The Honourable, the International Joint Commission,

Washington, D. C. and Ottawa, Canada.

Gentlemen:

In compliance with the provisions of clause 11 of your order of April 3, 1919, directing the division of the waters of St. Mary and Milk rivers between the United States and Canada, we are transmitting herewith a report on the operations during the irrigation season of 1919.

Respectfully submitted:

E. A. Drake

Accredited Irrigation Officer of His Majesty.

A. P. Davis

Accredited Reclamation Officer of the United States.

January 31 st. 1920

REPORT TO INTERNATIONAL JOINT COMMISSION

on

DIVISION AND USE OF WATER OF ST. MARY AND MILK RIVERS

by

E. F. DRAKE,
representing Canada

and

A. P. DAVIS,
representing the United States.

C O N T E N T S

TABLES

PLATES

INTRODUCTION.

The field work in the division of the water of St. Mary and Milk rivers in 1919 was carried on by B. E. Jones on behalf of A. P. Davis, representing the United States, and by R. J. Burley and S. G. Dawson on behalf of E. F. Drake, representing Canada. These engineers, working together, divided the water between the two countries in accordance with the order of the commission. As each country was able to use its entire share of the flow of St. Mary River from early in July until late in October, the men in the field were compelled to keep constantly informed as to the natural flow of the rivers, the water being stored or released from storage, and the amount being diverted by each country, and to check up the results every few days from the automatic gauge records at the principal stations. Any discrepancy in the division was therefore quickly discovered and corrected. Semi-monthly statements showing the daily division of the water were prepared and forwarded to the Superintendent, Lethbridge Section, Canadian Pacific Irrigation System, and to the Project Manager, United States Reclamation Service. Considerable work was also done in determining the seepage and evaporation losses in Milk River between the outlet of the United States Reclamation Service St. Mary canal and Havre, Montana.

DIVISION OF WATER.

Mr. Dawson and Mr. Jones had their headquarters on St. Mary River near the international boundary, from which point it is but a few hours' ride by automobile to most of the gauging stations on that river and its tributaries, or to the stations on the two main canals diverting from St. Mary River.

The headgates of the U.S.R.S. St. Mary Canal were first opened, this year, on April 18th and were closed for the season on October 23rd. The headgates of the A.R. & I. Co.'s canal at Kimball were operated from April 22nd to October 24th, when they were closed for the season.

Any question as to one country or the other receiving more than its share of the flow of St. Mary River was decided ~~by them~~ in the following manner. Current meter measurements were made of Swiftcurrent Creek at Many Glacier, Canyon Creek near Many Glacier, and the flow of the other small creeks entering Swiftcurrent above Sherburne dam was either measured or estimated. The total flow of these creeks gave the inflow into Sherburne Lake reservoir. A current meter measurement at the gauging station below the dam gave the outflow from the reservoir, and the difference between the inflow and outflow showed the quantity of water being stored or released from storage. A measurement of the United

States

States Reclamation Service St. Mary canal at St. Mary Crossing was made to find the water being diverted by the United States, and a measurement of St. Mary River at Kimball to determine the water being received by Canada.

If water was being stored in Sherburne reservoir the natural flow was obtained by adding the water stored and diverted by the United States, and that received by Canada. If water was being released from storage the quantity of water released was subtracted from the water being diverted by the United States, and the remainder was added to the flow of St. Mary River at Kimball to give the natural flow of St. Mary River.

The natural flow having been found, the share to which each country was entitled was determined on the following basis:-

1. When flow was less than 667 second-feet, one-fourth to United States, and three-fourths to Canada.

2. When flow was between 667 and 1,000 second-feet, 500 second-feet to Canada, and the rest to the United States.

3. When flow was above 1,000 second feet, water was divided equally.

Owing to the very low natural flow in the North Branch of Milk river and practically no flow in the South Branch from June to October, it was considered unnecessary to make any actual division of these waters.

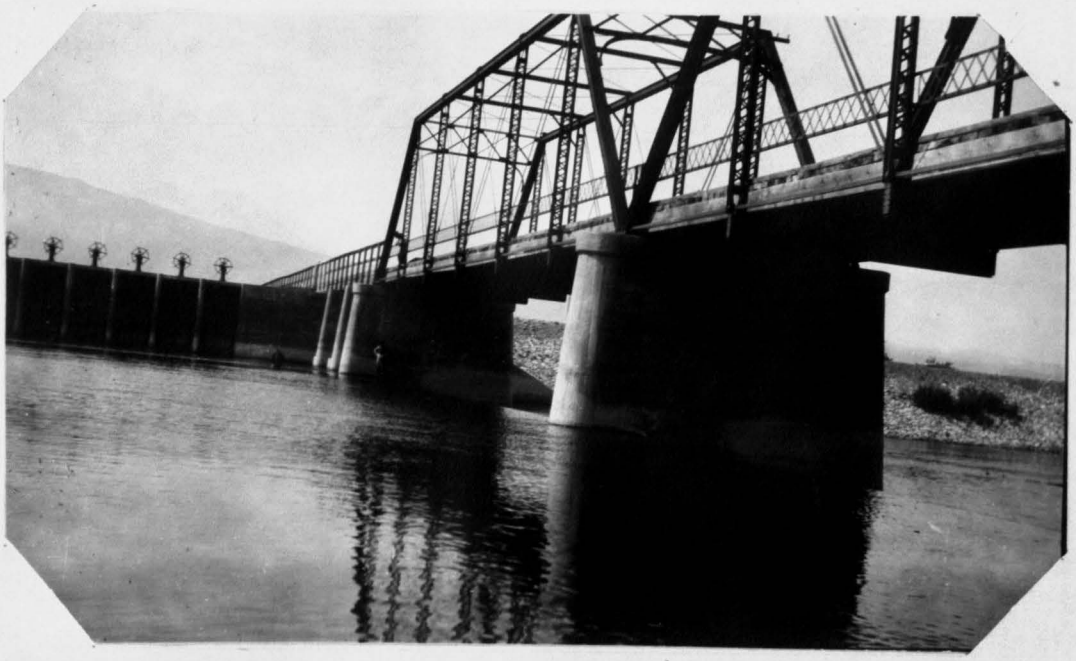
The quantity each country was receiving was then compared with

with the quantity to which it was entitled, and the results were brought to the attention of the Project Manager of the United States Reclamation Service and the Superintendent of the Lethbridge Section, Canadian Pacific Railway Project, in order that any necessary changes in diversions could be made.

Early in July, Mr. Porter, Superintendent of the Lethbridge Section, Canadian Pacific Railway Project, in conversation with Messrs. Dawson and Jones expressed the desire to be kept informed as to the facts of the division, in order that he might use the information in planning the operation of his system. To supply this information a statement was prepared every two weeks by Messrs. Dawson and Jones giving the daily results for the period covered.

An example of these statements is given below in Table 1, covering the period August 1-15, inclusive.

Date	Diverted by U.S.R.S. Canal	St. Mary River at Boundary	Total	Stored water used	Natural Flow St. Mary River at Kimball	Canada's share	Canada's Excess + Deficiency -
August	Sec.-Ft.	Sec.-Ft.	Sec.-Ft.	Sec.-Ft.	Sec.-Ft.	Sec.-Ft.	Sec.-Ft.
1	388	466	854	224	630	472	-6
2	388	466	854	210	644	483	-17
3	389	470	859	203	656	492	-22
4	389	480	869	198	671	500	-20
5	386	475	861	233	628	471	+4
6	385	470	855	259	596	447	+23
7	385	457	842	257	585	439	+18
8	385	452	837	255	582	436	+16
9	384	434	818	247	571	428	+6
10	387	421	808	257	551	413	+8
11	388	417	805	285	520	390	+27
12	390	413	803	291	512	384	+29
13	392	408	800	301	499	374	+34
14	392	404	796	303	493	370	+34
15	392	400	792	325	457	350	+50



A...United States Reclamation Service St.Mary Canal.

Diversion dam and headgate.

B...United States Reclamation Service St.Mary Canal.

Gaging Station at Intake.

This table is simply a summary of Table 3 of this report, the latter showing in detail how the various results were obtained. The method of computation was the same as that used in checking up questions of division which is described above. The only difference is that for these daily records the discharge at the gauging stations was obtained by applying the daily gauge height to a rating table instead of obtaining the discharge directly by current-meter measurement. As all the stations immediately concerned in this statement, excepting the one on Swiftcurrent Creek below Sherburne dam are equipped with water-stage recorders, and as the stage-discharge relation at these stations is fairly permanent, the records obtained in this way are nearly as good as those obtained by current-meter measurement.

WATER SUPPLY.

The precipitation on the drainage basins of St. Mary and Milk rivers during the winter of 1918-19 was probably the lowest ever recorded. In the spring of 1919 the snow accumulated in the mountains at the head of St. Mary River was much below the average, and on the prairies forming most of the drainage basin of Milk River there was practically no snow. As a result, the spring flood run-off of Milk River was very small, and the flow of St. Mary River after the month of May was the lowest on record. During the growing season the precipitation was low, and this shortage increased the demand for irrigation water in both countries.

tries. At the same time it practically eliminated rainfall as a source of supply for the two rivers from May to September, and after the middle of June the only run-off from Milk River basin was a small amount at the headwaters of two or three of the tributaries. St. Mary River is fed largely by glaciers, and although the average flow was much below normal, yet the mean of the natural flow at Kimball in May was 1,980 second-feet, in June 2,120 second-feet, and in July 919 second-feet. The discharge fell off rapidly in August and September, but this was after the peak of the demand for irrigation had passed.

The inflow to the Milk River from the northern tributaries was very small after the 1st of June. Lodge Creek and Battle Creek went dry early in July and remained so until October. The Frenchman River was dry at the boundary during August and September, with very little flow during October. The tributaries from the south, especially those from the Bear Paw Mountains, ceased flowing early in June.

Although practically the entire flow of Milk River above Dodson after the middle of April was diverted and used, the shortage of water was so great that crops failed on those lands depending entirely on the natural flow of Milk River and tributaries for their supply. The United States Indian Service canal near Harlem, which has a prior right to 125 second-feet of the flow of Milk River, was compelled to reduce its diversion the

last

last part of June, and to shut down entirely July 12 on account of lack of water.

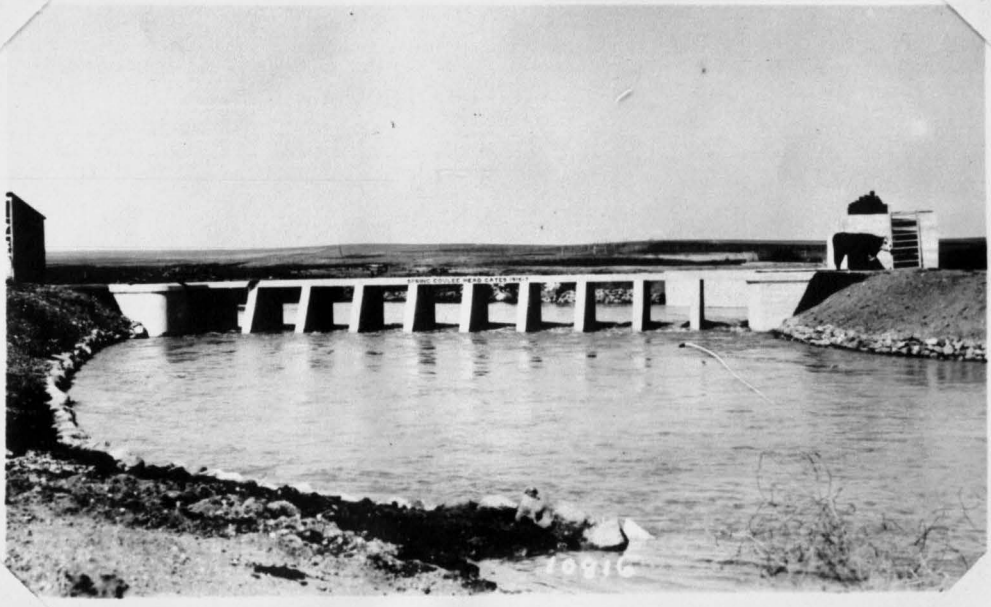
The canals depending on the supplementary flow from St. Mary River were fairly well supplied throughout the irrigation season, but this supply was not always sufficient, and at times available water had to be divided between the upper valley around Chinook and Harlem and the lower valley around Dodson and Malta. In the lower valley rotation was also practiced, the upper part of the valley receiving the entire flow one week, the lower end of the canal receiving all the water the following week. In this way the available supply was distributed in such a manner that there were no serious losses due to lack of water.

After the middle of July, the United States' share of the flow of St. Mary River was not sufficient to meet its requirements, and a supplementary supply was obtained from Sherburne reservoir, which was operated during June, July, August and September. Measurements were made to separate natural flow from stored water, and because of daily variations in the natural flow of the river constant record had to be kept of the flow into and out of Sherburne reservoir, diversions by the United States, and the water passing the international boundary.

The natural flow of Milk River after the month of June did not equal the losses due to seepage and evaporation, and

without

A - International Gauging Station. St.Mary River near Kimball.



B - A.R.& I.Co.'s Canal System. Headgates at Spring Coulee.

without the supplementary supply from St. Mary River the channel would probably have been dry below the town of Milk River, Alberta. For this reason, the people of various towns along Milk River in the United States asked that the flow of St. Mary River water be continued as late in the fall as possible, to furnish them with a domestic supply, they agreeing to pay the cost of operation. The canal was, therefore, continued in operation until October 23, when it was closed on account of very cold weather.

About 1,000 acre feet of water were used in the United States from St. Mary and Milk rivers of which no accurate record is available, and which is therefore not included in the accompanying tables. Part of this water, sufficient to irrigate about 400 acres, was pumped from Milk River. The remaining water was diverted from Swiftcurrent Creek and Kennedy Creek to irrigate about 300 acres of hay land in the St. Mary River Valley in the United States.

HYDROMETRIC WORK.

For the purpose of division, and to obtain data for studies of seepage and other subjects, 64 gauging stations, of which 10 were international, were operated under the general supervision of the engineers delegated to represent the undersigned. A map herewith submitted shows the location of the

gauging

stations, and a table, to which the numbers on the map refer, gives the name of each station. Early in April a water-stage recorder was installed at the gauging station on Lodge Creek near the international boundary, so that the equipment of all the joint international gauging stations is now of the most modern type. Nine of the other gauging stations are also equipped with water-stage recorders and sufficient current meter measurements are made each year at all the stations to insure good results. Special attention was given to those stations upon whose results the division of water directly depended and also the stations used in studies of seepage losses. An appendix to this report gives the results of current meter measurements, the daily gauge heights and discharge, at all of the gauging stations operated in the two drainage basins in 1919. Any of the data upon which these results were based will be furnished on request to the commission.

The joint report, containing all stream-flow records collected in both countries in the basins of St. Mary and Milk rivers up to and including 1917, has been completed and sent to the printer.

SEEPAGE INVESTIGATION.

The engineers engaged in the division of water made numerous trips down Milk River from the outlet of the United States

States Reclamation Service St. Mary canal to Havre, making current-meter measurements at several points on Milk River, to determine losses due to seepage. In general, it was found from the work in 1918 that the best results could be obtained by making a large number of measurements at each gauging station, in an endeavour to increase the accuracy of the results, determining the seepage losses from the records at those stations. This was the plan adopted in 1919, and the data obtained at the principal gauging stations is shown graphically by the hydrograph that forms Plate II of this report. The percentage of loss of St. Mary River water in flowing from St. Mary Crossing to Havre was practically the same in the two years for which records are available, being 25 per cent in 1918, and 24 per cent in 1919. During the hot, dry periods of July and August, however, the loss considerably exceeded 25 per cent. These investigations will be continued in 1920 to determine how increase in the flow in the river affects loss due to seepage.

DESCRIPTION OF TABLES AND DIAGRAMS.

Several tables and diagrams have been prepared, summarizing the data on the division and use of the water of the two rivers and showing it graphically.

Table 1 has already been described.

Table 2 compares the estimated requirements for 1919 with

the

the water actually diverted.

Table 3 shows the method of determining the natural flow of St. Mary River during the irrigation season, the water available for use and used by the United States and the water available for use by Canada. For June, July, August and September this table covers four sheets for each month. The first two sheets show the determination of the total daily flow which if not interfered with would cross the international boundary, or the natural flow of St. Mary river at Kimball. Sheet 1 for each month shows the daily inflow into and out of Sherburne reservoir, the difference giving the water stored or released from storage. Sheet 2 shows the water diverted, stored or released from storage by the United States and finally the total natural flow of St. Mary river at Kimball. Sheet 3 shows the water available for use by the United States, the water used, and the excess or deficiency of this quantity over the quantity available. Sheet 4 shows the natural flow of St. Mary river at Kimball, Canada's share, the actual discharge of St. Mary river at Kimball, which is the quantity of water received by Canada, and the excess or deficiency of the quantity received by Canada as compared with her share.

For April, May, and October there are only three sheets for each month, the first sheet, dealing with stored water, being omitted

omitted as there was no water stored or released from storage during those months.

An examination of table 3 shows that except during a few short periods each country received the share to which it was entitled. The headgates of the United States Reclamation St. Mary Canal were opened April 22 and from April 22 to 28, through a misunderstanding as to the requirements of Canada, the United States diverted more than its share of the flow of St. Mary River. There was no other serious deficiency until the storage in Sherburne reservoir began to be exhausted, when from September 5 to 8, inclusive, the United States diverted more than it should have received before the headgates were adjusted to the new conditions of flow. The small deficiency October 9 to 23 was due to a change in the rating of the gauging station and could not be charged to the operation of the irrigation works.

Table 3 shows that the water released from storage during 1919 exceeded the amount stored, which is accounted for as follows. During the building of Sherburne dam a small construction dam was placed in the channel of the stream to raise the water level for purposes of navigation. This served to store about 3,000 acre-feet which amount of water was already in the reservoir at the beginning of the season of 1919. In order to supply the irrigation requirements of the United States in August, it was found necessary to release this water in addition to that stored during June and this

this accounts for the excess of the water released from storage over the amount stored.

Table 4 contains the information requested by the Commission in paragraph 11 of its order of April 3, 1919, which reads as follows:

> A statement in duplicate showing the quantity of water taken in each month by each country and the quantity thereof applied to the land, and also the quantity of water diverted from St. Mary to Milk River and stored or held back by either country.

In addition it shows for St. Mary and Milk rivers the water available, diverted, used, stored, wasted, and losses in canals and reservoirs. This table does not include water diverted from tributaries of St. Mary and Milk rivers.

Table 5 gives the available data on diversions for the principal northern tributaries of Milk River. It should be explained that the Canadian Reclamation Service is largely dependent upon the irrigators themselves for such records, as most of the diversions are too small to justify the expense of appointing and paying gauge observers. The records are, therefore, incomplete and of doubtful value in a report such as this, since they probably do not show the total diversions.

Matheson and Cook canals are the only diversions from these streams in the United States for which reliable records are available. The North Chinook Irrigation Co. diverted a considerable amount of water from Lodge Creek in the spring. This

water

water was stored and used during the irrigation season.

The discharge of these streams for the year is shown in the stream-flow records. No attempt to analyze the results has been made because of insufficient data on the diversions.

The two hydrographs accompanying the report show the total flow of St. Mary and Milk rivers for the period April to October, inclusive. The quantity diverted from St. Mary River by the United States and Canada has been plotted, together with the total natural flow. For Milk River the flow of the two forks at the international crossing, including the water from St. Mary River, has been plotted with the flow at Milk River at Eastern Crossing and Havre. This diagram shows graphically the losses due to seepage and evaporation.

DEVELOPMENTS AND FUTURE REQUIREMENTS.

Although both countries could have used more water in 1919 had it been available, the crops on those lands depending on St. Mary River for a supply were not seriously damaged by lack of water. The flow of Milk River and tributaries on the other hand was very low, ceasing entirely about the middle of July, and the supply of water from this source alone was insufficient to produce a crop.

The deficiency in precipitation during the last three years, however, has greatly revived interest in irrigation in

this

this section. As a result the Paradise, Harlem, and Fort Belknap canals are being enlarged and extended. The canals heading at Dodson and Vandalia already are able to irrigate twice the area served in 1919, and undoubtedly a large part of this surplus will be brought under irrigation next year, so that, if the precipitation is no greater, the demand for water in 1920 will far exceed that in 1919.

To meet this larger requirement the United States Reclamation Service has doubled the capacity of the flume at St. Mary crossing on its St. Mary canal and will probably be able to divert from 25 to 50 per cent more St. Mary River water in 1920 than it could in 1919.

Improvements to increase the capacity of the A.R. & I. Co.'s canal were made after the closing of the season. The headgates were improved to give greater capacity; a new dam and diversion works, to replace the old structures at Magrath, were built to reduce the wastage down Pothole creek; two cut-offs between Magrath and Welling are expected to increase the canal's capacity from 700 second feet to 1,000 second feet. The canals of the Taber extension, which will irrigate some 17,000 acres, will be ready to carry water by June, 1920.

Owing to these improvements and the increased area to be irrigated, there will be a heavier demand on the waters of the St. Mary River in the future.

Table 2.

ESTIMATED REQUIREMENTS AND ACTUAL DIVERSIONS

SEASON 1919.

CANADA

Month	Estimated Requirements Acre-Ft.	Diverted Acre-Ft.	Wasted Acre-Ft.	Balance [b] Acre-Ft.	Percentage Estimated	Percentage Actual
April	1,811	2,374	2,243	131	1	0.1
May	14,488	23,550	5,884	17,666	8	13.7
June	54,330	42,724	3,155	39,569	30	30.7
July	54,330	34,925	744	34,181	30	26.4
August	36,220	22,935	2,029	20,906	20	16.2
Sept.	18,110	13,507	696	12,811	10	9.9
Oct.	1,811	6,093	2,251	3,842	1	3.0
Total	181,100	146,108	17,002	129,106	100	100.0

UNITED STATES

Month	Estimated Requirements Acre-Ft.	Diverted [a] Acre-Ft.	Wasted Acre-Ft.	Balance Acre-Ft.	Percentage Estimated	Percentage Actual
April	1,800	13,591	322	13,269	1	10
May	18,000	24,440	1,735	22,705	10	17.5
June	54,000	30,725	1,083	29,642	30	23
July	54,000	23,772	1,224	22,548	30	17.5
August	36,000	23,551	1,810	21,741	20	16.5
Sept.	14,400	16,316	909	15,407	8	12
Oct.	1,800	5,357	900	4,457	1	3.5
Total	180,000	137,752	7,983	129,769	100	100

[a] Water diverted from Milk River plus St. Mary River water lost by seepage and evaporation in transit.

[b] Includes losses by seepage and evaporation.

Table 3.

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER.

APRIL - 1919.

Day:	St. Mary River at Kimball	Diverted by USRS	Stored by USRS	Total	Stored Water Released	Natural Flow St. Mary River at Kimball.	
	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	
1	272			272		272	
2	286			286		286	
3	292			292		292	
4	296			296		296	
5	263			263		263	
6	243			243		243	
7	240			240		240	
8	235			235		235	
9	235			235		235	
10	246			246		246	
11	249			249		249	
12	252			252		252	
13	258			258		258	
14	258			258		258	
15	243			243		243	
16	238			238		238	
17	246			246		246	
18	246			246		246	
19	166			166		166	
20	180			180		180	
21	207			207		207	
22	173	139		312		312	
23	138	207		345		345	
24	134	230		364		364	
25	147	247		394		394	
26	225	222		447		447	
27	289	248		537		537	
28	342	274		616		616	
29	564	301		865		865	×
30	826	328		1154		1154	
Total	7,989	2,196		10,185		10,185	
Mean	266	244		340		340	
Acre Ft.	15,800	4,360		20,200		20,200	✓

Table 3.

DIVISION OF WATER OF ST. MARY RIVER
WATER USED BY UNITED STATES APRIL
1919.

Day	Natural Flow St.Mary River at Kimball Sec.Ft.	Available for use by U.S. U.S. Share Sec.ft.	Stored Water Released Sec.ft.	Total Sec.ft.	Used Diverted Sec.Ft.	Used Stored Sec.Ft.	Used Total Sec.Ft.	Excess Sec.Ft.	Deficiency. Sec.Ft.
1	272	68		68					68
2	286	72		72					72
3	292	73		73					73
4	296	74		74					74
5	263	66		66					66
6	243	61		61					61
7	240	60		60					60
8	235	59		59					59
9	235	59		59					59
10	246	62		62					62
11	249	62		62					62
12	252	63		63					63
13	258	64		64					64
14	258	64		64					64
15	243	61		61					61
16	238	60		60					60
17	246	62		62					62
18	246	62		62					62
19	166	42		42					42
20	180	45		45					45
21	207	52		52					52
22	312	78		78	139		139	61	
23	345	86		86	207		207	121	
24	364	91		91	230		230	139	
25	394	98		98	247		247	149	
26	447	112		112	222		222	110	
27	537	134		134	248		248	114	
28	816	154		154	274		274	120	
29	865	365		365	301		301		
30	1154	577		577	328		328		64
									249
Total	10185	2986		2986	2196		2196	814	1604
Mean	340	99.5		99.5	244		244	27.1	53.5
Ac.Ft.	20200	5920		5920	4360		4360	1610	3180

Table 3.

DIVISION OF WATER OF ST.MARY RIVER
WATER AVAILABLE FOR USE BY CANADA
APRIL - 1919.

Day	Natural flow St.Mary River at Kimball Sec.Ft.	Canada's Share Sec.Ft.	St.Mary River at Kimball Sec.Ft.	Excess Sec.Ft.	Deficiency Sec.Ft.
1	272	204	272	68	
2	286	214	286	72	
3	292	219	292	73	
4	296	222	296	74	
5	263	197	263	66	
6	243	182	243	61	
7	240	180	240	60	
8	235	176	235	59	
9	235	176	235	59	
10	246	184	246	62	
11	249	187	249	62	
12	252	189	252	63	
13	258	194	258	64	
14	258	194	258	64	
15	243	182	243	61	
16	238	178	238	60	
17	246	184	246	62	
18	246	184	246	62	
19	166	124	166	42	
20	180	135	180	45	
21	207	155	207	52	
22	312	234	173		61
23	345	259	138		121
24	364	273	134		139
25	394	296	147		149
26	447	335	225		110
27	537	403	~~389~~ 289		114
28	616	462	342		120
29	865	500	564	64	
30	1154	577	826	249	
Total-	10185	7199	7989	1604	814
Mean	340	240	266	53.5	27.1
Ac. Ft.	20200	14300	15800	3180	1610

Table 3.

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER

MAY 1919.

Day	St. Mary River at Kimball Sec. Ft.	Diverted by USRS Sec. Ft.	Stored by USRS Sec. Ft.	Total Sec. Ft.	Stored Water Released Sec. Ft.	Natural Flow St. Mary River at Kimball Sec. Ft.
1	994	355		1349		1349
2	1112	368		1480		1480
3	1162	372				1534
4	1153	388				1541
5	1072	394				1466
6	1001	398				1399
7	962	386				1348
8	871	385				1256
9	803	388				1191
10	737	388				1125
11	652	388				1040
12	613	388				1001
13	581	397				978
14	531	407				938
15	510	411				921
16	542	393				935
17	587	402				989
18	645	402				1047
19	737	405				1142
20	962	393				1355
21	1263	395				1658
22	1607	391				1998
23	2176	372				2548
24	2612	378				2990
25	2850	373				3223
26	3008	376				3384
27	3300	380				3680
28	3798	381				4179
29	4110	386				4496
30	4306	389				4695
31	4052	386				4438
Total	49309	12015				61324
Mean	1590	388				1980
Ac. Ft.	97800	23900				122000

Storage 7,000 Ac. Ft. credited see letter of March 21, 1922 P.M. to Director.

Total natl flow

97,765
23,857
7,000
128,622

See P.M. letter March 21, 1922

Table 3.

DIVISION OF WATER OF ST.MARY RIVER
WATER USED BY UNITED STATES
MAY - 1919.

Day	Natural flow St.Mary River at Kimball Sec.Ft.	Available for use by US: U.S. Share Sec.Ft.	Stored Water Released Sec.Ft.	Total S.Ft.	Used: Diverted Sec.Ft.	Stored S.Ft.	Total S.Ft.	Excess S.Ft.	Deficiency Sec.Ft.
1	1349	674		674	355		355		319
2	1480	740		740	368		368		372
3	1534	767		767	372		372		395
4	1541	770		770	388		388		382
5	1466	733		733	394		394		339
6	1399	700		700	398		398		302
7	1348	674		674	386		386		288
8	1256	628		628	385		385		243
9	1191	596		596	388		388		208
10	1125	562		562	388		388		174
11	1040	520		520	388		388		132
12	1001	500		500	388		388		112
13	978	478		478	397		397		81
14	938	438		438	407		407		31
15	921	421		421	411		411		10
16	935	435		435	393		393		42
17	989	489		489	402		402		87
18	1047	524		524	402		402		122
19	1142	571		571	405		405		166
20	1355	678		678	393		393		285
21	1658	829		829	395		395		434
22	1998	999		999	391		391		608
23	2548	1274		1274	372		372		902
24	2990	1495		1495	378		378		1117
25	3223	1612		1612	373		373		1239
26	3384	1692		1692	376		376		1316
27	3680	1840		1840	380		380		1460
28	4179	2090		2090	381		381		1709
29	4496	2248		2248	386		386		1862
30	4695	2348		2348	389		389		1959
31	4438	2219		2219	386		386		1833
Total	61,324	30,544		30,544	12,015		12,015		18,529
Mean	1,980	985		985	388		388		598
Ac.Ft.	122,000	60,600		60,600	23,900		23,900		36,800

Table 3.

DIVISION OF WATER OF ST.MARY RIVER
WATER AVAILABLE FOR USE BY CANADA
MAY - 1919.

Day	Natural Flow St.Mary River at Kimball Sec.Ft.	Canada's Share Sec.Ft.	St.Mary River at Kimball Sec.Ft.	Excess Sec.Ft.	Deficiency Sec.Ft.
1	1349	675	994	319	
2	1480	740	1112	372	
3	1534	767	1162	395	
4	1541	771	1153	382	
5	1466	733	1072	339	
6	1399	699	1001	302	
7	1348	674	962	288	
8	1256	628	871	243	
9	1191	595	803	208	
10	1125	563	737	174	
11	1040	520	652	132	
12	1001	501	613	112	
13	978	500	581	81	
14	938	500	531	31	
15	921	500	510	10	
16	935	500	542	42	
17	989	500	587	87	
18	1047	523	645	122	
19	1142	571	737	166	
20	1355	677	962	285	
21	1658	829	1263	434	
22	1998	999	1607	608	
23	2548	1274	2176	902	
24	2990	1495	2612	1117	
25	3223	1611	2850	1239	
26	3384	1692	3008	1316	
27	3680	1840	3300	1460	
28	4179	2089	3798	1709	
29	4496	2248	4110	1862	
30	4695	2347	4306	1959	
31	4438	2219	4052	1833	
Total	61,324	30,780	49,309	18,529	
Mean	1,980	993	1,590	598	
Ac.Ft.	122,000	61,100	97,800	36,800	

Table 3.

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER

WATER STORED AND RELEASED BY UNITED STATES.

JUNE - 1919.

Day:	In Flow into Sherburne Reservoir				Swiftcurrent Cr. below Sherburne Dam.	STORED	Released from Storage.
	Swiftcurrent Cr. at Many Glacier	Canyon Creek	Other Creeks (Estimated)	Total In Flow			
	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.
1	311	44	40	395	550		155
2	259	36	30	325	144	181	
3	280	33	25	338	0	338	
4	367	34	25	426	0	426	
5	469	37	30	536	0	536	
6	474	41	30	545	0	545	
7	437	38	30	505	0	505	
8	401	36	30	467	0	467	
9	365	34	25	424	0	424	
10	329	32	25	386	0	386	
11	289	28	20	337	0	337	
12	271	27	20	318	0	318	
13	255	26	20	301	0	301	
14	285	29	20	334	0	334	
15	276	29	20	325	0	325	
16	343	34	25	402	0	402	
17	372	35	25	432	0	432	
18	362	35	25	422	0	422	
19	372	36	25	433	0	433	
20	390	40	25	455	0	455	
21	408	42	25	475	0	475	
22	427	42	25	494	0	494	
23	437	41	25	503	0	503	
24	396	37	25	458	0	458	
25	334	35	25	394	0	394	
26	302	34	20	356	118	238	
27	377	34	20	431	320	111	
28	298	30	20	348	338	10	
29	276	26	20	322	350		28
30	242	24	15	281	350		69
Total	10,404	1,029	735	12,168	2,170	10,250	252
Mean	347	34.3	24.5	406	72.3	342	8.40
Ac. Ft.	20,600	2,040	~~14,060~~ 1460	24,200	4,300	20,400	500

Talbe 3.

DETERMINATION OF NATURAL FLOW OF ST MARY RIVER.

JUNE - 1919.

Day:	St. Mary River: at Kimball : Sec. Ft.	Diverted: by USRS : Sec. Ft.	Stored: by USRS: Sec. Ft.	Total: Sec. Ft	Stored Water: Released Sec. Ft.	Natural Flow : St. Mary River: At Kimball : Sec. Ft.
1	3584	389		3973	155	3818
2	2902	~~388~~ 338	181	3471		3471
3	2206	388	388	2932		2932
4	1790	389	426	2605		2605
5	1564	391	536	2491		2491
6	1474	391	545	2410		2410
7	1436	386	505	2327		2327
8	1398	390	467	2255		2255
9	1360	388	424	2172		2172
10	1281	392	386	2059		2059
11	1195	392	337	1924		1924
12	1096	392	318	1806		1806
13	1025	392	301	1718		1718
14	970	392	334	1696		1696
15	931	389	325	1645		1645
16	924	389	402	1715		1715
17	970	387	432	1789		1789
18	1001	390	422	1813		1813
19	1025	389	433	1847		1847
20	1064	388	455	1907		1907
21	1137	388	475	2000		2000
22	1229	387	494	2110		2110
23	1289	~~390~~ 390	503	2182		2182
24	1307	387	458	2152		2152
25	1298	386	394	2078		2078
26	1263	384	238	1885		1885
27	1238	384	111	1733		1733
28	1254	386	10	1650		1650
29	1307	384		1691	28	1663
30	1307	383		1690	69	1621
Total	41,825	11,651	10,250	63,726	252	63,474
Mean	1,390	388	342	2,120	8.40	2,120
Ac. Ft.	82,700	23,100	20,400	126,000	500	126,000

Table 3.

DIVISION OF WATER OF ST. MARY RIVER

WATER USED BY UNITED STATES

JUNE - 1919

Day	Natural Flow St. Mary River at Kimball Sec. Ft.	Available for use by US: U.S. Share Sec. Ft.	Water Released STORED Sec. Ft.	Total Sec. Ft.	USED: DIVERTED Sec. Ft.	STORED Sec. Ft.	TOTAL Sec. Ft.	Excess Sec. Ft.	Deficiency Sec. Ft.
1	3818	1909	155	2064	389		389		1675
2	3471	1736		1736	388	181	569		1167
3	2932	1466		1466	388	338	726		740
4	2605	1302		1302	389	426	815		487
5	2491	1246		1246	391	536	927		319
6	2410	1205		1205	391	545	936		269
7	2327	1164		1164	386	505	891		273
8	2255	1128		1128	390	467	857		271
9	2172	1086		1086	388	424	812		274
10	2059	1030		1030	392	386	778		252
11	1924	962		962	392	337	729		233
12	1806	903		903	392	318	710		193
13	1718	859		859	392	301	693		166
14	1696	848		848	392	334	726		122
15	1645	822		822	389	325	714		108
16	1715	858		858	389	402	791		67
17	1789	894		894	387	432	819		75
18	1813	906		906	390	422	812		94
19	1847	924		924	389	433	822		102
20	1907	954		954	388	455	843		111
21	2000	1000		1000	388	475	863		137
22	2110	1055		1055	387	494	881		174
23	2182	1091		1091	390	503	893		198
24	2152	1076		1076	387	458	845		231
25	2078	1039		1039	386	394	780		259
26	1885	942		942	384	238	622		320
27	1733	866		866	384	111	495	371	~~271~~
28	1650	825		825	386	10	396		429
29	1663	832	28	860	384		384		476
30	1621	810	69	879	383		383		496
Total	63,474	31,738	252	31,990	11,651	10,250	21,901		10,089
Mean	2,120	1,060	8.40	1,070	388	342	730		336
Ac. Ft.	126,000	63,100	500	63,700	23,100	20,400	43,400		20,000

DIVISION OF WATER OF ST.MARY RIVER
WATER AVAILABLE FOR USE BY CANADA
JUNE - 1919.

DAY	Natural Flow St.Mary River at Kimball Sec.Ft.	Canada's Share Sec.Ft.	St Mary River at Kimball. Sec. Ft.	Excess Sec.Ft.	Deficiency. Sec.Ft.
1	3818	1909	3584	1675	
2	3471	1735	2902	1167	
3	2932	1466	2206	740	
4	2605	1303	1790	487	
5	2491	1245	1564	319	
6	2410	1205	1474	269	
7	2327	1163	1436	273	
8	2255	1127	1398	271	
9	2172	1086	1360	274	
10	2059	1029	1281	252	
11	1924	962	1195	233	
12	1806	903	1096	193	
13	1718	859	1025	166	
14	1696	848	970	122	
15	1645	823	931	108	
16	1715	857	924	67	
17	1789	895	970	75	
18	1813	907	1001	94	
19	1847	923	1025	102	
20	1907	953	1064	111	
21	2000	1000	1137	137	
22	2110	1055	1229	174	
23	2182	1091	1289	198	
24	2152	1076	1307	231	
25	2078	1039	1298	259	
26	1885	943	1263	320	
27	1733	867	1238	371	
28	1650	825	1254	429	
29	1663	831	1307	476	
30	1621	811	1307	496	
Total	63,474	31,736	41,825	10,089	
Mean	2,120	1,060	1,390	336	
Ac.Ft.	126,000	63,100	82,700	20,000	

Table 3.

DETERTERMINATION OF NATURAL FLOW OF ST.MARY RIVER

WATER STORED AND RELEASED BY UNITED STATES.

JULY - 1919.

Day:	In Flow into Sherburne Reservoir				Swiftcurrent Cr.below Sherburne Dam.	Stored	Released From Storage
	Swiftcurrent Cr. at Many Glacier	Canyon Creek	Other Creeks (Estimated)	Total In Flow			
	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.
1	215	22	10	247	326		79
2	181	20	10	211	211	0	0
3	181	20	10	211	152	59	
4	192	22	10	224	152	72	
5	218	24	10	252	260		8
6	251	28	10	289	260	29	
7	207	23	10	240	267		27
8	171	19	10	200	267		67
9	168	22	10	200	163	37	
10	178	22	10	210	165	45	
11	199	26	8	233	265		32
12	234	27	8	269	265	4	
13	211	24	8	243	265		22
14	192	23	8	223	265		42
15	178	22	8	208	265		57
16	196	24	8	228	284		56
17	215	24	8	247	289		42
18	178	20	8	206	304		98
19	145	15	8	168	331		163
20	122	13	8	143	340		197
21	122	13	5	140	385		245
22	128	14	5	147	463		316
23	137	13	5	155	463		308
24	131	15	5	151	398		247
25	148	16	5	169	423		254
26	137	14	5	156	433		277
27	120	12	5	137	466		329
28	112	11	5	128	415		287
29	115	11	5	131	388		257
30	120	14	5	139	388		249
31	122	15	5	142	388		246
Total	5,224	588	235	6,047	9,706	246	3,905
Mean	169	19.0	7.58	195	313	7.94	126
Ac. Ft.	10,400	1,170	466	12,000	19,200	488	7,750

Table 3.

DETERMINATION OF NATURAL FLOW OF ST.MARY RIVER

JULY - 1919.

Day:	St.Mary River at Kimball Sec.Ft.	Diverted by USRS Sec.Ft.	Stored by USRS Sec.Ft.	Total Sec.Ft.	Stored Water Released Sec.Ft.	Natural Flow St.Mary River at Kimball Sec.Ft.
	1246	380		1626	79	1547
	1112	382		1494		1494
	978	383	59	1420		1420
	833	382	72	1287		1287
	752	384		1136	8	1128
	752	391	29	1172		1172
	737	391		1128	27	1101
8	701	393		1094	67	1027
9	645	390	37	1072		1072
10	559	392	45	996		996
11	559	394		953	32	921
12	594	395	4	993		993
13	607	390		997	22	975
14	619	389		1008	42	966
15	587	388		975	57	918
16	581	388		969	56	913
17	587	390		977	42	935
18	581	391		972	98	874
19	564	389		953	163	790
20	553	389		942	197	745
21	559	390		949	245	704
22	559	390		949	316	633
23	575	389		964	308	656
24	575	390		965	247	718
25	553	391		944	254	690
26	553	389		942	277	665
27	553	388		941	329	612
28	536	386		922	287	635
29	510	385		895	257	638
30	500	387		887	249	638
31	490	388		878	246	632
Total	20,110	12,044	246	32,400	3,905	28,495
Mean	649	389	7.94	1,050	126	919
Ac.Ft.	39,900	23,900	488	64,600	7,750	56,500

DIVISION OF WATER OF ST. MARY RIVER

WATER USED BY UNITED STATES

JULY - 1919.

DAY	Natural Flow St. Mary River at Kimball Sec. Ft.	Available for use by US: U.S. Share Sec. Ft.	Available for use by US: Stored Water Released Sec. Ft.	Available for use by US: Total Sec. Ft.	USED: Diverted Sec. Ft.	USED: Stored Sec. Ft.	USED: Total Sec. Ft.	Excess Sec. Ft.	Deficiency Sec. Ft.
1	1547	774	79	853	380		380		473
2	1494	747		747	382		382		365
3	1420	710		710	383	59	442		268
4	1287	644		644	382	72	454		190
5	1128	564	8	572	384		384		188
6	1172	586		586	391	29	420		166
7	1101	550	27	577	391		391		186
8	1027	514	67	581	393		393		188
9	1072	536		536	390	37	427		109
10	996	496		496	392	45	437		59
11	921	421	32	453	394		394		59
12	993	493		493	395	4	399		94
13	975	475	22	497	390		390		107
14	966	466	42	508	389		389		119
15	918	418	57	475	388		388		87
16	913	413	56	469	388		388		81
17	935	435	42	477	390		390		87
18	874	374	98	472	391		391		81
19	790	290	163	453	389		389		64
20	745	245	197	442	389		389		53
21	704	204	245	449	390		390		59
22	633	158	316	474	390		390		84
23	656	164	308	472	389		389		83
24	718	218	247	465	390		390		75
25	690	190	254	444	391		391		53
26	665	166	277	443	389		389		54
27	612	153	329	482	388		388		94
28	635	159	287	446	386		386		60
29	638	160	257	417	385		385		32
30	638	160	249	409	387		387		22
31	632	158	246	404	388		388		16
Total	28,495	12,041	3,905	15,946	12,044	246	12,290		3,656
Mean	919	389	126	514	388	7.94	396		118
Ac. Ft.	56,500	23,900	7,750	31,600	23,900	488	24,300		7,260

DIVISION OF WATER OF ST.MARY RIVER

WATER AVAILABLE FOR USE BY CANADA.

JULY - 1919.

Day	Natural Flow St.Mary River at Kimball Sec.Ft.	Canada's Share Sec.Ft.	St.Mary River at Kimball Sec.Ft.	EXCESS Sec.Ft.	Deficiency Sec.Ft.
1	1547	773	1246	473	
2	1494	747	1112	365	
3	1420	710	978	268	
4	1287	643	833	190	
5	1128	564	752	188	
6	1172	586	752	166	
7	1101	551	737	186	
8	1027	513	701	188	
9	1072	536	645	109	
10	996	500	559	59	
11	921	500	559	59	
12	993	500	594	94	
13	975	500	607	107	
14	966	500	619	119	
15	918	500	587	87	
16	913	500	581	81	
17	935	500	587	87	
18	874	500	581	81	
19	790	500	564	64	
20	745	500	553	53	
21	704	500	559	59	
22	633	475	559	84	
23	656	492	575	83	
24	718	500	575	75	
25	690	500	553	53	
26	665	499	553	54	
27	612	459	553	94	
28	635	476	536	60	
29	638	478	510	32	
30	638	478	500	22	
31	632	474	490	16	
Total	28,495	16,454	20,110	3,656	
Mean	919	531	649	118	
A. Ft.	56,500	32,600	39,900	7,260	

Table 3.

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER

WATER STORED AND RELEASED BY UNITED STATES.

AUGUST - 1919.

Day:	In Flow into Sherburne Reservoir				Swiftcurrent Cr. below Sherburne Dam.	STORED	Released From Storage
	Swiftcurrent Cr. at Many Glacier	Canyon Creek	Other Creeks (Estimated)	Total In Flow			
	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.	Sec. Ft.
1	142	17	5	164	388		224
2	154	19	5	178	388		210
3	157	20	5	182	385		203
4	161	21	5	187	385		198
5	131	16	5	152	385		233
6	112	14	5	131	390		259
7	112	14	5	131	388		257
8	112	13	5	130	385		255
9	118	15	5	138	385		247
10	112	14	5	131	388		257
11	108	13	4	125	410		285
12	105	13	4	122	413		291
13	100	13	4	117	418		301
14	96	12	4	112	415		303
15	90	12	4	106	431		325
16	92	11	2	105	426		321
17	94	12	2	108	415		307
18	100	12	2	114	418		304
19	105	12	2	119	415		296
20	112	12	2	126	433		307
21	112	12	2	126	428		302
22	108	11	2	121	418		297
23	96	11	2	109	426		317
24	90	10	2	102	415		313
25	85	10	2	97	423		326
26	85	9.4	2	96	426		328
27	96	9.4	2	101	431		330
28	90	10	2	102	423		321
29	83	9.4	2	94	423		329
30	83	8.7	2	94	423		329
31	83	9.0	2	94	420		326
Total	3,320	394.9	102	3,816	12,717		8,901
Mean	107	12.7	3.29	123	410		287
Ac. Ft.	6,580	781	202	7,560	25,200		17,600

Table 3.

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER

AUGUST - 1919.

Day	St. Mary River at Kimball Sec. Ft.	Diverted by USRS Sec. Ft.	Stored by USRS Sec. Ft.	Total Sec. Ft.	Stored Water Released Sec. Ft.	Natural Flow St. Mary River at Kimball Sec. Ft.
1	466	388		854	224	630
2	466	388		854	210	644
3	470	389		859	203	656
4	480	389		869	198	671
5	475	386		861	233	628
6	470	385		855	259	596
7	457	385		842	257	585
8	452	385		837	255	582
9	434	384		818	247	571
10	421	387		808	257	551
11	417	388		805	285	520
12	413	390		803	291	512
13	408	392		800	301	499
14	404	392		796	303	493
15	400	392		792	325	467
16	387	391		778	321	457
17	375	392		767	307	460
18	366	389		755	304	451
19	358	390		748	296	452
20	358	390		748	307	441
21	362	391		753	302	451
22	362	390		752	297	455
23	362	391		753	317	436
24	358	389		747	313	434
25	346	389		735	326	409
26	350	389		739	328	411
27	342	390		732	330	402
28	342	389		731	321	410
29	338	387		725	329	396
30	326	387		713	329	384
31	326	389		715	326	389
Total	12,291	12,053	24,344		8,901	15,443
Mean	396	389	785		287	498
Ac. Ft.	24,300	23,900	48,300		17,600	30,600

Table 3.

DIVISION OF WATER OF ST.MARY RIVER
WATER USED BY UNITED STATES.

AUGUST - 1919.

Day	Natural Flow St.Mary River at Kimball Sec.Ft.	Available for use by US: U.S. Share Sec.Ft.	Available for use by US: Stored Water Released Sec.Ft.	Available for use by US: Total Sec.Ft.	Used: Diverted Sec.Ft.	Used: Stored Sec.Ft.	Used: Total Sec.Ft.	Excess Sec.Ft.	Deficiency Sec.Ft.
1	630	158	224	382	388		388	6	
2	644	161	210	371	388		388	17	
3	656	164	203	367	389		389	22	
4	671	171	198	369	389		389	20	
5	628	157	233	390	386		386		4
6	596	149	259	408	385		385		23
7	585	146	257	403	385		385		18
8	582	146	255	401	385		385		16
9	571	143	247	390	384		384		6
10	551	138	257	395	387		387		8
11	520	130	285	415	388		388		27
12	512	128	291	419	390		390		29
13	499	125	301	426	392		392		34
14	493	123	303	426	392		392		34
15	467	117	325	442	392		392		50
16	457	114	321	435	391		391		44
17	460	115	307	422	392		392		30
18	451	113	304	417	389		389		28
19	452	113	296	409	390		390		19
20	441	110	307	417	390		390		27
21	451	113	302	415	391		391		24
22	455	114	297	411	390		390		21
23	436	109	317	426	391		391		35
24	434	108	313	421	389		389		32
25	409	102	326	428	389		389		39
26	411	103	328	431	389		389		42
27	402	100	330	430	390		390		40
28	410	102	321	423	389		389		34
29	396	99	329	428	387		387		41
30	384	96	329	425	387		387		38
31	389	97	326	423	389		389		34
Total	15,443	3,864	8,901	12,765	12,053		12,053	65	777
Mean	498	125	287	412	389		389	2.10	25.1
Ac.Ft.	30,600	7,690	17,600	25,300	23,900		23,900	129	1,540

DIVISION OF WATER OF ST. MARY RIVER
WATER AVAILABLE FOR USE BY CANADA
AUGUST - 1919

Day	Natural Flow St. Mary River at Kimball Sec. Ft.	Canada's Share Sec. Ft.	St. Mary River at Kimball Sec. Ft.	Excess Sec. Ft.	Deficiency Sec. Ft.
1	630	472	466		6
2	644	483	466		17
3	656	492	470		22
4	671	500	480		20
5	628	471	475	4	
6	596	447	470	23	
7	585	439	457	18	
8	582	436	452	16	
9	571	428	434	6	
10	551	413	421	8	
11	520	390	417	27	
12	512	384	413	29	
13	499	374	408	34	
14	493	370	404	34	
15	467	350	400	50	
16	457	343	387	44	
17	460	345	375	30	
18	451	338	366	28	
19	452	339	358	19	
20	441	331	358	27	
21	451	338	362	24	
22	455	341	362	21	
23	436	327	362	35	
24	434	326	358	32	
25	409	307	346	39	
26	411	308	350	42	
27	402	302	342	40	
28	410	308	342	34	
29	396	297	338	41	
30	384	288	326	38	
31	389	292	326	34	
Total	15,443	11,579	12,291	777	65
Mean	498	374	396	25.1	2.10
Sec. Ft.	30,600	23,000	24,300	1,540	129

Table 3.

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER.

WATER STORED AND RELEASED BY UNITED STATES.

SEPTEMBER - 1919.

Day:	In Flow into Sherburne Reservoir.				Swiftcurrent Cr. below Sherburne Dam.	Stored	Released From Storage
	Swiftcurrent Cr. At Many Glacier	Canyon Creek	Other Creeks (Estimated)	Total In Flow			
	Sec.Ft.	Sec.Ft.	Sec.Ft.	Sec.Ft.	Sec.Ft.	Sec.Ft.	Sec.Ft.
1	79	9.4	1	89	423		334
2	75	9.0	1	85	433		348
3	71	8.4	1	80	423		343
4	67	7.8	1	76	350		274
5	63	10.	1	74	230		156
6	59	8.4	1	68	193		125
7	55	8.1	1	64	176		112
8	52	7.2	1	60	165		105
9	49	6.3	1	56	160		104
10	49	6.0	1	56	138		82
11	49	5.8	1	56	157		101
12	53	6.6	1	61	118		57
13	61	6.9	1	69	79		10
14	59	7.2	1	67	79		12
15	59	6.9	1	67	79		12
16	58	6.6	1	66	79		13
17	58	6.3	1	65	79		14
18	58	6.3	1	65	78		13
19	59	6.6	1	67	78		11
20	67	6.6	1	75	61	14	
21	64	6.0	1	71	61	10	
22	54	5.2	1	60	70		10
23	53	4.5	1	58	65		7
24	52	4.5	1	58	61		3
25	53	4.3	1	58	58		0
26	57	5.0	1	63	65		2
27	57	5.2	1	63	58	5	
28	54	4.7	1	60	63		3
29	47	4.5	1	52	58		6
30	44	3.9	1	49	56		7
31							
Total	1,735	194.2	30	1,958	4,193	29	2,264
Mean	57.8	6.47	1.00	65.3	140	0.967	75.5
Sec.Ft.	3,440	385	60	3,890	8,330	58	4,490

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER

SEPTEMBER - 1919.

Day	St. Mary River at Kimball Sec. Ft.	Diverted by USRS Sec. Ft.	Stored by USRS Sec. Ft.	Total Sec. Ft.	Stored Water Released Sec. Ft.	Natural Flow St. Mary River at Kimball Sec. Ft.
1	330	389		719	334	385
2	299	387		686	348	338
3	296	386		682	343	339
4	292	385		677	274	403
5	375	322		697	156	541
6	326	303		629	125	504
7	269	298		567	112	455
8	233	294		527	105	422
9	292	198		490	104	386
10	260	191		451	82	369
11	289	126		415	101	314
12	272	123		395	57	338
13	263	98		361	10	351
14	292	76		368	12	356
15	266	78		344	12	332
16	240	77		317	13	304
17	225	76		301	14	287
18	214	78		292	13	279
19	217	72		289	11	278
20	220	68	14	302		302
21	227	69	10	306		306
22	220	68		288	10	278
23	217	68		285	7	278
24	207	67		274	3	271
25	204	65		269		269
26	222	59		281	2	279
27	227	58	5	290		290
28	233	57		290	3	287
29	217	56		273	6	267
30	217	58		275	7	268
Total	7,661	4,650	29	12,340	2,264	10,076
Mean	255	155	0.967	411	75.5	336
Ac. Ft.	15,200	9,220	58	24,500	4,490	20,000

58
15,200
9,220
24,478
4490

35.

Table 3.

DIVISION OF WATER OF ST. MARY RIVER
WATER USED BY UNITED STATES
SEPTEMBER - 1919

Day	Natural Flow St. Mary River at Kimball Sec. Ft.	Available for use by U.S. U.S. Share Sec. Ft.	Stored Water Released Sec. Ft.	Total Sec. Ft.	Used Diverted Sec. Ft.	Stored Sec. Ft.	Total Sec. Ft.	Excess Sc. Ft.	Deficiency Sec. F
1	385	96	334	430	389		389		41
2	338	84	348	432	387		387		45
3	339	85	343	428	386		386		42
4	403	101	274	375	385		385	10	
5	541	135	156	291	322		322	31	
6	504	126	125	251	303		303	52	
7	455	114	112	226	298		298	72	
8	422	106	105	211	294		294	83	
9	386	96	104	200	198		198		2
10	369	92	82	174	191		191	17	
11	314	78	101	179	126		126		53
12	338	84	57	141	123		123		18
13	351	88	10	98	98		98	0	0
14	356	89	12	101	76		76		25
15	332	83	12	95	78		78		17
16	304	76	13	89	77		77		12
17	287	72	14	86	76		76		10
18	279	70	13	83	78		78		5
19	278	70	11	81	72		72		9
20	302	76		76	68	14	82	6	
21	306	76		76	69	10	79	3	
22	278	70	10	80	68		68		12
23	278	70	7	77	68		68		9
24	271	68	3	71	67		67		4
25	269	67		67	65		65		2
26	279	70	2	72	59		59		13
27	290	72		72	58	5	63		9
28	287	72	3	75	57		57		18
29	267	67	6	73	56		56		17
30	268	67	7	74	58		58		16
Total	10,076	2,520	2,264	4,784	4,650	29	4,679	274	379
Mean	336	84.0	75.5	159	155	0.967	156	9.13	12.6
Ac. Ft.	20,000	5,000	4,490	9,460	9,220	58	9,280	543	750

Table 3.

DIVISION OF WATER OF ST. MARY RIVER
WATER AVAILABLE FOR USE BY CANADA
SEPTEMBER - 1919

Day	Natural Flow St. Mary River at Kimball Sec. Ft.	Canada's Share Sec. Ft.	St. Mary River at Kimball Sec. Ft.	Excess Sec. Ft.	Deficiency Sec. Ft.
1	385	289	330	41	
2	338	254	299	45	
3	339	254	296	42	
4	403	302	292		10
5	541	406	375		31
6	504	378	326		52
7	455	341	269		72
8	422	316	233		83
9	386	290	292	2	
10	369	277	260		17
11	314	236	289	53	
12	338	254	272	18	
13	351	263	263	0	0
14	356	267	292	25	
15	332	249	266	17	
16	304	228	240	12	
17	287	215	225	10	
18	279	209	214	5	
19	278	208	217	9	
20	302	226	220		6
21	306	230	227		3
22	278	208	220	12	
23	278	208	217	9	
24	271	203	207	4	
25	269	202	204	2	
26	279	209	222	13	
27	290	218	227	9	
28	287	215	233	18	
29	267	200	217	17	
30	268	201	217	16	
Total	10,076	7,556	7,661	379	274
Mean	336	252	255	12.6	9.13
Ac. Ft.	20,000	15,000	15,200	750	543

Table 3.

DETERMINATION OF NATURAL FLOW OF ST. MARY RIVER

OCTOBER - 1919.

Day	St. Mary River at Kimball Sec. Ft.	Diverted by USRS Sec. Ft.	Stored by USRS Sec. Ft.	Total Sec. Ft.	Stored Water Released Sec. Ft.	Natural Flow St. Mary River at Kimball Sec. Ft.
1	207	55		262		262
2	200	54		254		254
3	187	54		241		241
4	175	54		229		229
5	168	53		221		221
6	156	52		208		208
7	147	52		199		199
8	156	52		208		208
9	150	54		204		204
10	150	54		204		204
11	150	52		202		202
12	147	52		199		199
13	138	51		189		189
14	130	50		180		180
15	123	50		173		173
16	123	49		172		172
17	125	48		173		173
18	125	49		174		174
19	121	49		170		170
20	119	51		170		170
21	117	54		171		171
22	117	79		196		196
23	115	74		189		189
24	140	30		170		170
25	150			150		150
26	159			159		159
27	158			158		158
28	157			157		157
29	157			157		157
30	157			157		157
31	157			157		157
Total	4,581	1,272		5,853		5,853
Mean	148	53.0		189		189
Ac. Ft.	9,100	2,520		11,600		11,600

DIVISION OF WATER OF ST.MARY RIVER
WATER USED BY UNITED STATES
OCTOBER - 1919.

Day	Natural Flow St.Mary River at Kimball Sec.Ft.	Available for use by US: U.S. Share Sec.Ft.	Available for use by US: Stored Water Released Sec.Ft.	Available for use by US: Total Sec.Ft.	Used: Diverted Sec.Ft.	Used: Stored Sec.Ft.	Used: Total Sec.Ft.	Excess Sec.Ft.	Deficiency Sec.Ft.
1	262	66		66	55		55		11
2	254	64		64	54		54		10
3	241	60		60	54		54		6
4	229	57		57	54		54		3
5	221	55		55	53		53		2
6	208	52		52	52		52	0	0
7	199	50		50	52		52	2	0
8	208	52		52	52		52	0	0
9	204	51		51	54		54	3	
10	204	51		51	54		54	3	
11	202	50		50	52		52	2	
12	199	50		50	52		52	2	
13	189	47		47	51		51	4	
14	180	45		45	50		50	5	
15	173	43		43	50		50	7	
16	172	43		43	49		49	6	
17	173	43		43	48		48	5	
18	174	44		44	49		49	5	
19	170	42		42	49		49	7	
20	170	42		42	51		51	9	
21	171	43		43	54		54	11	
22	186	46		46	79		79	30	
23	189	47		47	74		74	27	
24	170	42		42	30		30		12
25	150	38		38					38
26	159	40		40					40
27	158	40		40					40
28	157	39		39					39
29	157	39		39					39
30	157	39		39					39
31	157	39		39					
Total	5,853	1,462		1,462	1,272		1,272	128	318
Mean	189	47.2		47.2	53.0		53.0	4.13	10.3
Ac.Ft.	11,600	2,900		2,900	2,520		2,520	254	633

DIVISION OF WATER OF ST. MARY RIVER
WATER AVAILABLE FOR USE BY CANADA
OCTOBER - 1919.

Day	Natural Flow St. Mary River at Kimball Sec. Ft.	Canada's Share Sec. Ft.	St. Mary River at Kimball Sec. Ft.	Excess Sec. Ft.	Deficiency. Sec. Ft.
1	262	196	207	11	
2	254	190	200	10	
3	241	181	187	6	
4	229	172	175	3	
5	221	166	168	2	
6	208	156	156	0	
7	199	149	147		2
8	208	156	156	0	0
9	204	153	150		3
10	204	153	150		3
11	202	152	150		2
12	199	149	147		2
13	189	142	138		4
14	180	135	130		5
15	173	130	123		7
16	172	129	123		6
17	173	130	125		5
18	174	130	125		5
19	170	128	121		7
20	170	128	119		9
21	171	128	117		11
22	196	147	117		30
23	189	142	115		27
24	170	128	140	12	
25	150	112	150	38	
26	159	119	159	40	
27	158	118	158	40	
28	157	118	157	39	
29	157	118	157	39	
30	157	118	157	39	
31	157	118	157	39	
Total	5,853	4,391	4,581	318	128
Mean	189	142	148	10.3	4.13
Ac. Ft.	11,600	8,730	9,100	633	254

- Table 4 Continued -

a/ This total was obtained by adding the natural flow of North Fork of Milk River near International Boundary to the flow of South Fork of Milk River near International Boundary. The natural flow of North Fork of Milk River for the period May 9 to September 25 was obtained from records at a gauging station maintained about one mile above the outlet of the United States Reclamation Service St. Mary canal. For the remaining period in April, May, September and October when the canal was in operation the natural flow was estimated from records on North Fork of Milk River near International Boundary and the station on the United States Reclamation Service St. Mary Canal at Hudson Bay Divide.

b/ Fort Belknap Canal near Chinook — Agency ditch near Harlem
Paradise Canal near Chinook — Dodson North and South canals near Dodson
Harlem Canal near Zurich — Vandalia Canal near Vandalia
The rainfall and tributary run-off for Nelson reservoir was included.

c/ Water diverted by the Milk River canals less that which was wasted or stored. It does not include losses of St. Mary River water in passing down Milk River.

d/ Water turned into the reservoir was assumed to include rainfall and tributary run-off. The column headed "stored or released" shows the difference between the inflow and outflow for the month. This difference when combined with the losses, gives the changes in amount in the reservoir at the end of each month, as shown in the next column.

e/ These losses occurred between the point of measurement of the United States Reclamation Service St. Mary canal at St. Mary Crossing and the gauging station at Havre, Mont. Havre is about 30 miles upstream from the first important diversion in the United States, the Fort Belknap canal heading near Lohman, Mont. The results given are based on stream flow records of St. Mary canal at St. Mary crossing, North and South Forks of Milk River near International Boundary, North Fork of Milk River above the outlet of St. Mary canal, Milk River at Havre and the estimated tributary inflow not otherwise measured.

f/ This water was returned to the river by the canals and includes the water wasted into Lodge Creek by Fort Belknap canal.

g/ This column shows the flow below Vandalia dam, which is the only water wasted in Milk River valley without chance of further use.

Table 4.

Month	WATER AVAILABLE: St. Mary River at Kimball	Rolph Creek	Pothole Creek	Lee Creek	Combined Flow	DISPOSITION: Diverted A.R.& I.Co.	Wasted A.R.& I.Co.	Losses A.R.& I.Co.	Stored Chin Reservoir	St. Mary Lethbridge
April	15,828	422	256	2,499	19,005	2,374	2,243	131		19,220
May	97,765	640	326	3,751	102,482	23,550	5,884	2,706		73,047
June	82,949	363	22	1,904	85,238	42,724	3,155	3,392		46,949
July	39,905	234	nil	400	40,539	34,925	744	2,275		7,071
August	24,349	209	nil	204	24,822	22,935	2,029	3,075		3,259
Sept.	15,174	149	nil	196	15,519	13,507	696	306	6,324	1,785
Oct.	9,100	197	nil	250 e	9,547	6,093	2,251	636		9,072
Total	285,070	2,214 d	604 b	9,264 b	297,152	146,108	17,002	12,523 x	6,324	160,403 a

a. Below all points of diversion.
b. Natural flow only.
c. Computed.
d. Includes seepage losses from St.Mary Canal U.S.B.S.
e. Estimated.
x. Only includes evaporation and seepage between headgate and Spring Coulee.

USE OF WATER FOR IRRIGATION
APRIL TO OCTOBER 1919.

UNITED STATES.

Month	WATER AVAILABLE: Natural Flow St. Mary River at Kimball	Diverted St. Mary River To Milk River	Total Natural Flow North and South Forks Milk River at Boundary [a]	Milk River at Eastern Crossing	Milk River at Havre	DIVERTED and USED: Diverted by Milk River Canals [b]	Applied to the Land Gross [c]
	ac.-ft.	ac.-ft.	ac.-ft.	ac.-ft.	ac.-ft.	ac.-ft.	ac.-ft.
April	20,200	4,360	7,020	13,700	15,600	12,981	5,289
May	122,000	23,900	5,580	26,100	25,500	21,880	14,995
June	126,000	23,100	1,926	24,500	20,800	25,525	30,342
July	56,500	23,900	529	20,500	17,400	17,002	20,778
August	30,600	23,900	475	20,800	18,500	17,591	8,366
September	20,000	9,220	430	13,000	12,300	14,896	3,137
October	11,600	2,520	1,627	4,060	2,510	3,857	1,659
Total	386,900	110,900	17,587	122,660	112,610	113,732	84,566

Month	NELSON RESERVOIR: Stored or Released [d]	In Reservoir at End of Month	LOSSES: Carriage Losses in St. Mary Canal and Milk River [e]	Nelson Reservoir	Total	WASTED: By Milk River Canals [f]	Milk River at Vandalia [g]
	ac.-ft.	ac.-ft.	ac.-ft.	ac.-ft.	ac.-ft.	ac.-ft	ac.-ft.
April	+ 7,370	25,450	881	720	1,601	322	176,000
May	+ 5,150	27,400	3,187	3,200	6,387	1,735	6,360
June	- 5,900	18,000	5,645	3,500	9,145	1,083	162
July	- 5,000	10,300	6,952	2,700	9,652	1,224	2,200
August	+ 7,415	16,000	6,098	1,715	7,813	1,810	400
September	+10,850	25,400	1,499	1,450	2,949	909	3,650
October	+ 1,298	25,700	2,488	998	3,486	900	941
Total			26,750	14,283	41,033	7,983	189,713

(over)

TABLE 5

FRENCHMAN RIVER BASIN.

Diversion in acre-feet.

CANADA.

Irrigator	April	May	June	July	August	September	October	Total
A.M.Cross		7	46	41				94
[illegible] Cross		49	125	48				222
[illegible]ple Creek Cattle Co.	89	56	47	19	27	5	1	244
Armstrong East Bate	Diverted small amount in June (No gauge heights)	"	"	"	"	"	"	
UNITED STATES (No Records)								560

LODGE CREEK.

CANADA.

Irrigator	April	May	June	July	August	September	October	Total
J.E.Hartt	Diverted small amount in May (No gauge heights).							
W.B.Gregg	"	"	"	"	"	"	"	
W.Mitchell (Lower)	"	"	"	"	"	"	"	
M.M.M.& J.M. Spangler	(No gauge heights)							
W.T.Clarke (South)	19	26	11	2				58

BATTLE CREEK.

CANADA.

Irrigator	April	May	June	July	August	September	October	Total
J.M.Spangler	10							10
Gaff	63		221	96				380
Patterson		49	23					72
Linder Bros.	76	77	26	17				196
Stirling & Nash	27	289	276					592
W.S.Wilson			79	100				179
Marshall & Gaff	220	412	202	81	60	104	143	1192
[illegible]d & Anderson			1					1
L.N.Richardson	Diverted small amount in May (No gauge heights).							
R.W.& W.L. Wilkes	"	"	"	" June	"	"	"	
J.McKinnon	"	"	"	" May	"	"	"	
UNITED STATES.	504	965	1059	374	87	109	144	3240
Matheson Canal	208	31	95					334
Cook Canal	838	1160	139					2137

504
965
1059
374
87
109
144
3242

17 R.S.

MB/SGD

DEPARTMENT OF THE INTERIOR

Reclamation Service

Ottawa, 10th February, 1920.

MEMORANDUM:

Mr. Drake

In order to complete the joint report to the International Joint Commission, the following additions, which have already been inserted in the original, will have to be made to the bound copies at Washington:-

1. Views submitted by the United States to be inserted.

2. Plate III, the map of the drainage basins, to be completed and inserted.

   To finish Plate III, the addition of stations 17 and 71A on St.Mary River and Pothole Creek at Russell's ranch. These are plotted on the map.

   The red x denoting discontinued stations has been placed opposite abandoned Canadian stations.

3. Hydrographs to be completed and inserted.
   Plate IV add record of the diversions of the A.R. & I. Co.
   Plate V add records taken at Milk River.

Discuss the advisability of making the American stations on McDermott Lake and Canyon Creek into joint international stations and the establishment of international stations on the Swift Current below Sherburne dam, and on Milk River above the outlet of the U.S.R.S. Canal.

Diversions of which no records are kept from Kennedy and Rolph Creeks.

Discuss the proposed agreement between U.S.R.S. and A.A. Humphrey in view of recent ruling by Dept. of Justice, a copy of which agreement is attached.

Ralph J. Burley