·632	17,851
December				....		
The period	760	49	277	0·522	3·543	100,137
1913						
May	364	109	210	0·396	0·457	12,900
June	400	48	107	0·202	0·225	6,350
July	448	48	189	0·357	0·412	11,600
August	388	43	201	0·379	0·437	12,400
September	325	82	172	0·325	0·363	10,200
October	203	65	122	0·230	0·265	7,525
November	109	60[1]	86[1]	0·162	0·181	5,100
December						
The period	448	43	155	0·293	2·340	66,100
1914						
April	455	0	267[1]	0·504	0·562	15,900
May	323	145	237	0·447	0·515	14,600
June	908	167	475	0·896	1·000	28,300
July	1,043	63	467	0·881	1·016	28,700
August	258	52	86	0·162	0·186	5,275
September	136	61	85	0·160	0·179	5,050
October	376	80	227	0·428	0·494	14,000
November	234	44	137	0·258	0·288	8,150
December	44[1]	13	28	0·053	0·061	1,720
The period	1,043	0	223	0·421	4·301	121,695

[1] Estimated.

NOTE.—Data insufficient to compute discharge, etc., for December, 1912, and for January to April inclusive, and December, 1913.

MANIGOTAGAN RIVER.

The Manigotagan river, also known as the Bad Throat river, empties into lake Winnipeg from the east, about 50 miles north of Fort Alexander. The drainage area is approximately 300 square miles, though it cannot be definitely determined, as the river lies almost entirely in unsurveyed territory. The general course of the river from source to mouth is northwest. There are a number of lake-like expanses in the river between Long lake and Turtle lake, these are known as Caribou, Musk Rat, Moose, and Bull Frog lakes.

At the mouth of the river the land is adapted to agriculture, being good clay land. Above Wood falls the country changes and rock outcrops occur; these form barriers across the river, causing falls or rapids; between these, the banks vary between high and rocky, to low, bordering on muskegs.

The river above Wood falls for a distance of 25 miles has an average width of 175 feet, above this point it is a series of small lake-like expanses or pools of several hundred feet in width, joined by narrow stretches, which in the majority of cases are broken by falls or rapids.

The entire drainage area is more or less covered with timber growth; this is not of merchantable size and is of inferior quality, consisting of spruce, scrub oak, birch, and poplar. In the upper part a fringe of good spruce timber is to be found bordering the lakes.

In 1913 a reconnaissance survey of the power possibilities of the river was made by a party sent out by the Manitoba Hydrographic Survey.

Manigotagan River at Wood Falls.

History.—The station on the Manigotagan was established on December 21, 1912, by G. J. Lamb, and has been operated since that date.

Location of section.—The meter section is located 200 feet above the first falls known as Wood falls; it is about 1 mile northeast of the Manigotagan post office, and 3 miles from the large island at the mouth of the river. The initial point is marked by a spike driven into a 12-inch tree, which is blazed and stands near the water's edge on the left bank.

Records Available.—A record of daily gauge height has been secured for the periods April 19 to October 31, 1913, and April 18 to November 15, 1914. Estimates of daily discharge have been computed for the same period.

Drainage Area.—The drainage area tributary to the Manigotagan above the section is 375 square miles.

Gauge.—Two gauges are in operation at this point, the first is a 3-foot vertical staff enamelled gauge fastened to a 2-by 4-inch scantling, which is driven into the river-bed 135 feet below the meter section, and in a small bay near the right bank above the falls. The second is a 3-foot vertical staff enamelled gauge fastened to a 2- by 4-inch scantling which is secured to the perpendicular rock face on the right shore 100 feet below and facing Wood falls. Both gauges are referred to a bench-mark which is located on a horizontal ledge of rock 10 feet from the gauge below the falls, and is marked by means of paint on the rock face, W.P.S. B.M.

Channel.—The river occupies one channel at all stages: it is straight for 300 feet above and 100 feet below the section. The banks are high and wooded and not liable to overflow.

Discharge Measurements.—Discharge measurements have been taken at this point by means of a canoe which is kept on the section with the aid of a tagged line stretched across the river.

Accuracy.—On account of the small number of discharge measurements taken at this point the discharge curve is not well defined.

Discharge Measurements of Manigotagan River above Wood Falls, 1912-14.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Dec. 28	G. J. Lamb	1,375	125	884	1·62	729·64	144[1]
1913							
May 26	D. B. Gow	1,435	100	460	1·02	730·79	469
" 31	"	1,435	89	293	1·45	730·69	423
Aug. 23	A. Pirie	1,496	75	310	0·31	729·43	93
Oct. 9	"	1,496	66	72	0·91	729·03	65
1914.							
Feb. 21	C. O. Allen	1,496	50	136	0·28	728·97	39[1]

Note.—[1]Measurement taken under ice conditions

Daily Gauge Height and Discharge of Manigotugan River above Wood Falls, for 1913.

[Drainage area 375 square miles.]

Day	January		February.		March		April		May		June	
	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge	Gauge Height	Discharge.
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1			29·64		29·59				30·39	292	30·60	424
2									30·39	292	30·68	420
3									30·46	322	30·60	424
4	29·69								30·49	336	30·69	424
5							29·60		30·54	353	30·79	468
6									30·59	380	30·50	380
7									30·61	388	30·59	380
8			29·64		29·60				30·59	380	30·59	380
9									30·65	406	30·49	336
10									30·69	424	30·49	336
11	29·69								30·69	424	30·49	336
12							29·49		30·77	459	30·44	314
13									30·79	468	30·42	308
14									30·79	468	30·39	292
15			29·64		29·60				30·79	468	30·39	292
16									30·69	424	30·38	287
17									30·79	468	30·38	287
18	29·64								30·79	468	30·39	292
19							30·29	249	30·81	476	30·49	336
20							30·24	233	30·81	476	30·19	217
21							30·22	226	30·79	468	30·29	249
22			29·59		29·69		30·19	217	30·79	468	30·29	249
23							30·19	217	30·79	468	30·19	217
24							30·19	217	30·79	468	30·39	292
25	29·64						30·19	217	30·79	468	30·29	249
26							30·19	217	30·79	468	30·29	249
27							30·27	242	30·79	468	30·19	217
28							30·29	249	30·77	459	30·29	249
29							30·29	249	30·69	424	30·19	217
30					29·69		30·29	249	30·79	468	30·19	217
31									30·69	424		

Day	July.		August		September		October		November		December.	
1	30·49	336	29·59	110	29·38	88	29·25	78	29·06			
2	30·09	191	29·59	110	29·58	110	29·55	106				
3	30·19	217	29·49	99	29·35	86	29·55	106				
4	30·19	217	29·49	99	29·35	86	29·16	72				
5	30·09	191	29·69	122	29·35	86	29·29	90				
6	30·09	191	29·59	110	29·38	88	29·56	107			29·08	
7	29·99	169	29·59	110	29·37	87	29·05	66				
8	30·49	336	29·49	99	29·37	87	29·59	110	29·03			
9	29·99	169	29·19	99	29·35	86	29·05	66				
10	29·89	151	29·09	68	29·15	71	29·54	104				
11	29·99	169	29·39	89	29·15	71	29·29	78				
12	29·99	169	29·49	99	29·33	84	29·25	78				
13	29·99	169	29·49	99	29·37	87	29·03	65			28·98	
14	30·09	191	29·59	110	29·45	95	29·08	67				
15	29·89	151	29·49	99	29·53	103	29·05	66	29·08			
16	29·89	151	[1]29·49	99	29·25	78	29·25	78				
17	29·89	151	[1]29·49	99	29·23	76	29·58	109				
18	30·19	217	[1]29·45	95	29·25	78	29·37	87				
19	29·79	136	[1]29·45	95	29·55	106	29·54	104				
20	29·79	136	[1]29·45	95	29·43	97	29·46	96			29·08	
21	29·89	151	[1]29·45	95	29·25	78	29·45	95				
22	29·89	151	[1]29·45	95	29·15	71	29·03	65	28·98			
23	29·79	136	29·43	93	29·16	72	29·57	108				
24	29·69	122	29·43	93	29·18	73	29·59	110				
25	29·79	136	29·45	95	29·17	72	29·36	96				
26	29·79	136	29·33	84	29·27	79	29·28	80				
27	29·79	136	29·35	86	29·03	65	29·11	70				
28	29·79	136	29·35	86	28·55	48	29·28	80				
29	29·79	136	29·35	86	28·95	61	[1]29·34	85	29·08			
30	29·89	151	29·36	86	29·05	66	[1]29·28	80				
31	29·79	136	29·35	86			[1]29·24	77				

NOTE.—All gauge heights marked thus ([1]) interpolated. Ice conditions January 1 to April 19, and November 28 to end of year. Data insufficient to estimate discharges.

Daily Gauge Height and Discharge of Manigotagan River above Wood Falls, for 1914.

(Drainage area, 375 square miles.)

Day	January Gauge Height	January Discharge	February Gauge Height	February Discharge	March Gauge Height	March Discharge	April Gauge Height	April Discharge	May Gauge Height	May Discharge	June Gauge Height	June Discharge.
	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.	Feet	Sec.-ft.
1									29·58	109	30·33	265
2									29·63	115	30·38	287
3	29·08								29·73	127	30·38	287
4							28·63		29·73	127	30·43	309
5							28·63		29·78	134	30·43	309
6							28·68		29·88	150	30·38	287
7			29·65		28·63		28·68		30·13	201	30·43	309
8							28·68		30·18	215	30·43	309
9							28·73		30·33	265	30·38	287
10	29·03						28·73		30·33	265	30·53	353
11							28·78		30·23	230	30·53	353
12							28·83		30·13	201	30·53	353
13							28·88		30·03	178	30·53	353
14			29·68		28·63		28·88		29·93	158	30·43	309
15							28·93		29·83	142	30·33	265
16							28·98		29·73	127	30·33	265
17	29·05						29·23		29·78	134	30·43	309
18							29·53	103	29·83	142	30·53	353
19							29·58	109	29·83	142	30·13	201
20							29·58	109	29·98	167	30·33	265
21			29·63	39	28·63		29·48	98	29·98	167	30·53	[illegible]
22							29·48	98	30·03	178	30·63	[illegible]
23							29·38	88	30·08	189	30·73	441
24	29·08						29·43	93	30·13	201	30·83	485
25							29·43	93	30·28	216	30·93	529
26							29·43	93	30·13	201	30·83	485
27							29·48	98	30·13	201	30·63	397
28			29·63		28·63		29·53	103	30·23	230	30·63	397
29							29·53	103	30·23	230	30·63	397
30							29·53	103	30·28	216	30·73	441
31	29·05								30·33	265		

Day	July Gauge Height	July Discharge	August Gauge Height	August Discharge	September Gauge Height	September Discharge	October Gauge Height	October Discharge	November Gauge Height	November Discharge	December Gauge Height	December Discharge
1	30·83	485	30·13	201	29·53	103	29·63	115	30·18	215	....	....
2	30·83	485	30·03	178	29·48	98	29·63	115	30·18	215	....	....
3	30·93	529	30·03	178	29·48	98	29·73	127	30·18	215	....	....
4	30·93	529	29·93	158	29·48	98	29·73	127	30·18	215		....
5	30·93	529	29·93	158	29·48	98	29·83	142	30·13	201	30·03	....
6	31·03	573	29·93	158	29·48	98	29·88	150	30·13	201	.	....
7	31·03	573	29·88	150	29·48	98	29·93	158	30·13	201	.	....
8	31·13	617	29·88	150	29·13	93	29·98	167	30·13	201		....
9	31·13	617	29·88	150	29·43	93	30·03	178	30·13	201	.	....
10	31·13	617	29·88	150	29·43	93	30·13	201	30·13	201		...
11	31·03	573	29·88	150	29·43	93	30·23	230	30·13	201		....
12	31·03	573	29·83	142	29·43	93	30·33	265	30·08	189	30·13	....
13	30·83	485	29·83	142	29·43	93	30·43	309	30·08	189	30·13	....
14	30·83	485	29·83	142	29·43	93	30·53	353	30·08	189	30·13	....
15	30·83	485	29·78	131	29·43	93	30·58	375	30·03	178	30·13	....
16	30·73	441	29·78	131	29·43	93	30·58	375	30·03		30·13	....
17	30·73	441	29·78	134	29·38	88	30·58	375	30·03	...	30·13	....
18	30·78	463	29·78	134	29·38	88	30·48	331	30·03	...	30·13	....
19	30·78	463	29·78	134	29·38	88	30·48	331	30·03	...	30·13	....
20	30·63	397	29·73	127	29·38	88	30·38	287	30·03	...	30·13	....
21	30·43	309	29·73	127	29·13	93	30·38	287	30·03	...	30·13	....
22	30·43	309	29·73	127	29·43	93	30·38	287	....	...	30·13	....
23	30·33	265	29·73	127	29·43	93	30·33	265	....	...	30·13	....
24	30·33	265	29·68	121	29·48	98	30·33	265	....		30·13	....
25	30·33	265	29·68	121	29·48	98	30·28	246	...	.	30·13	....
26	30·33	265	29·68	121	29·48	98	30·28	246			30·13	....
27	30·23	230	29·63	115	29·48	98	30·23	230		....	30·13	....
28	30·23	230	29·63	115	29·53	103	30·23	230	30·03	....	30·13	....
29	30·23	230	29·63	115	29·53	103	30·18	215	...	....	30·13	....
30	30·13	201	29·58	109	29·58	109	30·18	215	...	....	30·13	....
31	30·13	201	29·58	109		..	30·18	215			30·13	....

NOTE.—Ice conditions January 1 to April 18, and November 15 to end of year; Data insufficient to compute daily discharges.

MONTHLY DISCHARGE of Manigotagan River above Wood Falls, for the years 1913-14.

[Drainage area, 375 square miles.]

Month	Discharge in Second-Feet				Run-Off	
	Minimum	Maximum	Mean	Per square mile	Depth in inches on Drainage area	Total in acre-feet
1913						
January			[1]130	0·347	0·400	8,000
April	249		[1]200	0·533	0·595	11,900
May	476	292	427	1·138	1·312	26,300
June	468	217	311	0·829	0·925	18,500
July	336	122	172	0·458	0·528	10,600
August	122	68	96	0·256	0·295	5,900
September	110	48	81	0·216	0·241	4,820
October	110	65	86	0·279	0·322	5,300
The period	476	48	188	0·507	4·618	91,320
1914						
February			[1]40	0·107	0·112	2,220
March			[1]40	0·107	0·123	2,460
April			[1]80	0·213	0·238	4,760
May	265	109	183	0·488	0·563	11,300
June	529	201	345	0·920	1·026	20,500
July	617	201	424	1·131	1·304	26,100
August	201	109	139	0·371	0·428	8,550
September	109	88	96	0·256	0·286	5,700
October	375	115	239	0·637	0·734	14,700
November			[1]120	0·320	0·357	7,150
December			[1]90	0·240	0·277	5,550
The period	617	39	163	0·435	5·444	108,980

NOTE.—Data insufficient to estimate discharge for February, March, November and December, 1913, and January, 1914. All marked thus ([1]) Estimated.

BERENS RIVER.

The Berens river enters lake Winnipeg from the east, about 140 miles north of Fort Alexander. It is the most important tributary of the lake entering from the east, with the exception of the Winnipeg river. It has a drainage area estimated to be 7,800 square miles, and a length of approximately 300 miles. The headwaters lie near the height of land which forms the south and west limits of the Severn and Albany drainage basins. Many lakes are to be found in the district, though their areas are not well defined, as they are in unsurveyed territory.

The country drained is typical of the Laurentian formation, abounding in muskegs and swamps, and the rock frequently outcrops. These rock outcrops form barriers across the river and are the reason for the numerous falls and rapids to be found on the river. Some 52 falls and rapids occur between the first fall, 5 miles from the mouth, and Family lake, and these vary in height or drop between 3 or 4 feet and 40 feet.

Family lake also forms the source of the Pigeon river, which parallels the course of the Berens and empties into lake Winnipeg a few miles south of the mouth of the former river.

The Berens river was examined by a party sent out by the Manitoba Hydrographic Survey to determine its power possibilities. This survey revealed the fact that there are a number of feasible sites on the river.

The country is not heavily timbered, but is covered with a growth of small spruce, poplar, birch, and scrub oak. There is little merchantable timber to be found along the river.

DISCHARGE MEASUREMENTS of Berens River above Little Grand Rapids, 1914.

Date	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 1	D. B. Gow	1,911	230	3,972	1.76	1006.93	7,001
July 9	"	1,911	227	3,990	1.82	1007.09	7,262
Aug. 28	"	1,435	216	3,711	0.85	1004.85	3,160

DISCHARGE MEASUREMENTS of Berens River below First Falls, 1914.

Date	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Feb. 28	C. O. Allen	1,469	116	515	0.99		510
June 13	D. B. Gow	1,911	120	1,173	0.96	717.50	1,126
July 27	"	1,435	126	1,291	1.70	718.55	2,190
Sept. 8	"	1,435	122	1,181	0.98	717.50	1,160

DISCHARGE MEASUREMENTS of Etomami River near Berens River, 1913.

Date	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 2	A. Pirie	1,497	36	150	0.80	94.94	119

NELSON RIVER.

General.—The Nelson river forms the outlet of lake Winnipeg flowing through the central portion of northern Manitoba and emptying into Hudson bay at Port Nelson. The Nelson river discharges all the water collected by lake Winnipeg from an immense drainage area, and forms one of the principal systems of the North American continent, the basin comprising an area of 450,000 square miles.

The territory drained varies from the open prairie forming the great central plain to the rugged and magnificent country found in the Rockies; between these extremes of physical characteristics all gradations may be found in the basin. The vegetation to be found covers as wide a range.

The western part of the drainage area is practically devoid of lakes, but in the south and eastern sections are to be found some of the largest fresh-water bodies on the continent. These lakes are so situated in relation to the Nelson river that the maximum natural storage effect is exerted upon the flow of that river; in consequence, the maximum discharge may be expected to approximate closely the mean discharge.

The river has a length of 430 miles, and in this distance the drop aggregates 712 feet. The potential power possibilities of the river are therefore apparent. In the upper reaches the river has the appearance of a chain of lakes connected by short stretches of river which are interrupted by falls and rapids. These characteristics which hold for the upper 250 miles of river gradually change as the mouth is approached, the drop in the river not being as distinct but more in the nature of swifts and flat rapids, though the banks become high as the bay is approached.

The first expanse below the lake Winnipeg outlet is known as Playgreen lake, below which there are two channels known as East and West rivers. Sea falls is to be found on East river, and the latter then expands into Pipestone lake. The junction of these two branches occurs in Cross lake. Below that point are Sipiwesk, Split lake, and Gull lake. The rapids and falls in order are Ebb and Flow rapids, Whitemud falls, Bladder rapids, Over the Hill, Red Rock, and Chain of Rocks rapids; Manitou or Devil's rapids, Grand rapids, Chain of Islands rapids, all being above Split lake. Below Split lake are Gull, Kettle, Long Spruce, and Limestone rapids.

The country adjacent to the Nelson river is practically unsettled, though on account of the building of the Hudson Bay railway there has been considerable activity along the river. The timber growth is scattered, including spruce, birch, and poplar, and it is claimed that the clay soil to be found is very fertile.

A reconnaissance survey of the river was made by the late William Ogilvie in 1910 for the Dominion Water Power Branch; also, discharge measurements were obtained. After gathering miscellaneous records in 1912-13, a metering station was established in 1914 by the Manitoba Hydrographic Survey above Manitou rapids, and this has been operated since that time.

NELSON RIVER AT MANITOU RAPIDS.

History.—This station was established by G. J. Lamb on July 18, 1914.

Location of Section.—The meter section is located at a point 3½ miles upstream from Manitou Landing, and 4 miles above the Shell rapids. The initial point is marked on a sloping face of rock northeast of the gauge and is a wooden plug driven in a 1½-inch hole drilled in the rock.

Records Available.—Records of daily gauge height were secured from July 2 to October 14, 1914, and a number of discharge measurements were taken over the same period.

Drainage Area.—The drainage area tributary to the Nelson river is 450,000 square miles, of which 24,000 square miles lies below Manitou rapids. The river drains lake Winnipeg into Hudson Bay. Practically all Canadian territory lying south of latitude 53 and between the summit of the Rockies and lake Superior is tributary to this river.

Gauge.—The gauge is a vertical staff enamelled gauge fastened to a 6-inch spruce post driven in the bed of the river, and braced; it is further strengthened by being weighted with large boulders. The gauge is referred to a bench-mark which is marked by a triangle painted in red on the face of the rock near the initial point and marked "M.H.S. B.M." The datum of the bench-mark is an assumed elevation.

Channel.—For 1,500 feet above the section, and 8,000 feet below, the channel is straight. The river is confined to one channel at all stages, and has a depth on the section varying between 20 and 69 feet. The bed of the stream is of gravel and boulders and not liable to shift. The current is swift and the banks are high and wooded and not liable to overflow.

Discharge Measurements.—The meterings are made from a canoe held on the section by means of a stay line stretched across the river and supported on floats.

Accuracy.—No daily discharge estimates have been arrived at from the gauge heights and discharge measurements, as it has been found impossible to define a regular rating curve on account of the varying slope in the river due to the prevalence of high winds.

Discharge Measurements of Nelson River at Manitou Rapids, 1914.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 18	G. J. Lamb	1861	918	34,490	3·01	93·13	103,736
" 25	"	1861	916	33,464	2·60	92·87	87,088
Aug. 3	"	1861	916	34,719	2·71	92·89	94,084
" 4	"	1861	916	34,755	2·65	92·84	92,083
" 4	"	1861	916	34,755	2·72	92·84	94,508
" 7	"	1861	916	34,665	2·77	92·79	96,179
" 8	"	1861	915	34,573	2·78	92·74	96,228
" 10	"	1861	916	34,665	2·74	92·80	95,043
" 11	"	1861	916	34,665	2·72	92·80	94,206
" 15	"	1861	915	34,723	2·65	92·69	91,928
" 17	"	1861	916	34,723	2·67	92·71	92·775
" 21	"	1861	912	34,628	2·74	92·59	94,861
" 24	"	1861	913	34,449	2·58	92·41	88,931
" 24	"	1861	913	34,442	2·67	92·44	91,985
Sept. 5	"	1861	909	34,083	2·57	92·04	87,542
" 7	"	1861	908	34,253	2·63	92·21	89,956
" 7	"	1861	908	34,253	2·68	92·20	91,806
" 24	"	1861	908	34,253	2·65	92·21	90,857

MISCELLANEOUS METERINGS.

In a number of cases where stations were established, after one or several meterings were taken, it was found that the location was unfavourable, either on account of the difficulty in obtaining an observer for the daily gauge heights or on account of the physical features obtaining at the station preventing accurate records being taken.

In other cases, sufficient information was not obtained to properly define a discharge curve, though the records would indicate that a curve may be defined by fuller information. In this case the gauge heights are on file, and when the necessary additional data are secured, estimates of daily discharge will be made.

Records are published under the heading "Miscellaneous Meterings," where discharges obtained under above conditions may be of some immediate value.

Discharge Measurements of Rainy Lake Feeders; Miscellaneous Meterings, 1912.

Date.	Hydrographer.	Meter No.	Width.	Area of Section	Mean Veloc'y	Gauge Height	Dis-charge	Remarks
1912			Feet.	Sq. ft	Ft per sec	Feet.	Sec.-ft	
Aug. 10	W. H. Richardson	1,374	10	8	0·13		1·0	Small creek, Hale bay.
" 11	"	1,374	13	7	1·00		7·1	Pipestone river.
" 13	"	1,374				No	flow.	Rat river.
" 14	"	1,374	210	3,518	0·45	..	1,592·1	Seine river.
" 15	"	1,374	2	1·6	2·17	...	3·2	Creek No. 1 in Seine bay.
" 15	"	1,374				..	.	Creek No. 2 in Seine bay.
" 17	"					No	flow.	Rocky Inlet creek.
" 20	"	1,374	135	1,016	0·21	...	216·4	Big Canoe river.
" 21	"	1,374	8	8	0·81	...	6·8	Little Canoe river.
" 22	"	1,374	143	1,224	0·67	.....	815·5	Manitou river.
" 24	"	1,374	9	5	0·20	...	1·0	Ash river.
" 25	"	1,374	2	0·5	1·0	...	0·5	Small creek in Ash bay.
" 25	"				Est'd.	......	0·5	Small creek in Alexndria bay.
" 26	"	1,374	43	77	2·64	..	202·8	North-west Bay river.
" 27	"	1,374	8	10	1·09	...	11·0	White Fish creek.
" 22	"	1,374	3	2	0·28		0·6	Brownlee's creek.
" 28	"	1,374	8	2	0·25	.	0·4	Small creek nr. Brownlee's
" 28	"	1,374	7	2	3·20	..	7·0	(N W bay) Lost creek.
" 29	"	1,374	13	6	0·13	.	0·7	Outlet of Wegg lake.
" 29	"				Est'd		0·5	Creek in Brown's inlet.
" 30	"	1,374	4	2·1	0·80	....	0·1	Grassy Narrows creek.
" 31	"	1,374	3	2·2	1·30	.	0·2	Wasaw creek.
Sept. 1	"	1,374	12	21	0·25	..	5·4	Frog creek.
" 5	"	1,374	10	9	0·68	.	6·7	Cranberry river.
" 6	"	1,374	4	4·3	0·11	...	5·9	Small creek, Lost bay.
" 7	"	1,374	7	2·4	0·21		0·5	Big Island river

Discharge Measurements of Middle Lake Outlet River at Darlington Bay, 1912.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 29	S. S. Scovil	1,375	20	30	3·03	......	89
Aug. 28	W. G. Worden	1,187	19	29	1·94	..	57

Discharge Measurements of Winnipeg at Throat Rapids, 1914.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914.			Feet.	Sq. ft.	Ft. per sec	Feet.	Sec.-ft.
Oct. 9	S. C. O'Grady	1,196	96	424	1·26	1,035·90	534

Discharge Measurements of Winnipeg River at Foot of Dalles, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 10	S. C. O'Grady	1,196	255	6,912	1·88	34·25	12,972

Discharge Measurements of English River at First Falls above Mouth, 1914.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
May 20	S. C. O'Grady	1,469	246	9,643	0·86	993·71	8,274

Discharge Measurements of Tye Creek below Slave Falls, Winnipeg River, 1912.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1912			Feet.	Sq. ft.	Ft. per sec.	Feet	Sec.-ft.
July 5	E. B. Patterson	1,197	61	128	0·56	901·68	71
" 9	W. H. Richardson	1,197	61	128	0·58	901·76	74

Discharge Measurements of Whiteshell River at Jessie Lake, 1912.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
July 4	E. B. Patterson	1,197	164	948	0·386	899·64	366
" 5	E. B. Patterson	1,197	164	949	0·328	899·64	311
" 9	W. H. Richardson	1,197	164	978	0·372	899·88	364

Discharge Measurements of Bird River at Lac du Bonnet, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec	Feet.	Sec.-ft
Jan. 8	R. H. Nelson	1,435	118	1,435	0·26	820·77	96·70

Note.—Measurement taken under ice conditions.

Discharge Measurements of Roseau River near Mayne's Farm (Dominion City), 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 13	G. J. Lamb	1,374	56	25	0·93	102·78	24

Discharge Measurements of Morris River at Morris, Man., 1912.

Date.	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1912.			Feet	Sq. ft	Ft. per sec.	Feet.	Sec.-ft.
Oct. 3	W. G. Worden	1,496	58	197	1·37	102·00	270

Discharge Measurements of La Salle River at La Salle, 1912.

Date.	Hydrographer	Meter No	Width.	Area of Section	Mean Velocity.	Gauge Height.	Discharge
1912.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 2	Worden & Lamb	1,496	53	151	0·451	1·29	68

Discharge Measurements of Seine River at St. Anne des Chenes, 1912.

Date.	Hydrographer	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1912.			Feet.	Sq	Ft per sec	Feet.	Sec-ft.
Oct. 4	Alex Pirie	1,186	74	397	0·71	97·31	282

Discharge Measurements of Little Saskatchewan River, 5 miles above Minnedosa, 1914.

Date.	Hydrographer.	Meter No	Width.	Area of Section	Mean Velocity.	Gauge Height	Discharge.
1914.			Feet.	Sq ft	Ft per sec	Feet	Sec-ft.
Jan. 30	W. J. Ireland	1,497	69	33	0·81		27
Mar 8	W. J. Ireland	1,469	23	38	0·91		34

Note.—Measurements taken under ice conditions.

Discharge Measurements of Red Deer River below Red Deer Lake, 1914.

Date.	Hydrographer.	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge.
1914.			Feet	Sq ft	Ft per sec	Feet	Sec-ft.
Jan. 24	C. O. Allen	1,375	315	1,152	0·33	91·05	380

Note.—Measurement taken under ice conditions.

Discharge Measurements of Mossy River at Cameron's Bridge, 1913.

Date	Hydrographer.	Meter No	Width	Area of Section	Mean Velocity	Gauge Height	Discharge.
1913			Feet	Sq ft	Ft per sec	Feet	Sec-ft.
May 21	L. Bankson	1,499	193	722	2·01	95·18	1,474

Discharge Measurements of Squirrel River at Austin, 1913.

Date	Hydrographer	Meter No	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1913.			Feet	Sq ft	Ft per sec	Feet.	Sec-ft.
June 21	Pirie Elmer	1,496	6	0·2	1·38	85·23	2·7

Discharge Measurements of Whitemud River at Gladstone, 1914.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge
1914			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Jan. 18	E. J. Budge	1,162	29	41	0·10		5·0

Note.—Measurement taken under ice conditions.

Discharge Measurements of Whitemud River at Westbourne, 1912.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean. Velocity.	Gauge Height	Discharge.
1912			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Oct. 15	W. G. Worden	1,496	. . .	599	0·38	101·60	226

Discharge Measurements of Shoal River at Swan Lake, 1914.

Date.	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity.	Gauge Height.	Discharge.
1914.			Feet	Sq. ft.	Ft. per sec.	Feet, W. L.	Sec.-ft.
Jan. 30	C. O. Allen	1,375	[illegible]	406	0·74	92·05	292

Note.—Measurement taken under ice conditions.

Discharge Measurements of Jack River at Norway House, 1913.

Date	Hydrographer	Meter No.	Width	Area of Section	Mean Velocity	Gauge Height	Discharge.
1913.			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Sept. 20	A. Pirie and [illegible] Allen	1,496	141	1,975	0·72	94·27	1,415

Discharge Measurements of Pigeon River, Miscellaneous Sections, 1914.

Date.	Hydrographer	Meter No.	Width	Area of Section	Mean Veloc'y.	Gauge Height	Discharge	Remarks.
1914.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.	
Mar. 1	C. O. Allen	1,496	79	645	1·49	. . .	960	Above 1st Falls.
July 4	D. B. Gow	1,911	[illegible]	3,103	1·51	985·11	4,698	Above Shining Falls.
Aug. 17	"	1,435	[illegible]	3,010	1·26	984·50	3,630	"
" 29	"	1,435	376	2,873	1·02	984·02	2,939	"
" 7	"	1,435	257	4,216	0·96	816·50	4,048	1,200 feet above 8th Rapids.

Discharge Measurements of Pigeon River below Sturgeon Falls, 1914.

Date.	Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914.			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 1	D. B. Gow	1,435	236	4,301	1·10	729·30	4,717
Sept 4	" ..	1,435	229	4,144	0·67	....	2,771

Discharge Measurements of Bloodvein River at Miscellaneous Sections, 1914

Date.	Hydrographer.	Meter No.	Width.	Area of Section	Mean. Veloc'y	Gauge Height.	Discharge	Remarks.
1914.			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft	
Mar. 7	C. O Allen	1,496	48	256	1·25	.	321	At First (Eagle) Falls.
Sept. 24	D. B Gow	1,435	68	664	0·83	716·02	554	Above First Rapids, 9 miles from mouth.
" 25	"	1,435	18	50	0·86	.....	43	Little Bloodvein river 200 feet above mouth.
Oct 1	"	1,435	34	99	0·49	881·91	49	N. branch above 15th Falls.
" [illegible]	"	1,435	197	689	1·57	..	1,077	Above 20th Falls.
" [illegible]	"	1,435	62	997	1·44	..	1,435	8 miles from mouth.

Discharge Measurements of Eating Point Creek West Shore Lake Winnipeg, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913			Feet.	Sq. ft.	Ft per sec.	Feet.	Sec.-ft.
Sept 2	A Pirie	1,496	36	116	0·53	93·12	62

Discharge Measurements of Sturgeon-Gill Creek near Grand Rapids, Lake Winnipeg, 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge
1913.			Feet	Sq. ft	Ft per sec.	Feet.	Sec.-ft.
Sept 5	A Pirie	1,496	41	68	0·76	93·81	51

Discharge Measurements of Waterhen River at Waterhen, 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 26	D B Gow	1,187	440	3,038	2·79	..	8,476

DISCHARGE MEASUREMENTS of West Branch of Nelson River near Wishky Jack Portage, 1913.

Date	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge. Height.	Discharge.
1913.			Feet	Sq. ft.	Ft. per sec	Feet.	Sec.-ft.
Sept. 25	Pirie-Allen.	1,497	1,235	26,020	1·79	97·61	46,549

DISCHARGE MEASUREMENTS of East Creek, Nelson River at Manitou Rapids, 1914.

Date.	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 1	C. J. Lamb....	..	26	24	0·50	98·48	12

DISCHARGE MEASUREMENTS of West Creek, Nelson River at Manitou Rapids, 1914.

Date.	Hydrographer.	Meter No	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1914.			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug 1[1]	G. J. Lamb	...	10	4	1·81	97·20	6

DISCHARGE MEASUREMENTS of Armstrong River near Nelson River, Camp No. 23, Hudson Bay Railway, 1914.

Date.	Hydrographer	Meter No.	Width.	Area of Section.	Mean Velocity	Gauge Height.	Discharge.
1914			Feet	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft.
Aug. 12	G. J. Lamb	1,462	43	114	0·62	99·21	71

DISCHARGE MEASUREMENTS of Nelson (East Branch) River at Sea Falls, South Channel, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
1913.			Feet.	Sq. ft.	Ft. per sec	Feet.	Sec.-ft.
Sept. 16	A. Pirie and F. Allan	1,496	7,080	23,266	0·67	91·89	15,501

DISCHARGE MEASUREMENTS of Nelson (East Branch) River at Sea Falls, North Channel, 1913.

Date.	Hydrographer.	Meter No.	Width.	Area of Section.	Mean Velocity.	Gauge Height.	Discharge.
			Feet.	Sq. ft.	Ft. per sec.	Feet.	Sec.-ft
1913.							
Sept. 16	A. Pirie and F. Allen	1,496	385	7,068	0·60	91·90	4,213

PROGRESS REPORT

OF

THE MANITOBA HYDROGRAPHIC SURVEY

FOR

1912-13-14

PART III

GAZETTEER OF LAKES AND RIVERS

PART III.

HYDROGRAPH GAZETTEER OF LAKES AND RIVERS IN THE PROVINCE OF MANITOBA.

This list of lakes and rivers cannot be considered complete, but is compiled from all available sources of information, such as Government maps and surveys, local knowledge, etc. Most of the names are those adopted by the Geographic Board of Canada, others being merely local names. The areas of the different lakes and drainage areas of the streams have been given as far as possible, but owing to the fact that a grea many of them lie in wholly unsurveyed territory, the figures can only be con idered approximate, but are based upon the best maps available.

Antler Creek.—Tributary of the Souris, rises in the vicinity of Manor and flows southeasterly, joining the Souris in Tp. 2, R. 27, W.P.M.

Armit River.—Flows into Red Deer lake. Has its source in a small lake in Tp. 42, R. 30, W.P.M.

Assiniboine River.—Has its source in the province of Saskatchewan in the southeasterly slopes of Nut mountain adjacent to the headwaters of the Red Deer river. From here the river flows in a southwes direction until it crosses the boundary between Saskatchewan and Manit where it bends southward and follows this direction until approximately a the latitude of Brandon, where it assumes an easterly bearing, and this general direction is followed to a point where it joins the Red river in the city of Winnipeg.

The total drainage basin of the Assiniboine covers an area of 59,550 square miles. Of this area approximately 8,800 square miles lie in the state of North Dakota, 37,700 miles in the province of Saskatchewan, and 13,0.0 miles in the province of Manitoba.

The principal tributaries of the river are the Qu'Appelle, the Souris, the Shell, and the Little Saskatchewan.

The drainage entering the river in the lower hundred miles of its course is very slight, as the basin is confined between the watersheds of the Red river and lake Manitoba.

Above the city of Brandon a large increase of the incoming drainage is noticed, and in its upper course the river is continually fed by springs, and streams draining the numerous small lakes with which the upper basin is dotted.

Athapapuskow Lake.—Has an area of 107 square miles. The waters of this lake discharge into Goose lake, and through the Goose river into Namew lake, an expanse of the Saskatchewan river.

Atikameg Lake or Clearwater Lake.—Lies in Tps. 58 and 59, R. 24 and 25, W.P.M. It has an area of 96 square miles. It drains through Cormorant lake and Moose lake into the Saskatchewan river.

Beaver Creek.—Flows into lake Winnipeg from the east in Tp. 34, R. 5, E.P.M.

Beaverhill Lake.—Is an expanse of Island Lake river, which drains Island lake into God's lake, forming a part of the Hay river draina system. It has an area of approximately 77 square miles.

Belanger river.—Flows east, emptying into lake Winnipeg south of Spider island.

Berens River.—Has its source on the height of land between the great lakes and Hudson bay, drains Snake lake, Rocky Island lake, Fishing lake, and

Family lake, flows into lake Winnipeg from the east. Mouth in Tp. 39, R. 3, E.P.M. Has power possibilities. No determination has been made of the size of the drainage area, the territory being unsurveyed.

Big Black River.—Flows west emptying into lake Winnipeg near the north end.

Big Grass River.—Flows easterly into Big Grass marsh, joining the latter in Tp. 17, R. 11, W.P.M.

Birch Lake.—In Tp. 13, R. 14, E.P.M. forms part of the drainage system of the Whiteshell river.

Birch River.—Tributary of the Whitemouth, rises in a small lake in sec. 3, Tp. 7, R. 14, E.P.M., and flows northwesterly, joining the Whitemouth in sec. 10, Tp. 10, R. 12, E.P.M.

Birch River.—Rises in Swan lake and flows northeasterly, emptying into Saskeram lake, which lies just to the west of the junction of the Carrot and the Saskatchewan rivers.

Birdtail Creek.—Tributory of the Assiniboine, rises on the southwestern slope of the Riding mountains and flows southwesterly into the Assiniboine in Tp. 15, R. 27, W.P.M.

Black River.—Flows into lake Winnipeg from the east in Indian reserve No. 9 or Tp. 22, R. 9, E.P.M.

Bloodvein River.—Flows into lake Winnipeg from the east, mouth in Tp. 32, R. 6, E.P.M. It drains territory that is almost entirely unsurveyed, so that its drainage area is indeterminate.

Bosshill Creek.—Flows easterly through Virden and empties into the Assiniboine in Tp. 10, R. 25, W.P.M.

Brokenhead River.—Drains into lake Winnipeg in Tp. 16, R. 6, E.P.M. The drainage area above Sinnot is 530 square miles.

Burntwood Lake.—Forms one of the sources of the Burntwood river. It belongs to the Nelson River drainage basin, and has an area of 67 square miles.

Burntwood River.—Is a tributary of the Nelson. It joins the latter in Split lake. It rises in Reed lake which lies almost due north of Pas, and drains that lake, Limestone Point lake, Burntwood lake, Three Point lake, Footprint lake, Wuskwatin lake and Pipe lake. There are power possibilities on this river.

Butnau Lake.—Discharges through the Butnau river into the Nelson river. It has a drainage area of 5·4 square miles.

Butnau River.—A small tributary of the Nelson, which flows into the latter from the east, about midway between Gull and Kettle rapids. Moose Nose lake and Butnau lake are drained by it.

Carrot River.—A tributary of the Saskatchewan. It has its source in a number of small streams south of the Saskatchewan, and flows northeasterly emptying into that river 2 miles west of Pas.

Catfish Creek.—Drains large swamp lying between the Brokenhead river and Lac du Bonnet, flows northerly into Traverse bay in Indian Reserve No. 3.

Catfish Creek.—Flows into lake Winnipeg at Catfish point in Tp. 36, R. 4 E.P.M.

Cedar Lake.—Is an expanse of the Saskatchewan river, just above Grand Rapids. It has an area of 340 square miles. It forms a natural regulating basin for the Saskatchewan river, its influence upon the discharge of that river being quite marked especially during high and low stages.

Child's Lake.—Lies in Tps. 30 and 31, R. 26, W.P.M. It forms the headwaters of the Shell river. The area of the lake is 5 square miles.

Churchill River.—Is one of the largest rivers in the province. It flows in a general northeasterly direction and empties into Hudson bay at Fort Churchill. The country drained by the Churchill lies generally north of latitude 55 and south of latitude 59; to the west the territory extends to 112 west longitude, being approximately 114,000 square miles in extent. Contained in this territory there are a number of large lakes. Owing to the fact that practically all of the territory drained is in unsurveyed territory, a more definite description of the drainage area is not possible. The larger of the lakes drained by this river are: Lac le Ronge, at an elevation of 1,225 feet above sea-level; Reindeer lake, which is drained into the Churchill by the Reindeer river, lies at elevation 1,150; Wollaston lake is on the height of land between the Arctic drainage area and the Hudson bay, at an elevation of 1,300 feet, the best available maps indicate that the waters of this lake flow both to the Arctic and to the Hudson bay; and Isle la Cross at an elevation of 1,330 feet above sea-level. Going down the stream the other lakes drained are: Cold lake, Grenville lake, Southern Indian lake, and Northern Indian lake. In addition to these there are a great many others, but since they are more in the nature of expanses of the river they are not individually named.

Clear Creek.—Tributary of the Minnedosa river, it drains Clear lake and flows westerly joining the Minnedosa in Tp. 20, R. 20, W.P.M.

Clear Lake. In Tps. 19 and 20, R. 18 and 19, W.P.M., has an area of 14 square miles, and forms one of the sources of the Little Saskatchewan. It is being u[illegible] as a storage basin in connection with the regulation of flow on the Little Sask[illegible]chewan.

Clearwater River.—Is a tributary of the Nelson, draining Clearwater lake. It flows due west joining the Nelson below Whitewater falls.

Clearwater Lake. Drains through Touchwood lake into God's lake. It has an area of 23 square miles and belongs to the Hay River drainage system.

Cook Creek.—Tributary of the Red river, flows northwesterly and joins the Red below Selkirk.

Cormorant Lake.—Is skirted by the Hudson Bay railway. It has an area of 135 square miles, and drains through Moose lake into the Saskatchewan river.

Cranberry Lake.—Lies just about on the height of land between the Nelson and Saskatchewan drainage basins. It is not certain from the maps which way the waters flow, as in some cases it is shown flowing towards the Nelson through the Grass river and in others through Athapapuskow lake and Goose lake into Cumberland lake, an expanse of the Saskatchewan river. The area is 19 square miles.

Cross Lake.—Lies in Tps. 10 and 11, R. 16 and 17, E.P.M., drains through Whiteshell river into the Winnipeg river below Slave falls. It has an area of 2·9 square miles.

Cross Lake. Has an area of 9 square miles. It forms an enlargement of the Saskatchewan river and lies about 12 miles due west of lake Winnipeg on that river. The effect of this lake, together with that of Cedar lake, is quite marked upon the high and low stages of the river.

Cross Lake. Is an expanse of the Nelson river, and it is in this lake that the waters of the east and the west branches below the outlet of lake Winnipeg are joined. The river flows from it in four distinct channels, and it is upon this that the Ebb and Flow, Whitemud, and Bladder rapids are to be found. It has an area of 20·1 square miles.

Crow Duck Lake.—Lies in Tps. 13 and 14, R. 17, E.P.M., and drains through Crow Duck river into the Winnipeg below the mouth of the English river. It has an area of 19·9 square miles.

Cypress River.—Tributary of the Assiniboine, flows west and northeast, joining the Assiniboine in Tp. 8, R. 9, W.P.M.

Dauphin River.—Drains lake St. Martin, flowing north and east into Sturgeon bay, an arm of lake Winnipeg, in Tp. 34, R. 5, W.P.M. Owing to the regulating effect of the lakes above there are considerable power possibilities on this river.

Dauphin Lake.—Lies in Tps. 24, 25, 26, 27, and 28, R. 16, 17, and 18, W.P.M. It has an area of 197 square miles, and lies at an elevation of 860 feet above sea-level. A number of streams which have their source in the Riding and Duck mountains drain into this lake, viz., Turtle, Ochre, Vermilion, Wilson, Valley, and others. It is drained by the Mossy river, which flows into lake Winnipegosis at Winnipegosis.

Deer River.—Tributary of the Hayes river.

Deer Horn Creek.—Tributary of the Assiniboine, flows southeasterly and empties into the Assiniboine in Tp. 18, R. 29, W.P.M.

Devil's Creek.—Tributary of the Red river, flows northwesterly and empties into the Red river in sec. 34, Tp. 15, R. 5, E.P.M.

Dog Creek.—Drains Dog lake into lake Manitoba, flowing through Tps. 22 and 23, R. 9, W.P.M., or the Dog Creek Indian Reserve No. 46.

Dog Lake.—Lies in Tps. 23 and 24, R. 7, 8, and 9, W.P.M. It has an area of 61 square miles and lies at elevation 815 above sea level. It drains through Dog creek into lake Manitoba.

Drifting River.—Tributary of the Valley river, joining that river in Tp. 26, R. 20, W.P.M.

Ebb and Flow Lake.—Lies in Tps. 23 and 24, R. 11 and 12, W.P.M. It has an area of 37·5 square miles, and drains through a short channel into lake Manitoba.

Edward's Creek.—A tributary of the Vermilion river.

Elbow Lake.—A small lake in the Grass River drainage basin. It has an area of 4 square miles.

Eagle Lake.—Lies on the interprovincial boundary between Ontario and Manitoba. It forms a source of the Berens and Pigeon rivers. As a possible storage basin for these rivers it is of importance, the area being 30·5 square miles.

Etawnei Lake.—Forms the source of the Pocokatakuskow river. The area of the lake is 666 square miles.

Etomami River.—Branch of the Berens river.

Fairford River.—Joins lake Manitoba and lake St. Martin, draining the former, and flows through Tp. 30, R. 9, W.P.M. This river has considerable power possibilities. The drainage area is 31,500 square miles.

Falcon River.—Drains Falcon lake and flows into Indian bay, Shoal lake, in Indian Reserve No. 40.

Falcon Lake.—Forms the headwaters of the Falcon river, and therefore part of the Lake of the Woods system; it is in Tp. 8, R. 16 and 17, E.P.M. The area of the lake is 7·8 square miles.

Family Lake.—Lies in Tps. 33 and 34, R. 14 and 15, E.P.M. It has an area of 37 square miles and forms the connecting link between the Berens and Pigeon rivers, to both of which rivers its waters are added.

Farell River.—Tributary of the Swan river, rises on the northern slope of the Duck mountain, and flows north joining the Swan river in Tp. 37, R. 25, W.P.M.

File River.—Drains File lake and Loonhead lake into Burntwood lake. It forms part of the Burntwood drainage system.

Fisher River.—Rises in Tp. 24, R. 2 and 3, W.P.M., flows northeast into Fisher bay, an arm of lake Winnipeg, in Indian Reserve No. 44.

Fishing Creek.—Tributary of the Mossy, joining the latter at Oak Brae.

Fishing Lake.—Lies in Tp. 36, R. 15, E.P.M. It has an area of 14 square miles, and forms part of the drainage system of the Berens river, for which reason it is valuable from the standpoint of storage possibilities.

Fork River.—A tributary of the Mossy river, joins the latter in Tp. 29, R. 19, W.P.M.

Footprint Lake.—A tributary of the Burntwood river, which enters into Nelson and Split lake. The area is 12·5 square miles.

Fox River.—Tributary of the Hayes river, rises to the east of Split lake. It drains Bear, Backbone, Little Fox, and Fox lakes. The Leaf river is a tributary.

Gainsborough Creek.—Tributary of the Souris, flows south through the town of Gainsborough, and then east, joining the Souris in Tp. 2, R. 27, W.P.M. The greater part of its drainage area is in Saskatchewan.

God's River.—Flows northeasterly, draining God's lake, and emptying into the Shamattawa river, a main tributary of the Hayes river. It lies in latitude 54°30′ to 56° and longitude 92°30′ to 94°30′.

God's Lake.—Is drained by God's river, a tributary of the Hayes river. The area is approximately 370 square miles.

Goose River.—Joins Goose lake and Namew lake, part of the drainage system which finds its outlet in Cumberland lake, an enlargement of the Saskatchewan. Other lakes drained by it are Cranberry lake and Athapapuskow lake.

Granville Lake.—Is an expanse of the Churchill river, and lies just below Granville falls. It has an area of 146 square miles.

Grass River.—Drains Reed lake into Wekusko lake, Wekusko lake into Setting lake, and Setting lake into Point lake; it forms part of the Nelson River drainage system. The fall between Reed lake to Point lake is 320 feet (barometric), and, in consequence, power prospects are to be expected.

Gunisao River.—Rises in Gunisao lake. It forms the southern branch of the McLaughlin river, which flows northwesterly, emptying into the Nelson within the boundary of Indian Reserve 17, about 5 miles south of Norway House.

Hay River.—Flows into Shoal lake in Indian Reserve 37 A.

Hayes River.—Is one of the largest in the northern part of the province. Its general course is northeasterly, and it rises on the height of land about 40 miles northeast of Norway House, in Molson lake. It also drains Touchwood lake, Clearwater lake, Rat lake, Windy lake, Oxford lake, and Knee lake, all of which might be termed enlargements or expanses of the river. The main tributaries of the river are the Shamattawa river and the Fox river. The total drainage area is approximately 36,250 square miles. Having a drop of 900 feet from source to mouth, there are power possibilities on the river. The mouth is in latitude 57° north, longitude 92°·30′ west, and empties into the Hudson bay.

Hill Lake.—Is drained by Minago river into Cross lake on the Nelson river, and forming part of that drainage system. The area of the lake is 16 square miles.

Icelandic River.—Rises in small lake in Tp. 23, R. 1, W.P.M., flows easterly into lake Winnipeg in Tp. 23, R. 4, E.P.M.

Inland Lake.—In Tp. 38, R. 16, W.P.M. It has an area of 12·5 square miles.

Insect River.—Is a branch of North Duck river; it flows northeast, emptying into lake Winnipegosis at Duck bay.

Island Lake.—At an elevation of 900 feet above sea-level. It discharges into Island river, a tributary of the Hayes river. Its area is 520 square miles.

Island Lake River.—Lies due east of Norway House. It joins Island lake and Beaverhill lake, draining the former into the latter, and is part of the drainage system of the Hayes river. There are a number of falls and rapids on this stream, and, with Island lake above, there appears to be an opportunity for water-power development.

Jackson Creek.—Tributary of the Souris, rises near Merryfield and flows south, joining the Souris in Tp. 4, R. 26, W.P.M.

Jackfish Creek.—Flows into Traverse bay, lake Winnipeg, in Tp. 19, R. 2, E.P.M.

Jessica Lake.—Lies in Tp. 12, R. 15 and 16, E.P.M., drains through the Whiteshell into the Winnipeg river. The area is 3 square miles.

Kississing River.—A tributary of the Churchill river, flows out of Kississing lake northward.

Kississing Lake, or Cold Lake.—Drains through Kississing river into the Churchill river. The area is 102 square miles.

Kiskitto Lake.—Is an arm-like expanse of the Nelson river, and lies above Netchanais rapids. It has an area of 58 square miles.

Kiskittogisu Lake.—Is an arm-like expanse of the Nelson river, lying above Netchanais rapids. It has an area of 95 square miles.

Knee Lake.—Lies below Oxford lake and forms an expanse of the Hayes river. The area of the lake is approximately 100 square miles.

Lac du Bonnet.—Lies in Tps. 15 and 16, R. 11, 12, and 13, E.P.M.; it forms part and is an enlargement of the Winnipeg river. It has an area of 32·7 square miles, and has an important bearing upon power production of the river owing to its possible regulating effect on that river in connection with power development.

Lake of the Woods.—Touches Manitoba at the southeastern corner of the province; it forms the largest lake in the Winnipeg river drainage basin and is very important as a regulation basin for the run-off of that river. It has an area of 1,500 square miles, part of which lies in United States territory. The lake of the Woods lies at an elevation of 1,060 feet above sea-level.

Landing Lake.—Empties through a small river into the Nelson river, just above Whitewater falls. It has an area of 31 square miles.

Limestone River.—Tributary of the Nelson, joining the latter at the head of Limestone rapids, flows due east draining Clearwater lake.

Limestone Point Lake.—Is drained by the File river into Burntwood lake, one of the sources of the Burntwood river. The area of the lake is approximately 10 square miles.

Little Saskatchewan (also called Minnedosa River).—Tributary of the Assiniboine, rises on the southern slope of Riding mountain, and has as its source a number of small lakes; it flows south and joins the Assiniboine river in Tp. 10, R. 20, W.P.M. The total drainage area of this river is 1,500 square miles.

Little Souris River.—Rises near Hayfield and flows easterly into the Assiniboine in Tp. 9, R. 17, W.P.M.

Little Swan River.—Tributary of the Red Deer river, flows north and joins the Red Deer in Tp. 44, R. 3, W.2.M.

Long Lake.—Is in Tp. 19, R. 19, W.P.M., and forms one of the sources of the Little Saskatchewan river. It has an area of 2·8 square miles.

Long River.—Has its source in Montana, tributary of the Pembina, flows northwesterly through Tps. 1 and 2, R. 12, W.P.M., and joins the Pembina in Tp. 3, R. 12, W.P.M.

Loon Creek.—Flows into lake Winnipeg from the east, mouth in Indian Reserve No. 11, Tp. 29, R. 7, E.P.M.

Manigotagan River.—Drains Muskrat, Long and Caribou lakes, flows into the Winnipeg river from the east in Tp. 25, R. 9, E.P.M. Has power possibilities. The drainage area has not been estimated, as all the territory drained is unsurveyed.

Manitoba Lake.—Lies at an elevation of approximately 810 feet above sea-level, has an area of 1,711 square miles. It lies immediately north of the town of Portage la Prairie and forms one of the links in a chain of rivers and lakes which add their waters to lake Winnipeg through the Dauphin river. The following lakes drain into lake Manitoba: Dog lake, Ebb and Flow lake, Waterhen lake, and the Fairford river forms the outlet, connecting with lake St. Martin which lies to the northeast.

Mantagao River.—Rises in North Birch lake and flows north into Sturgeon bay, an arm of lake Winnipeg, in Tp. 33, R. 3, W.P.M.

Maskawa River.—Flows into Winnipeg river above Pine falls in Tp. 18, R. 10, E.P.M.

McLaughlin River.—Flows west and northwest, emptying into the east channel of the Nelson river about 5 miles south of Norway House.

Minago River.—Drains Hill lake, and several small lakes above, into Drunken lake, which is in turn an arm of Cross lake, an enlargement of the Nelson river.

Mitishto River.—Flows north into Grass river; is part of the Nelson River drainage basin.

Molson Lake.—Lies to the northwest of Norway House, and it forms the headwaters of the Hayes river. It has an area of 51 square miles.

Moose Lake.—Lies to the north of Cedar lake. It has an area of approximately 500 square miles. Atikameg lake and Cormorant lake, which lie to the north and west, drain through Moose lake into the Saskatchewan river.

Moose Nose Lake.—On the line of the Hudson Bay railway, the waters drain into the Nelson through Butnau riv.r. The area is 8·5 square miles.

Morris River.—Tributary of the Red. lows easterly and enters the Red at Morris, Tp. 1, R. 1, E.P.M. It drains part of the low-lying ground between Pembina mountains and the Red river.

M.ssy River.—Drains lake Dauphin into ke Winnipegosis, flows north and enters into the latter at Winnipegosis in Tp. 31, R. 18, W.P.M. The drainage area above Winnipegosis is 3,950 square miles.

Muhigan River.—Drains Waskik lake and Lilly lake into Duck lake, part of the Nelson river drainage.

Muskrat Lake.—Lies in Tp. 22, R. 14, E.P.M.; it has an area of approximately 8·4 square miles, and forms the headwaters of the Manigotagan river. It is therefore valuable from a storage standpoint.

Nelson River.—Forms the outlet of lake Winnipeg, discharging the waters of that lake into Hudson bay. It forms one of the large drainage systems of the North American continent, practically all of the drainage between the Great Lakes and the Rocky mountains and north of the international boundary as far as the 54th parallel of latitude being tributary to it. Among the rivers which belong to this drainage area and are themselves of considerable magnitude are: the Saskatchewan, having two branches known as the North and South branches, the Winnipeg, of which the English river is a tributary, the Red and the Dauphin. Numerous other rivers of less magnitude are to be found in the basin. The range of physical features which may be found in this drainage basin is great, varying from the rugged country of the Rocky mountains to the comparatively level central plane known as the prairie.

Owing to the large amount of lake area to be found in the drainage basin, the variation between high and low discharge may be expected to be small. This is undoubtedly true, though since records have been obtained the variation has proved to be greater than was anticipated.

The total drainage area tributary to the Nelson is 45,000 square miles; between lake Winnipeg and the mouth the fall is approximately 700 feet in a length of about 430 miles. In this distance a number of lake-like expanses occur, as Playgreen lake, Little Playgreen lake, Pipestone lake, Cross lake, Sipiwesk lake, and Split lake.

Throughout the whole length of the river, numerous rapids occur, and with the high minimum discharge of the river the power possibilities are considerable. Owing to the proximity of the Hudson Bay railway, these have become of more than passing value, though up to the present time the remoteness of the different sites has rendered their development unfeasible.

North Birch Lake.—Is in Tp. 27, R. 4, W.P.M. It has an area of 3·3 square miles, and forms the source of the Mantagao river, which flows into the south end of Sturgeon bay.

North Duck River.—Rises on the eastern slope of the Duck mountain and flows east and north into lake Winnipegosis at Duck bay.

Northern Indians Lake.—An expanse of the Churchill river. It is the lowest of the chain of lakes drained by that river. The area is approximately 170 square miles.

Oak Creek.—Tributary of the Souris, flows northerly and westerly emptying into the latter in Tp. 8, R. 16, W.P.M.

Oak Lake.—Forms the catch basin for Pipestone creek, which lies in Tp. 8, R. 25, E.P.M. Its area is 7·3 square miles.

Oak River.—Tributary of the Assiniboine, flows southerly and empties into the Assiniboine in Indian Reserve No. 58.

Ochre River.—Flows northeasterly into lake Dauphin, emptying into the latter in Tp. 24, R. 17, W.P.M. It has a drainage area of 250 square miles.

Oiseau Lake.—Lies in Tps. 19, and 20, R. 15, E.P.M., part of the drainage system of the Oiseau river. It has an area of 21 square miles.

Oiseau or Bird River.—Drains Oiseau lake and Snowshoe lake, flows into Lac du Bonnet in Tp. 17, R. 13, E.P.M.

Overflowing River.—Drains into Dawson bay, lake Winnipegosis.

Oxford Lake.—An expanse of the Hayes river. It lies in unsurveyed territory, the area being approximately 95 square miles.

Partridge Crop Lake.—An expanse of the Grass river, part of the Nelson river drainage system. It has an area of 23 square miles.

Pasquia River.—A tributary of the Saskatchewan. It rises in Tp. 49, R. 2, W. 2 M., and flows northeasterly, joining the Saskatchewan river at Pas.

Pelican Lake.—In Tps .4 and 5, R. 16, W.P.M. It forms part of the drainage system of the Pembina river, and has an area of approximately 10 square miles.

Pelican Lake.—In Tp. 41, R. 21, W.P.M. Water from Pelican lake flows through a small stream into an arm of lake Winnipeg, known as Pelican bay. The area of this lake is 27 square miles.

Pembina River.—Rises in the northeastern slope of the Turtle mountains, flows easterly, draining Rock lake and Swan lake, then southeasterly, crossing the international boundary in sec. 4, Tp. 1, R. 6, W.P.M.; then flows easterly through Minnesota, joining the Red river about 4 miles south of the international boundary. It has a drainage area of 1,840 square miles, part of which is in United States territory.

Pickerel Lake.—In Tps. 41 and 42, R. 15, W.P.M. Flows into lake Winnipegosis. The area of the lake is approximately 12·5 square miles.

Pigeon River.—Rises in Pigeon lake, and also drains Family lake; flows into lake Winnipeg from the east in Tp. 38, R. 3, W.P.M. Has power possibilities. The country drained is pratically unsurveyed, so no estimate has been made of the size of the drainage area.

Pine River.—Rises on the eastern slope of the Duck mountain, and flows northeasterly into lake Winnipegosis, emptying into that lake in Indian Reserve No. 66.

Pink Lake.—An expanse of the Grass river.

Pine Root River.—Joins Wabishkok lake and Athapapuskow lake, a part of the Saskatchewan drainage system.

Pipe Lake.—Is a tributary of the Burntwood river above Manaxo falls. It has an area of about 13 square miles.

Pipestone Creek.—Flows southeasterly and empties into Oak lake in Tp. 8, R. 25, W.P.M.

Pipestone Lake.—Is an expanse of the east branch of the Nelson river. The waters of this lake discharge into Cross lake. It has an area of 32 square miles.

Playgreen Lake.—Is an expanse of the Nelson river, just below the outlet from lake Winnipeg. The area is 144 square miles.

Plum Creek.—Tributary of the Souris, drains Lizard and Plum lakes, empties into the Souris in Tp. 7, R. 21, W.P.M.

Poplar River.—Flows into lake Winnipeg from the east, draining Thunder lake; enters lake Winnipeg in about Tp. 46, R. 2, E.P.M.

Portage Creek.—Flows northerly into lake Manitoba joining the latter two miles east of Delta.

Qu'Appelle River.—Tributary of the Assiniboine, flows easterly and empties into the Assiniboine in Tp. 17, R. 28, W.P.M. It has a drainage area of 18,357 square miles and forms one of the main tributaries of the latter stream.

Rat Creek.—Tributary of Squirrel creek, joining the latter in Tp. 14, R. 19, W.P.M.

Rat River.—Tributary of the Red, rises to the west of Whitemouth lake, flows westerly for approximately 50 miles, and then northwesterly, joining the Red river about 2 miles north of Ste. Agathe. Above the metering station at Joubert's farm the drainage area is 820 square miles.

Red River.—Rises to the south of the international boundary, and flows almost due north into lake Winnipeg. Two of the main tributaries of this river are the Pembina and the Assiniboine, the latter adding its waters to the Red within the city limits of Winnipeg. The drainage area is 116,347 square miles, 42,547 square miles of which are in United States territory.

Red Deer Lake.—Lies in Tps. 45 and 46, R. 27 and 28, W.P.M. It has an area of 95 square miles, and forms an expansion of the Red Deer River, which drains into Dawson bay, an arm of lake Winnipegosis.

Red Deer River.—Flows easterly into Red Deer lake, joining the latter in Tp. 46, R. 28, W.P.M. The drainage area above the metering station at Erwood, on the Canadian Northern railway, is 4,900 square miles.

Reed Lake.—Forms part of the drainage basin of the Grass river. It is interesting from the fact that there may be power possibilities on the Grass river in close proximity to the Hudson Bay railway. The area is approximately 71 square miles.

Reindeer Lake.—Discharges into the Churchill river through Reindeer river, forming one of the chief sources of the former. The area of the lake is approximately 2,173 square miles.

Rice River.—Tributary of the Red Deer, rises in two small lakes in Tp. 23, R. 28, W.P.M.

Rice River.—Flows into lake Winnipeg from the east, mouth in Tp. 27, R. 8, E.P.M.

Rock Lake.—Lies in Tp. 3, R. 13 and 14, W.P.M. It forms an enlargement of the Pembina river, and has an area of 5·9 square miles.

Roaring River.—Rises on the northwestern slope of the Duck mountain, and flows west and northeast into Swan river, joining the latter in Tp. 37, R. 25, W.P.M.

Rocky Island Lake.—Lies on the interprovincial boundary in Tp. 34. It has an area of 7 square miles, and forms the connecting link between the Berens and Pigeon rivers, to both of which rivers its waters are added.

Rolling River.—Tributary of the Minnedosa, drains Otter lake and flows south into Minnedosa river in Tp. 16, R. 19, W.P.M.

Roseau River.—Rises to the south of Whitemouth lake, flows southerly across the international boundary into Minnesota, drains Roseau lake and then flows northwesterly, re-crossing the international boundary in sec. 6, Tp. 1,

R. 8. E.P.M., then generally westerly, joining the Red opposite Letellier. It has a drainage area of approximately 1,950 square miles.

Sale River.—Tributary of the Red, flows southeasterly, joining the Red near St. Norbert.

Salt Creek.—A tributary of the Vermilion river.

Sandy Lake.—Is in Tp. 18, R. 20, W.P.M. It has an area of 2·25 square miles, and forms one of the sources of the Little Saskatchewan river.

Sandy River.—Flows into lake Winnipeg from the east, Tp. 23, R. 8, E.P.M.

Saskeram Lake.—Lies to the west of Pas. It has an area of 98·5 square miles.

Seine River.—Tributary of the Red, flows northwesterly, and joins the Red within the city limits of St. Boniface.

Setting Lake.—An expanse of Grass river. Interesting in view of the possible power possibilities of that stream. The area is approximately 64 square miles.

Saskatchewan River.—Is one of the most important rivers entering the province of Manitoba; it forms one of the chief tributaries of lake Winnipeg, and has a drainage area which extends from that lake westward to the summit of the Rocky mountains. There are two main branches of this river, known as the North and South branches. There are a number of streams of importance which form the South branch; of these may be mentioned the Bow river, the Old Man, the Belly, the St. Mary's, and the Red Deer. The North branch, while subdivided into a number of streams and of practically the same length as the South branch, has not as many streams of importance entering it; of those that add their waters to this branch, however, the ones of importance are the Clearwater and the Battle. The total drainage area of the Saskatchewan is 155,000 square miles.

Setting River.—Flows into Setting lake from the west.

Shamattawa River.—In latitude 56°, longitude 92°30′ flows northwesterly into the Hayes river, of which it forms one of the main tributaries; God's river and its tributary drainage flowing into the Shamattawa.

Shell River.—Tributary of the Assiniboine, rises on the western slope of the Duck mountain, with its headwaters in Child's lake, and flows south and empties into the Assiniboine in Tp. 23, R. 29, W.P.M. The drainage area above Assessippi is 930 square miles.

Shoal Lake.—Is connected to the lake of the Woods by a narrow channel and may be considered as an arm of that lake, since it lies at the same elevation as the lake of the Woods. It is the source of the Greater Winnipeg water supply and has an area of 107 square miles.

Shoal Lake.—Lies in Tps. 15 to 19, R. 1 and 2, W.P.M. It has an area of 87·5 square miles. This lake has neither tributary nor outlet.

Shoal River.—Drains Swan lake into lake Winnipegosis, entering the latter in Tp. 43, R. 23, W.P.M.

Siequer Lake.—Lies in Tp. 15, R. 15, E.P.M., has an area of approximately 5·2 square miles.

Singoosh Lake.—Lies in Tp. 31, R. 24, W.P.M. Forms the headwaters of the Valley river. It has an area of 5·5 square miles.

Sipiwesk Lake.—An expanse of the Nelson river below Chain of Rock rapids. The area is approximately 171 square miles.

Sisipuk Lake.—An expanse of the Churchill river, just above Bloodstone falls.

Skunk Creek.—Tributary of the Assiniboine, flows west and empties into the Assiniboine in Tp. 21, R. 29, W.P.M.

Smith Creek.—Tributary of the Assiniboine, flows south and east, and empties into the Assiniboine in Tp. 21, R. 29, W.P.M.

Smoking Tent River.—Tributary of the Red Deer, flows north into Red Deer, joining the latter in Tp. 45, R. 1, W.2.M.

Snowflake Brook.—Rises in Rush lake, Minnesota, and flows north, joining the Pembina in Tp. 1, R. 9, W.P.M.

Snowshoe Lake.—Lie in Tps. 21 and 22, R. 17, E.P.M. It forms part of the drainage system of the Oiseau river. The area is 22·6 square miles.

Souris River.—Tributary of the Assiniboine, joins the latter in Tp. 8, R. 16, W.P.M. It has a drainage area of 22,500 square miles, of which 8,840 square miles lies in United States territory. The flow varies between 4 and 1,434 c.f.s., as recorded at the metering station at Wawanesa about 6 miles from the mouth.

South Duck River.—Rises on the eastern slope of the Duck mountain, and flows east and north into lake Winnipegosis at Duck bay.

Southern Indians Lake.—A large expanse of the Churchill river, which lies just above Missi falls. It has an area of approximately 760 square miles.

Spence Lake.—Discharges into lake Manitoba. It lies in Tps. 29 and 30, R. 16, W.P.M., and has an area of 4 square miles.

Split Lake.—An expanse of the Nelson river below Cross lake on the same river. The area is 173 square miles.

Squirrel Creek.—A tributary of the Whitemud river, flows northeasterly joining the Whitemud in Tp. 13, R. 9, W.P.M.

St. Martin Lake.—Forms the last expanse in the chain of lakes which drain into lake Winnipeg. It has flowing into it the Fairford river, which drains lake Manitoba and is, in turn, drained by the Dauphin river directly into Sturgeon bay, an arm of lake Winnipeg. It has an area of 139 square miles.

Steep Rock River.—Has its source in two small lakes on the northeastern slope of Porcupine mountains; flows northeasterly into Dawson bay, lake Winnipegosis.

Stony Creek.—Tributary of Willow Creek, joining the latter 1 mile southeast of Neepawa.

Swan River.—Rises on the western slope of the Porcupine mountain, flows south and crosses the second meridian in Tp. 34, and then northeasterly into Swan lake, emptying into the latter in Tp. 40, R. 23, W.P.M. The drainage area above the metering station at Swan river on the Canadian Northern railway is 1,400 square miles.

Swan Lake.—Lies in Tps. 39, 40, and 41, R. 22, 23, and 24, W.P.M. It has an area of 119 square miles, and forms the basin into which two rivers, the Woody and the Swan, which have their source on Porcupine mountain, drain. It is drained by the Shell river into Dawson bay, an arm of lake Winnipegosis.

Swan Lake.—In Tps. 4 and 5, R. 11, W.P.M. It is an enlargement of the Pembina, and has an area of 4·7 square miles.

Three Point Lake.—On the Burntwood river, being an expanse of that stream. It belongs to the Nelson River drainage area, and is 13·3 square miles in extent.

Thunder Lake.—Lies in Tp. 43, R. 5 and 6, E.P.M.; is an enlargement of the Poplar river. It has an area of approximately 21 square miles.

Touchwood Lake.—Drains into God's lake, forming part of the Hayes river drainage system. It has an area of approximately 28 square miles.

Turtle River.—Flows northerly into lake Dauphin, joining the latter in Tp. 24, R. 16, W.P.M.

Valley River.—Rises in Singoosk lake on the western slope of the Duck mountain; flows south and northeast, emptying into lake Dauphin in Tp. 27, R. 18, W.P.M. The drainage area above the Canadian Northern Railway crossing, at which point there is a metering station, is 1,040 square miles.

Vermilion River.—Rises on the northeastern slope of the Riding mountain, and flows northeasterly into lake Dauphin, joining the latter in Tp. 25, R. 17, W.P.M.

Wanipigow River.—Flows into lake Winnipeg from the east in Tp. 26, R. 9, E.P.M.

Waterhen Lake.—Forms an expanse in the drainage system of the Waterhen river, which is the connecting stream between lake Winnipegosis and lake Manitoba. It lies in Tps. 35, 36, and 37, R. 15 and 16, W.P.M. It has an area of 75 square miles.

Wekusko Lake.—A lake draining into Grass river, interesting from a standpoint of power possibilities on that stream. The lake has an area of 130 square miles.

West Hawk Lake.—In Tp. 9, R. 17, E.P.M., has an area of about 5·8 square miles, and forms part of the system with Cross lake and lake Jessica, which finally drains into the Winnipeg river through the Whiteshell river.

Whirlpool River.—A branch of the Rolling river, flows south and joins the latter in Tp. 18, R. 18, W.P.M.

Whitemouth Lake.—Lies in Tp. 3, R. 13, and 14 E.P.M. It has an area of 26·3 square miles and forms the headwaters of the Whitemouth river.

Whitemouth River.—Tributary of the Winnipeg, rises in Whitemouth lake, flows northerly and empties into the Winnipeg in sec. 34, Tp. 13, R. 11, E.P.M. Above the Whitemouth traffic bridge the area drained is 1,400 square miles.

Whitemud River.—Tributary of the Pembina, joining the latter in Tp. 3, R. 15, W.P.M.; rises on the northeasterly slope of Turtle mountain.

Whitemud River.—Flows easterly and northerly into lake Manitoba, joining the latter in Tp. 15, R. 9, W.P.M.

Whiteshell Lake.—Forms the headwaters of the Whiteshell river; it lies in Tp. 13, R. 16, E.P.M., and is drained by the Whiteshell river into the Winnipeg river. The area of the lake is 5 square miles.

Whitewater Lake.—Lies in Tps. 3 and 4, R. 21 and 22, W.P.M. It has an area of 29·8 square miles, and is fed by a number of small streams which have their source on the northern slope of Turtle mountain. This lake is of interest from a standpoint that it has no visible outlet.

Willow Creek.—Tributary of the Whitemud river, flows northerly and easterly, joining the latter in Tp. 14, R. 13, W.P.M.

Wilson River.—Rises on the northern slope of Riding mountain and flows north and east into lake Dauphin in Tp. 25, R. 17, W.P.M.

Winnipeg Lake.—Lies wholly within the province of Manitoba and occupies a considerable portion of the southern area of the province. It is one of the largest fresh-water lakes on the continent, having a superficial area of 9,414 square miles. It is 260 miles from end to end, and has an average width of about 40 miles. Lake Winnipeg forms what may be called the catching basin or regulation basin, for a large part of the drainage coming from that part of Western Canada lying between the summit of the Rockies and the Great Lakes, and between the international boundary and the 54th parallel of latitude. The Winnipeg river and the Red river add their waters to the southern part of the lake. On the eastern shore a number of streams of somewhat small size drain into it. On the west, about midway between the north and south extremities of the lake, the drainage to the west of the lake lying within the province of Manitoba and part of the eastern portion of Saskatchewan flows in through the Dauphin river. At the northwestern corner of the lake, the Saskatchewan empties in, draining perhaps the largest area of any of the several rivers which form part of the drainage system. At the northern end of the lake the Nelson river, which is the only river flowing from the lake, has its source. It will be seen from this brief description what an important bearing lake Winnipeg has upon the flow of the Nelson river.

Winnipeg River.—Which has as its source the lake of the Woods and contributary drainage, is among the most notable rivers on the continent in regard to its potential power possibilities. The total drainage area of the Winnipeg river is 53,500 square miles. Of this, 49,100 lies above the mouth of the English river, one of the main tributaries, the latter having a drainage area of 21,600 square miles. The total fall of the Winnipeg river between the lake of the Woods outlet and lake Winnipeg is approximately 350 feet. Of this, approximately 320 feet is capable of development. The number of lakes within the upper drainage area, some 111, varying in size from 2 to 1,500 square miles, have a noticeable natural regulating effect upon the discharge of the river, the minimum flow being approximately 12,000 c.f.s. By means of storage on the lake of the Woods, this may be increaseed to 20,000 c.f.s., giving very complete regulation of the river.

Winnipegosis Lake.—Is connected to lake Manitoba by the Waterhen river through which stream it drains into the latter lake. It has an area of 1,995 square miles, and lies at an elevation of approximately 828 feet above sea-level. A number of streams and lakes which have their source in the Riding, Duck, and Porcupine mountains in the western part of the province, drain into a basin which is formed by it.

Wintering Lake.—Is an expanse of the Grass river, and lies just to the west of the Hudson Bay railway. It has an area of approximately 33 square miles.

Witchai Lake.—An expanse of the Grass river. It discharges through Grass river into the Nelson. The area of the lake is approximately 13 square miles.

Woody River.—Rises in a small lake in Tp. 38, R. 31, W.P.M., flows southeast and then northeast into Swan lake in Tp. 41, R. 24, W.P.M.

Wuskwatin Lake.—An expanse of the Burntwood river, forming part of the Hayes River drainage system. The area of the lake is approximately 16 square miles.

INDEX.

A

Acre foot PAGE
Acknowledgements 12
Antler Creek 27
  Gazetteer
Ar..t River 259
  Gazetteer
Armstrong River 259
  Discharge Measurement
Ash River (Rainy Lake) 253
  Discharge Measurement
Assiniboine River and tributaries 249
Assiniboine River District 161
Assiniboine River (Brandon) 13
  Daily Gauge Height and Discharge
  Description of station
  Discharge Measurements 167
  Monthly discharge 166
  Gazetteer 167
  170
Assiniboine River (Headingly) 259
  Daily gauge heights and discharge
  Description of station
  Discharge Measurements 172
  Monthly Discharge 170
  171
Assiniboine River (C.P.R., St. James) 171
  Daily gauge height and discharge
  Description of station
  Discharge measurements 176
  Monthly discharge 174
  175
Assiniboine River (Millwood) 178
  Daily gauge height and discharge
  Description of station
  Discharge measurements 164
  Monthly discharge 161
  163
Athapapuskow Lake 166
  Gazetteer
Atikameg Lake (or Clearwater Lake) 259
  Gazetteer
  259

B

Bazin Formula
Bearer Creek 13
  Gazetteer
Beaverhill Lake 259
  Gazetteer
Belanger River 259
  Gazetteer
Berens River 259
  Gazetteer
Berens River 259
Berens River (First Falls) 246
  Discharge measurements
Berens River (Little Grand Rapids) 247
  Discharge measurements
Big Black River 247
  Gazetteer

260

PAGE

Big Canoe River (Rainy Lake)
Discharge measurements 249

Big Grass River
Gazetteer 260

Big Island River (Rainy Lake)
Discharge measurements 249

Birch Lake
Gazetteer 261

Birch River
Gazetteer 260

Birch River
Gazetteer 260

Bird River (Lac du Bonnet)
Discharge measurements 251

Birdtail Creek 181

Birdtail Creek (Birtle)
Daily gauge height and discharge 184
Description of station 181
Discharge measurements 182
Monthly discharge 185
Gazetteer 260

Black River
Gazetteer 260

Bloodvein River
Discharge measurements 254
Gazetteer 260

Boat Stations 25

Bosshill Creek
Gazetteer 260

Bolster method of correcting discharge 26

Bridge Stations (for metering) 24

Brokenhead River 237

Brokenhead River (Sinnot)
Daily gauge height and discharge 239
Description of station 237
Discharge measurements 238
Monthly discharge 242
Gazetteer 260

Brownlee's Creek (Rainy Lake)
Discharge measurements 249

Burntwood Lake
Gazetteer 260

Burntwood River
Gazetteer 260

Butnau Lake
Gazetteer 260

Butnau River
Gazetteer 260

C.

Cable Stations (for metering) 24

Cable Carrier Stations (for metering) 25

Carrot River
Gazetteer 260

Catfish Creek
Gazetteer 260

Catfish Creek.
Gazetteer 260

Cedar Lake
Gazetteer 260

Chezy formula 15

Chemical method of determining discharge 17

	PAGE.
Child's Lake	
Gazetteer	260
Churchill River	
Gazetteer	260
Clear Creek	
Gazetteer	261
Clear Lake	
Gazetteer	261
Clearwater Lake	
Gazetteer	261
Clearwater River	
Gazetteer	261
Cook Creek	
Gazetteer	261
Convenient equivalents	14
Cormorant Lake	
Gazetteer	261
Cranberry River, (Rainy Lake)	
Discharge measurement	249
Cranberry Lake	
Gazetteer	261
Cross Lake	
Gazetteer	261
Cross Lake	
Gazetteer	261
Cross Lake	
Gazetteer	261
Crow Duck Lake	
Gazetteer	261
Current Meter—Determination of velocity by	19
Cypress River	196
Cypress River (Cypress River)	
Description of station	197
Discharge measurements	197
Gazetteer	261
D	
Data, explanation of	27
" preparation of	25
Dauphin Lake	
Gazetteer	262
Dauphin River	
Gazetteer	261
Deer River	
Gazetteer	262
Deer Horn Creek.	
Gazetteer	262
Definitions and terms	12
Devil's Creek	
Gazetteer	262
Discharge—Methods of determining	14
Districts	5
Dog Creek.	
Gazetteer	262
Dog Lake.	
Gazetteer	262
Drifting River.	
Gazetteer	262
E.	
Eagle Lake.	
Gazetteer	262

PAGE.

Eating Point Creek.
Discharge measurements ... 254

Ebb and Flow Lake.
Gazetteer ... 262

Edwards Creek.
Gazetteer ... 262

Elbow Lake.
Gazetteer ... 262

English River.
Discharge measurements ... 250

Etawnei Lake.
Gazetteer ... 262

Etomami River.
Discharge measurements ... 247
Gazetteer ... 262

Equivelants, convenient ... 14

Explanation of Data ... 27

F.

Fairford River ... 235

Fairford River (Fairford).
Description of station ... 235
Discharge measurements ... 236
Gazetteer ... 262

Falcon Lake.
Gazetteer ... 262

Falcon River.
Gazetteer ... 262

Family Lake.
Gazetteer ... 262

Farrell River.
Gazetteer ... 262

File River.
Gazetteer ... 262

Fisher River.
Gazetteer ... 262

Fishing Creek.
Gazetteer ... 262

Fishing Lake.
Gazetteer ... 262

Float method of determining velocity ... 18

Fork River ... 213

Fork River (Fork River)
Description of station ... 213
Discharge measurements ... 214
Gazetteer ... 263

Footprint Lake
Gazetteer ... 263

Fox River.
Gazetteer ... 263

Francis formula ... 16

Frog Creek (Rainy Lake).
Discharge measurement ... 249

G.

Gainsborough Creek.
Gazetteer ... 363

God's Lake
Gazetteer ... 263

God's River
Gazetteer ... 263

PAGE.

Goose River.
  Gazetteer ... 263

Granville Lake.
  Gazetteer ... 263

Grass River.
  Gazetteer ... 263

Grassy Narrows Creek (Rainy Lake).
  Discharge measurement ... 249

Gunisao River.
  Gazetteer ... 263

H

Hale Bay (Rainy Lake).
  Discharge measurement ... 249

Hay River.
  Gazetteer ... 263

Hayes River.
  Gazetteer ... 263

Hill Lake.
  Gazetteer ... 263

Hydrographic data ... 29

Hydrographic Gazetteer of Lakes and Rivers in the Province of Manitoba ... 259

I.

Icelandic River.
  Gazetteer ... 263

Inland Lake.
  Gazetteer ... 263

Insect River.
  Gazetteer ... 263

International Joint Commission ... 8

Integration method of determining velocity ... 22

Introduction ... 3

Island Lake.
  Gazetteer ... 263

Island Lake River.
  Gazetteer ... 263

J

Jack River at Norway House.
  Discharge measurements ... 253

Jackfish Creek.
  Gazetteer ... 264

Jackson Creek.
  Gazetteer ... 263

Jessica Lake.
  Gazetteer ... 264

K.

Kettle Falls (International Channel).
  Daily gauge height and discharge ... 36
  Description of station ... 35
  Discharge measurements ... 35

Kettle Falls (Canadian Channel).
  Daily gauge height and discharge ... 34
  Description of station ... 33
  Discharge measurements ... 33

Kettle Falls (Combined Channels).
  Daily gauge height and discharge ... 37
  Monthly discharge ... 38

Kississing Lake (or Cold Lake).
  Gazetteer ...

PAGE.

Kississing River.
Gazetteer ... 264

Kiskitto Lake.
Gazetteer ... 264

Kiskittogisu Lake.
Gazetteer ... 264

Knee Lake.
Gazetteer ... 264

Kutter's formula ... 15

L

Lac du Bonnet.
Gazetter ... 264

Lake of the Woods tributaries and outlets ... 31

Lake of the Woods District ... 46

Lake of the Woods.
Gazetteer ... 264

Lake of the Woods Outlets (Kenora Power House).
Daily gauge height and discharge ... 49
Description of station ... 46
Discharge measurements ... 47
Monthly discharge ... 57

Lake of the Woods Outlets (Middle Lake).
Discharge measurements ... 250

Lake of the Woods Outlet (C. P. R. Culvert).
Description of station ... 76
Discharge measurements ... 77

Lake of the Woods Outlets (K.L. & M. Co. Millrace).
Daily gauge height and discharge ... 74
Description of station ... 73
Discharge measurements ... 73
Monthly discharge ... 76

Lake of the Woods Outlets (Millrace "A").
Description of station ... 65
Discharge measurements ... 65

Lake of the Woods Outlets (Millrace "C").
Description of station ... 70
Discharge measurements ... 71

Lake of the Woods Outlets (Norman Bridge).
Daily gauge height and discharge ... 63
Description of station ... 59
Discharge measurements ... 60
Monthly discharge ... 65

Lake of the Woods Outlets (North Tunnel Island).
Daily gauge height and discharge ... 83
Description of station ... 78
Discharge measurements ... 79
Monthly discharge ... 87

Lake of the Woods Outlets (War Eagle Lake)
Description of station ... 77
Discharge measurements ... 78

Lake of the Woods Outlets (Combined discharge ... 88

Landing Lake.
Gazetteer ... 264

La Salle River
Discharge measurements ... 251

Limestone River.
Gazetteer ... 264

Limestone Point Lake
Gazetteer ... 264

Little Canoe River, Rainy Lake
Discharge measurement ... 249

Little Saskatchewan River ... 185

SESSIONAL PAPER No. 25f

	PAGE
Little Saskatchewan River also called Minnedosa River.	
Gazetteer ...	264
Little Saskatchewan River (Bilbey's Bridge).	
Daily gauge height and discharge	187
Description of station	185
Discharge measurements	186
Monthly discharge	188
Little Saskatchewan River (Five miles above Minnedosa).	
Discharge measurements	252
Little Saskatchewan River (Minnedosa.)	
Description of station	188
Discharge measurements	189
Little Saskatchewan River (Riverdale).	
Daily gauge height and discharge	190
Description of station	189
Discharge measurements	189
Monthly discharge	191
Little Souris River.	
Gazetteer	264
Little Swan River.	
Gazetteer	264
Long Lake	
Gazetteer	264
Long River	
Gazetteer	264
Loon Creek.	
Gazetteer	264
Lost Creek (Rainy Lake).	
Discharge measurement	249
M	
Manigotagan River	242
Manigotagan River (Wood Falls).	
Daily gauge height and discharge.	244
Description of station	243
Discharge measurements	243
Monthly discharge...	245
Gazetteer	264
Manitoba Lake.	
Gazetteer	264
Manitou River (Rainy Lake).	
Discharge measurement	249
Mantagas River	265
Maskawa River	265
McLaughlin River	
Gazetteer	265
Measurements, winter	22
Methods of determining discharge	14
Mean Velocity—Method of determining	18
Metering stations	24
Mile foot	12
Minago River	
Gazetteer	265
Mitishto River.	
Gazetteer	265
Molson Lake	
Gazetteer	265
Moose Lake	
Gazetteer	265
Moose Nose Lake.	
Gazetteer	265
Morris River at Morris	
Discharge measurements	251
Gazetteer	265

PAGE

Mossy River ... 207

Mossy River (Cameron's Bridge).
 Discharge Measurement ... 252

Mossy River.
 Gazetteer ... 265

Mossy River (Lacey's Farm).
 Daily gauge height and discharge ... 209
 Description of station ... 208
 Discharge measurements ... 208
 Monthly discharge ... 212

Mossy River (Wilson's Farm).
 Daily gauge height and discharge ... 212
 Description of station ... 211
 Discharge measurements ... 212
 Monthly Discharge ... 211

Muhigan River.
 Gazetteer ... 265

Muskrat Lake.
 Gazetteer ... 265

N

Nelson River ... 247

Nelson River
 Gazetteer ... 11
 265

Nelson River, East Branch (Sea Falls). North and South Channels
 Discharge measurements ... 255

Nelson River, West Branch (Whiskey Jack Portage).
 Discharge measurements ... 255

Nelson River (Manitou Rapids).
 Description of station ... 248
 Discharge measurements ... 249

Nelson River (West Creek, Manitou Rapids).
 Discharge measurement ... 255

Nelson River (East Creek, Manitou Rapids).
 Discharge measurement ... 255

North Birch Lake.
 Gazetteer ... 266

North Duck River.
 Gazetteer ... 266

North Indian Lake.
 Gazetteer ... 266

North-west Bay River (Rainy Lake).
 Discharge measurement ... 249

O

Oak Creek
 Gazetteer ... 266

Oak Lake.
 Gazetteer ... 266

Oak River
 Gazetteer ... 266

Ochre River ... 219

Ochre River (Ochre River).
 Daily gauge height and discharge ... 221
 Description of station ... 219
 Discharge measurements ... 220
 Monthly discharge ... 224
 Gazetteer ... 266

Oiseau Lake.
 Gazetteer ... 266

Oiseau or Bird River
 Gazetteer ... 266

One point method of determining velocity ... 20

Organization and Scope of Survey ... 4

PAGE.

Overflowing River.
Gazetteer . 266

Oxford Lake.
Gazetteer . 266

P

Partridge Crop Lake.
Gazetteer 266

Pasquia River.
Gazetteer ... 266

Pelican Lake.
Gazetteer 266

Pelican Lake.
Gazetteer ... 266

Pembina River .. 144

Pembina River (La Riviere).
Discharge measurements 146
Gazetteer 266

Pembina River (Neche, N.D.).
Monthly discharge 1903-1910 144

Pickerel Lake.
Gazetteer 266

Pigeon River (Sturgeon Falls).
Discharge measurements . 254

Pigeon River (Miscellaneous sections).
Discharge measurements . 253

Pigeon River.
Gazetteer 266

Pinawa Channel (Above Control Dam.)
Description of station 122
Discharge measurements 123

Pinawa Channel (Below Control Dam.)
Daily gauge height and discharge.... . 118
Description of station 116
Discharge measurements 117
Monthly discharge 122

Pinawa Channel, Winnipeg Street Ry. Power House.
Description of Station .. 123
Discharge Measurements 124
Daily gauge height and discharge . 127

Pine River.
Gazetteer 266

Pine Root River.
Gazetteer .. 266

Pink Lake.
Gazetteer . 266

Pipe Lake.
Gazetteer 266

Pipestone Creek 197

Pipestone Creek (Cromer).
Description of station 197
Discharge measurements 198

Pipestone Creek.
Gazetteer 266

Pipestone River (Rainy Lake).
Discharge measurement 249

Pipestone Lake.
Gazetteer 267

Playgreen Lake.
Gazetteer 267

Plum Creek.
Gazetteer. 267

Poplar River.
Gazetteer 267

PAGE

Portage Creek
Gazetteer 267

Preparation of Data 25

Price Meter 19

Progress report 3

Q

Qu'Appelle River
Gazetteer 267

R

Rainfall—Annual 3

Rainy Lake feeders (Miscellaneous meterings) 249

Rainy River 31

Rainy River (Beaudette).
Description of station 45
Discharge measurements 46

Rainy River (Emo).
Description of station 45
Discharge measurements 45

Rainy River (Fort Francis)
Daily gauge height and discharge 39
Description of station 38
Monthly Discharge 44

Rat Creek
Gazetteer 267

Rat River (Rainy Lake)
Discharge measurement 249

Rat River 155

Rat River (Otterburne)
Daily gauge height and discharge 157
Description of station 155
Discharge measurements 156
Monthly discharge 161
Gazetteer 267

Recommendations and Summary 28

Red River and tributaries 135
Red River 135
Description of Station 136

Red River District 9

Red River
Gazetteer 267

Red River (Two miles below Emerson)
Description of station 141
Discharge measurements 142

Red River (Elm Park)
Description of station 142
Discharge measurements 143

Red River (Emerson)
Daily gauge height and discharge 138
Description of station 136
Discharge measurements 137
Monthly discharge 141

Red River (Redwood Bridge)
Description of station 143
Discharge measurements 144

Red Deer Lake
Gazetteer 267

Red Deer River 198

Red Deer River
Gazetteer 267

Red Deer River (Below Red Deer Lake)
Discharge measurement 252

	PAGE
Red Deer River (Erwood)	
Description of station	198
Discharge measurements	199
Red Deer River (Hudson Bay Junction).	
Daily gauge height and discharge	200
Description of station	199
Discharge measurements	200
Monthly discharge	202
Reed Lake	
Gazetteer	267
Reindeer Lake.	
Gazetteer	257
Rice River	
Gazetteer	267
Roaring River	
Gazetteer	267
Rock Lake	
Gazetteer	267
Rocky Inlet Creek (Rainy Lake)	
Discharge measurement	249
Rocky Island Lake	
Gazetteer	267
Rolling River	
Gazetteer	267
Roseau River	146
Roseau River	
Gazetteer	267
Roseau River (Baskerville's Farm)	
Daily gauge height and discharge	149
Description of station	147
Discharge measurements	147
Monthly discharge	150
Roseau River (Below Dominion City).	
Daily gauge height and discharge	154
Description of station	153
Discharge measurements	153
Monthly discharge	155
Roseau River (Dominion City)	
Daily gauge height and discharge	152
Description of station	151
Discharge measurements	152
Monthly discharge	155
Roseau River (Mayne's Farm).	
Discharge measurement	255
Sale River	
Gazetteer	268
Salt Creek	
Gazetteer	268
Sandy Lake	
Gazetteer	268
Sandy River	
Gazetteer	268
Saskatchewan River	225
Saskatchewan River	
Gazetteer	268
Saskatchewan River (Pas)	
Daily gauge height and discharge	229
Description of station	225
Discharge measurements	227
Monthly discharge	231
Saskatchewan River (Grand Rapids)	
Daily gauge height and discharge	232
Description of station	231
Discharge measurements	231
Monthly discharge	235

PAGE.

Saskeram Lake.
Gazetteer . 268

Second-foot 12

Second-foot per square mile .. 12

Seine River (Rainy Lake)
Discharge measurement . 249

Seine River (Ste. Anne des Chenes.)
Discharge measurements .. 252
Gazetteer . 268

Setting Lake.
Gazetteer . .. 268

Setting River.
Gazetteer 268

Shamattawa River
Gazetteer 268

Shell River 178

Shell River.
Gazetteer 268

Shell River (Assessippi).
Daily gauge height and discharge 180
Description of station 178
Discharge measurements . 179
Monthly Discharge 181

Shoal Lake.
Gazetteer . 268

Shoal Lake.
Gazetteer 268

Shoal River (Swan Lake).
Discharge measurements 253
Gazetteer 268

Siegner Lake
Gazetteer .. 268

Singoosk Lake.
Gazetteer 268

Sipiweek Lake.
Gazetteer 268

Sisipuk Lake
Gazetteer 268

Skunk Creek.
Gazetteer 268

Slope Method of determining discharge 15

Small Creek (Rainy Lake, Alexandria Bay).
Discharge measurements 249

Small Creek (Rainy Lake, Brownlees N. W. Bay).
Discharge measurement .. 249

Small Creek (Rainy Lake, Lost Bay).
Discharge measurement 249

Small Creeks Nos. 1 and 2 (Rainy Lake, Seine Bay).
Discharge measurements 249

Smith Creek.
Gazetteer . 268

Smoking Tent River.
Gazetteer 269

Snowflake Brook.
Gazetteer 269

Snowshoe Lake
Gazetteer 269

Souris River 192

Souris River
Gazetteer 269

PAGE

Souris River (Wawanesa).
- Daily gauge height and discharge 193
- Description of station 192
- Discharge measurements 193
- Monthly discharge 196

South Duck River.
- Gazetteer 269

Southern Indian Lake.
- Gazetteer 269

Spence Lake
- Gazetteer 269

Split Lake
- Gazetteer 269

Squirrel Creek
- Gazetteer 269

Squirrel River (Austin).
- Discharge measurements 252

Steep Rock River.
- Gazetteer 269

St. Martin Lake.
- Gazetteer 269

Stony Creek.
- Gazetteer 269

Stout method of correcting gauge heights 26

Sturgeon Gill Creek.
- Discharge measurement 254

Summary and recommendations. 28

Swan River 202

Swan River.
- Gazetteer 269

Swan River (Swan River).
- Daily gauge height and discharge 204
- Description of station 202
- Discharge measurements 203
- Monthly discharge 207

Swan Lake.
- Gazetteer 209

T.

Terms and definitions 12

Three Point Lake.
- Gazetteer 269

Three Point Method for determining velocity 20

Thunder Lake.
- Gazetteer 269

Touchwood Lake.
- Gazetteer 269

Turtle River
- Gazetteer 269

Two Point Method for determining velocity 20

Tye Creek (below Slave Falls).
- Discharge measurements 250

V

Valley River. 214

Valley River.
- Gazetteer 269

Valley River (Valley River).
- Daily gauge height and discharge 216
- Description of station 214
- Discharge measurements 215
- Monthly discharge 219

	PAGE
Velocity, mean, methods of determining	18
Velocity Method of determining discharge	17
Vermilion River Gazetteer	269
Vertical Velocity Curves (determining velocity)	20

W

Wading stations (for metering)	25
Wampigow River Gazetteer	270
Wasaw Creek (Rainy Lake) Discharge measurement	249
Waterhen Lake Gazetteer	270
Waterhen River at Waterhen Discharge measurements	254
Wegg Lake (Rainy Lake) Discharge measurement	249
Weir Method of determining discharge	16
Wekusko Lake. Gazetteer	270
West Hawk Lake. Gazetteer	270
Whirlpool River Gazetteer	270
White Fish Creek (Rainy Lake). Discharge measurement	249
Whitemouth Lake. Gazetteer	270
Whitemouth River	130
Whitemouth River Gazetteer	270
Whitemouth River (Whitemouth) Daily gauge height and discharge Description of station Discharge measurements Monthly discharge	 132 130 131 135
Whitemud River Gazetteer	270
Whitemud River Gazetteer	270
Whitemud River (Gladstone). Discharge measurements	253
Whitemud River (Westbourne). Discharge measurements	253
Whiteshell Lake at Jessie Lake Gazetteer	270
Whiteshell River at Jessie Lake. Discharge measurements	251
Whitewater Lake. Gazetteer	270
Willow Creek. Gazetteer	270
Wilson River Gazetteer	270
Winnipeg Lake. Tributaries on East Tributaries on West Gazetteer	 11, 237 225 270

	PAGE
Winnipeg River and tributaries	8, 91
Winnipeg River	
Gazetteer	270
Winnipeg River (below Lake of the Woods outlets).	
Combined daily discharge	88
Monthly discharge at Lake of the Woods Outlets	91
Winnipeg River (Dalles).	
Discharge measurements	250
Winnipeg River (Head of Grand du Bonnet)	
Description of station	129
Discharge measurements	130
Winnipeg River (Minaki).	
Description of station	93
Discharge measurements	94
Winnipeg River (Utter Falls)	
Daily gauge height and discharge	110
Discharge measurements	109
Monthly discharge Years 1907 1911	114
Winnipeg River (Slave Falls)	
Daily gauge height and discharge, 1911 1914	104
Description of station	101
Discharge measurements 1911 1914	102
Monthly discharge 1911 1914	108
Winnipeg River (Throat Rapids).	
Discharge measurements	250
Winnipeg River, Whitedog Falls, North and South Channels	94
Daily gauge height and discharge, North Channel	96
Discharge measurements North Channel	95
Monthly discharge, North Channel	98
Description of station, South Channel	94
Daily gauge height and discharge, South Channel	99
Discharge measurements, South Channel	99
Monthly discharge, South Channel	101
" " Combined Channels	98
Winter Measurements	22
Wintering Lake	
Gazetteer	271
Witchai Lake	
Gazetteer	271
Woody River	
Gazetteer	271
Wuskwatin Lake	
Gazetteer	271