Report to

THE INTERNATIONAL JOINT COMMISSION

on

THE DIVISION OF THE WATERS OF THE

ST. MARY AND MILK RIVERS

1988

by

D.A. Davis
representing Canada

and

Philip Cohen
representing the United States

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March 1989

International Joint Commission
Ottawa, Ontario and Washington, D.C.

Gentlemen:

In compliance with the provisions of Article VI of the Boundary Waters Treaty of 1909 and Clause VIII (c) of your order of October 4, 1921, directing the division of the waters of the St. Mary and Milk rivers between the United States and Canada, we are transmitting herewith a report on the operations during the irrigation season ended October 31, 1988.

Respectfully submitted,

D. A. Davis
Accredited Officer of Her Majesty

Philip Cohen
Accredited Officer of the United States

SYNOPSIS

During 1988 a severe climatic drought affected the entire basins of the St. Mary and Milk rivers and their tributaries. The drought resulted from well below normal winter and summer precipitation and above normal temperatures. However, adequate and timely data collection and joint management ensured the best use of the limited water supplies.

The annual conference of the Field Representatives was held in Calgary, Alberta on February 1, 1989. Streamflow and water level records collected by Canada and the United States were reviewed and approved.

During the 1988 irrigation season, the natural flow of the St. Mary and Milk Rivers was 69 per cent and 26 per cent, respectively, of the long-term average.

The natural flow of the St. Mary River at the International Boundary during the irrigation season, April 1 to October 31, 1988, was 496 000 cubic decametres (dam^3) (402,000 acre-feet). Under the terms of the Treaty, the Canadian share was 314 000 dam^3 (255,000 acre-feet). The total flow recorded at the International Boundary during the irrigation season was only 98 per cent of the Canadian allotment due to 5 990 dam^3/s (4,860 acre-feet) being diverted to the Milk River system.

Moreover, Canada requested that the late October releases from Lake Sherburne, to refund previous deficits, be suspended in order to allow completion of repairs to the outlet works of the St. Mary Reservoir.

The natural flow of Milk River at the Eastern Crossing of the International Boundary from March 1 to October 31, 1988, was 35 900 dam^3 (29,100 acre-feet). Under the terms of the Treaty, the United States' allotment was 25 000 dam^3 (20,300 acre-feet). Computations indicated that the United States received 144 per cent of its allotment at Eastern Crossing, in addition to its share of St. Mary River water diverted into the Milk River by the St. Mary Canal.

During 1988, the four member ad hoc task force, formed to investigate the division of the waters of the southern tributaries of the Milk River, held a meeting to introduce and explain the purpose of the task force to ranchers and farmers from both countries. In addition, a three-year groundwater study was commissioned, miscellaneous streamflow measurements were made, and status reports were provided to the Accredited Officers.

The March to October natural flow of the three apportioned eastern tributaries of the Milk River, Lodge Creek, Battle Creek and Frenchman River, was 8, 30 and 16 per cent, respectively, of the long-term averages. The combined natural flow of these tribuaries was 26 400

dam^3 (21,400 acre-feet), of which the United States received 12 100 dam^3 (9,810 acre-feet). Deficits were incurred on Lodge Creek, Battle Creek, and on the Frenchman River at the end of the season, largely due to discrepancies between the interim computational techniques and the final irrigation season-end reporting of use. These deficits were not refunded due to extremely low flows and absence of stored water available.

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INTRODUCTION

Article VI of the Boundary Waters Treaty of 1909 between Great Britain and the United States governs the apportionment of the waters of the St. Mary and Milk rivers. The terms of the Treaty were further clarified by the 1921 Order of the International Joint Commission. Copies of Article VI and the 1921 Order are contained in Annex A of this report.

To comply with this Treaty, Field Representatives of the United States and Canada collected and compiled hydrometric data at 42 international gauging stations on a co-operative basis. An additional 25 gauging stations were operated independently by the United States or Canada to obtain data on diversions, reservoir contents, return flows and index runoff. Most of this additional information is used to improve the accuracy of natural flow computations.

This report summarizes the 1988 natural flow computations, mentions apportionment of the natural flow, and explains unusual occurrences during the year, as well as procedural modifications designed to increase the accuracy of the natural flow computations. Summary natural flow tables are included. Detailed natural flow computations are included in Appendix A. Daily discharge and other related data are included in Appendix B. Appendices A and B are submitted with this report under separate cover.

In accordance with the International System of Units (SI) conversion schedule established by the International Joint Commission, this report uses SI units first, followed by inch-pound units in parentheses. Data in tables are shown in SI units first, followed by the respective inch-pound units (for example, Tables 1 and 1A).

The format for Appendices A and B of the report is SI units only. All Canadian data are collected, computed and published in SI units. The United States' data, which are collected and computed in inch-pound units, were converted to SI units using the appropriate conversions. A summary of the conversion factors is contained in Annex B.

Mr. D. A. Davis, Director General, Inland Waters Directorate, as Accredited Officer of Her Majesty, was represented in the field by Mr. R. G. Boals, Chief, Water Resources Branch, Regina, Saskatchewan and Mr. G. H. Morton, Chief, Water Resources Branch, Calgary, Alberta. Mr. Philip Cohen, Chief Hydrologist, United States Geological Survey, as Accredited Officer of the United States, was represented in the field by Mr. J. A. Moreland, District Chief, United States Geological Survey, Helena, Montana. This report was prepared jointly by personnel of Environment Canada, Water Resources Branch, and the United States Geological Survey, under the supervision of Messrs. Boals, Morton and Moreland.

The annual conference of Field Representatives was held in Calgary, Alberta on February 1, 1989. Streamflow records collected jointly by

Canada and the United States were reviewed and approved. Mutual problems, future plans, and changes in computational procedures were discussed and a schedule of field operations for 1989 adopted.

ST. MARY RIVER

During the irrigation season, April 1 to October 31, Canada's share of the natural flow of the St. Mary River at the International Boundary, as stipulated by the 1921 Order, is three-fourths of the natural flow when that flow is 666 cubic feet per second (18.86 cubic metres per second) or less. Flows in excess of that quantity are divided equally between Canada and the United States. During the non-irrigation season, November 1 to March 31, the flow is divided equally between the two countries.

To comply with the above order, representatives of both countries make twice-monthly computations of the daily natural flow of the St. Mary River during the irrigation season. If use by the United States is in excess of its share, then a delivery of an equivalent quantity of water is normally made to Canada at the earliest opportunity. Regular interim reports of these computations are sent to all agencies involved in the water use and management of the flow of the St. Mary River. The interim reports keep these agencies informed as to the quantity of water that is available and the status of apportionment.

Tentative computations and interim reports are not made during the non-irrigation season when use by the United States is limited to storage in Lake Sherburne. The flow into Lake Sherburne is considerably less than 50 per cent of the natural flow. Occasionally, water is diverted into the St. Mary Canal during the non-irrigation season, necessitating additional tentative computations.

Lake Sherburne, the only storage reservoir within the St. Mary River basin in the United States, is used to store part of the United States' share of flow for later diversion to the Milk River. This water, which passes through Canada, is used by the United States for irrigation in the eastern portion of the Milk River basin.

Storage in Lake Sherburne (station 05AE036) was 43 400 dam^3 (35,200 acre-feet) on October 31, 1987 and increased to 52 400 dam^3 (42,500 acre-feet) on March 9, 1988 when releases began. Because of below-normal snowpack accumulation over the winter, storage increases from runoff in May and June failed to exceed the March 9 maximum. When releases were discontinued on August 17, storage had decreased to 4 650 dam^3 (3,770 acre-feet).

Water was diverted from the St. Mary River into the Milk River via the St. Mary Canal from March 10 to August 22, 1988. The total flow recorded at the gauging station on the St. Mary Canal at St. Mary Crossing (station 05AE029) was 219 000 dam^3 (178,000 acre-feet). Any seepage from the canal between the point of diversion and the crossing of the St. Mary River is assumed to return to the river and eventually become available to Canada.

The total natural flow of the St. Mary River at the International Boundary from November 1, 1987, to October 31, 1988, was 535 000 dam^3 (434,000 acre-feet) of which 496 000 dam^3 (402,000 acre-feet) occurred

during the irrigation season, April 1 to October 31, 1988. For the irrigation season, Canada's and the United States' shares were 314 000 dam^3 (255,000 acre-feet) and 182 000 dam^3 (148,000 acre-feet), respectively. A total discharge of 307 000 dam^3 (249,000 acre-feet) was recorded at the International Boundary, which was 98 per cent of the Canadian share. The computed natural flow during the irrigation season was 69 per cent of the average of the previous 85 years of record.

Actual deficit deliveries were recorded in 10 of the 14 division periods during the 1988 irrigation season. Because of the very dry conditions during June, July and August, the Canadian share of the Milk River decreased to zero. To permit continued irrigation by Canadian Milk River users, Canada requested that a portion of its share of the St. Mary River be diverted to the Milk River. In all, 5 990 dam^3 (4,860 acre-feet) of the Canadian share was diverted to the Milk River system, but 245 dam^3 (199 acre-feet) of this total was actually diverted down Hall Coulee in an attempt to provide stock water to Canadian users along Rolph Creek.

Shortly after a release from Lake Sherburne was begun in late October to refund the remaining deficit, a request was made by Canada to suspend the releases in order to allow completion of repairs to the outlet works of the St. Mary Reservoir in Canada. With the addition of the above-mentioned 5 990 dam^3 (4,860 acre-feet), the net result for the irrigation season was a delivery of 99.8 per cent of the Canadian allotment. The co-operation of both countries during this water-short year allowed

irrigators on both sides of the International Boundary to make the best use of available water supplies.

The division of St. Mary River natural flow is summarized in Tables 1 and 1A, which follow. These tables detail the portion of the Canadian share of the St. Mary River delivered to the Milk River. The column "BELOW SHARE, ACTUAL" includes the adjustments to the column "BELOW SHARE, APPARENT" for the Canadian share of the St. Mary River delivered to the Milk River. The detailed computation of the natural flow is given in Table 6 and the historical summary in Table 7 of Appendix A.

TABLE 1

SUMMARY OF DIVISION OF ST. MARY RIVER AND DIVERSION TO MILK RIVER[1]

1988

QUANTITIES IN CUBIC DECAMETRES

	ST. MARY RIVER AT INTERNATIONAL BOUNDARY				EXCESS REC'D. BY CANADA	CHANGE IN STORAGE-LAKE SHERBURNE	TOTAL AVAILABLE FOR DIVERSION	ST. MARY CANAL AT ST. MARY CROSSING	MILK RIVER AT EASTERN CROSSING
	RECORDED FLOW	NATURAL FLOW	U.S. SHARE	CANADA'S SHARE					
APR.	38 995	60 311	20 073	40 238	-1 243	-22 776	42 849	44 092	51 676
MAY	88 800	147 693	61 221	86 472	2 328	10 165	51 056	48 728	44 235
JUN.	81 532	144 054	59 808	84 246	-2 714	11 725	48 083	50 797	46 172
JUL.	37 616	58 304	17 283	41 021	-3 405	-25 591	42 874	46 279	37 579
AUG.	18 685	28 028	7 078	20 950	-2 265	-728	7 806	10 071	14 292
SEP.	11 202	14 764	3 692	11 072	130	3 562	130	0	978
OCT.	30 419	42 808	13 043	29 765	654	12 389	654	0	378
TOTAL IRRIGATION SEASON	307 249	495 962	182 198	313 764	-6 515	-11 254	193 452	199 967	195 310

QUANTITIES FOR ST. MARY RIVER DIVISION PERIODS, IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	CANADA'S SHARE	RECEIVED BY CANADA	RECEIVED BY CANADA		
				ABOVE SHARE	BELOW SHARE APPARENT	BELOW SHARE ACTUAL
APR 1 TO APR 15	15 976	11 963	11 522		441	
APR 16 TO APR 30	44 335	28 275	27 473		802	
MAY 1 TO MAY 15	55 077	33 648	36 810	3 162		
MAY 16 TO MAY 31	92 616	52 824	51 990		834	
JUN 1 TO JUN 15	81 282	46 751	46 099		652	40
JUN 16 TO JUN 30	62 772	37 495	35 433		2 062	1 145
JUL 1 TO JUL 15	35 218	23 718	23 252		466	(696)*
JUL 16 TO JUL 31	23 086	17 303	14 364		2 939	982
AUG 1 TO AUG 15	14 397	10 800	9 461		1 339	422
AUG 16 TO AUG 31	13 631	10 150	9 224		926	498
SEP 1 TO SEP 15	8 244	6 182	6 480	298		
SEP 16 TO SEP 30	6 520	4 890	4 722		168	
OCT 1 TO OCT 15	9 441	7 082	6 793		289	
OCT 16 TO OCT 31	33 367	22 683	23 626	943		

[1] This is a summary of data from Table 6, Appendix A.

* Above Share

TABLE 1A

SUMMARY OF DIVISION OF ST. MARY RIVER AND DIVERSION TO MILK RIVER[1]

1988

QUANTITIES IN ACRE-FEET

	ST. MARY RIVER AT INTERNATIONAL BOUNDARY				EXCESS REC'D. BY CANADA	CHANGE IN STORAGE-LAKE SHERBURNE	TOTAL AVAILABLE FOR DIVERSION	ST. MARY CANAL AT ST. MARY CROSSING	MILK RIVER AT EASTERN CROSSING
	RECORDED FLOW	NATURAL FLOW	U.S. SHARE	CANADA'S SHARE					
APR.	31,613	48,894	16,273	32,621	-1,008	-18,465	34,738	35,745	41,894
MAY	71,990	119,735	49,632	70,103	1,887	8,241	41,391	39,504	35,861
JUN.	66,098	116,785	48,486	68,298	-2,200	9,505	38,981	41,181	37,432
JUL.	30,495	47,267	14,011	33,256	-2,760	-20,747	34,758	37,518	30,465
AUG.	15,148	22,722	5,738	16,984	-1,836	-590	6,328	8,165	11,587
SEP.	9,081	11,969	2,993	8,976	105	2,888	105	0	793
OCT.	24,661	34,704	10,574	24,130	530	10,044	530	0	306
TOTAL IRRIGATION SEASON	249,087	402,076	147,708	254,368	-5,282	-9,124	156,832	162,113	158,338

QUANTITIES FOR ST. MARY RIVER DIVISION PERIODS, IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	CANADA'S SHARE	RECEIVED BY CANADA	RECEIVED BY CANADA		
				ABOVE SHARE	BELOW SHARE APPARENT	BELOW SHARE ACTUAL
APR 1 TO APR 15	12,952	9,698	9,341		358	
APR 16 TO APR 30	35,942	22,923	22,272		650	
MAY 1 TO MAY 15	44,651	27,278	29,842	2,563		
MAY 16 TO MAY 31	75,084	42,824	42,148		676	
JUN 1 TO JUN 15	65,895	37,901	37,372		529	32
JUN 16 TO JUN 30	50,889	30,397	28,726		1,672	928
JUL 1 TO JUL 15	28,551	19,228	18,850		378	(564)*
JUL 16 TO JUL 31	18,716	14,028	11,645		2,383	796
AUG 1 TO AUG 15	11,672	8,756	7,670		1,086	342
AUG 16 TO AUG 31	11,051	8,229	7,478		751	404
SEP 1 TO SEP 15	6,683	5,012	5,253	242		
SEP 16 TO SEP 30	5,286	3,964	3,828		136	
OCT 1 TO OCT 15	7,654	5,741	5,507		234	
OCT 16 TO OCT 31	27,051	18,389	19,154	764		

[1] All values are conversions of data from Table 1. Totals and shares may not add or subtract exactly as a result of rounding.

* Above Share

MILK RIVER

During the irrigation season, April 1 to October 31, the United States' share of the natural flow of the Milk River at the eastern crossing of the International Boundary, as stipulated by the 1921 Order, is three-fourths of the natural flow when that flow is 666 cubic feet per second (18.86 cubic metres per second) or less. Flows in excess of that quantity are divided equally between the United States and Canada. During the non-irrigation season, November 1 to March 31, the entire flow is divided equally between the two countries.

Prior to the mid-seventies, uses of the natural flow of the Milk River by Canada and the United States were assumed to be less than their respective shares and no formal apportionment was made. By 1977, it became apparent that the increasing numbers of sprinkler irrigation systems were capable of using all of the natural flow for long periods of time. Consequently, a more comprehensive natural flow computation and water division procedure was developed and has been used since 1985. The revised computation procedure includes an approximate accounting of irrigation consumptive uses in both countries, and the interbasin transfer of water in Canada. An additional refinement was made in 1988 when F.I. Morton's evapotranspiration model replaced the adjusted pan evaporation method in the natural flow computations.

During 1988, the United States' and Canada's respective estimated consumptive uses were 3 830 dam^3 (3,110 acre-feet) and 7 560 dam^3 (6,130 acre-feet), for a total of 11 400 dam^3 (9,240 acre-feet) or 32 per cent of the natural flow of the Milk River at the eastern crossing during the period March 1 to October 31, 1988. For the same period, the Canadian transfer of water into the Milk River from Verdigris Coulee near the Mouth (station 11AA038) was 371 dam^3 (301 acre-feet).

To comply with the 1921 Order, representatives of both countries now make tentative monthly computations of the natural flow of the Milk River during the irrigation season. Additional computations are made when the natural flow is low and irrigation use is high. When Canada uses more than its share of the natural flow for an extended period of time, the Accredited Officers, after Field Representatives' consultation with the appropriate water management agencies, may agree to make up the Canadian deficit on the Milk River by reducing the Canadian share of the St. Mary River by an equal amount. These arrangements are made on an ad hoc basis as the situations arise, and, during 1988, these arrangements were made during the period June 6 to August 22.

The natural flow of the Milk River at the eastern crossing of the International Boundary from March 1 to October 31, 1988, was 35 900 dam^3 (29,100 acre-feet). This flow was 26 per cent of the average computed natural flow of the previous 76 years of record. It is important to note, however, that natural flow computations prior to 1985 did not account for consumptive use. Also, based on comparative

computations in 1988 only, the use of Morton's evapotranspiration model, as compared with the adjusted pan evaporation method, has produced slightly lower natural flow values. Consequently, natural flow values after 1985 and 1988 are not directly comparable with natural flows of previous years. The respective shares of the United States and Canada were 25 000 dam^3 (20,300 acre-feet) and 10 900 dam^3 (8,840 acre-feet).

The division of Milk River natural flow is summarized in tables 2 and 2A, which follow. The detailed computation of natural flow is given in Table 8 and the historical summary in Table 9 of Appendix A.

TABLE 2

SUMMARY TABLE
NATURAL FLOW AND DELIVERIES OF
MILK RIVER AT THE EASTERN CROSSING
OF THE INTERNATIONAL BOUNDARY[1]

1988

QUANTITIES IN CUBIC DECAMETRES

PERIOD	NATURAL FLOW AT EAST CROSSING	SHARE		MILK RIVER AT EAST CROSSING	DIVERSION FROM ST. MARY BASIN	EXCESS(+)/ DEFICIT(-)/ DELIVERY TO U.S.	CUMULATIVE EXCESS(+)/ DEFICIT(-) U.S.
		U.S.	CANADA				
JAN 1 - JAN 31	211	105	105	-	-	+ 105	+ 105
FEB 1 - FEB 29	861	431	431	-	-	+ 432	+ 537
MAR 1 - MAR 31	7 737	3 868	3 868	16 963	10 741	+ 3 880	+ 4 417
APR 1 - APR 30	14 981	11 236	3 745	51 676	38 472	+ 3 762	+ 8 179
MAY 1 - MAY 31	4 121	3 091	1 030	44 235	44 472	+ 802	+ 8 981
JUN 1 - JUN 30	4 226	3 170	1 057	46 172	48 222	- 621	+ 8 360
JUL 1 - JUL 31	1 057	793	264	37 579	43 898	- 2 821	+ 5 539
AUG 1 - AUG 31	2 458	1 844	615	14 292	15 809	- 1 281	+ 4 258
SEP 1 - SEP 30	996	747	249	978	-	- 109	+ 4 149
OCT 1 - OCT 31	351	263	88	378	-	+ 115	+ 4 263
NOV 1 - NOV 30	867	434	434	-	-	+ 435	+ 4 698
DEC 1 - DEC 31	559	279	279	-	-	+ 279	+ 4 978
TOTALS	38 425	26 260	12 165	212 272	201 614	+ 4 978	+ 4 978

[1] This is a summary of data from Table 8, Appendix A.

TABLE 2A

SUMMARY TABLE
NATURAL FLOW AND DELIVERIES OF
MILK RIVER AT THE EASTERN CROSSING
OF THE INTERNATIONAL BOUNDARY[1]

1988

QUANTITIES IN ACRE-FEET

PERIOD	NATURAL FLOW AT EAST CROSSING	SHARE		MILK RIVER AT EAST CROSSING	DIVERSION FROM ST. MARY BASIN	EXCESS(+)/ DEFICIT(-)/ DELIVERY TO U.S.	CUMULATIVE EXCESS(+)/ DEFICIT(-) U.S.
		U.S.	CANADA				
JAN 1 - JAN 31	171	85	85	-	-	+ 85	+ 85
FEB 1 - FEB 29	698	349	349	-	-	+ 350	+ 435
MAR 1 - MAR 31	6,272	3,136	3,136	13,752	8,708	+ 3,145	+ 3,581
APR 1 - APR 30	12,146	9,109	3,036	41,894	31,190	+ 3,050	+ 6,631
MAY 1 - MAY 31	3,341	2,506	835	35,862	36,054	+ 650	+ 7,281
JUN 1 - JUN 30	3,426	2,570	857	37,432	39,095	- 503	+ 6,778
JUL 1 - JUL 31	857	643	214	30,466	35,588	- 2,287	+ 4,491
AUG 1 - AUG 31	1,993	1,495	498	11,586	12,816	- 1,039	+ 3,452
SEP 1 - SEP 30	807	605	202	793	-	- 88	+ 3,364
OCT 1 - OCT 31	285	213	71	306	-	+ 93	+ 3,456
NOV 1 - NOV 30	703	352	352	-	-	+ 353	+ 3,809
DEC 1 - DEC 31	453	227	227	-	-	+ 227	+ 4,036
TOTALS	31,152	21,290	9,862	172,092	163,451	+ 4,036	+ 4,036

[1] All values are conversions of data from Table 2. Totals and shares may not add or subtract exactly as a result of rounding.

SOUTHERN TRIBUTARIES OF THE MILK RIVER

Division of the waters of the southern tributaries of the Milk River is not clearly defined in the Order of the International Joint Commission, dated October 4, 1921. At its executive session on December 8, 1986, the Commission agreed, in principle, that the issue of the utilization of the southern tributaries should be addressed in an informal, pragmatic manner. Accordingly, the Commission instructed the Accredited Officers to proceed with discussions with the goal of determining an early solution. To assist them in implementing the Commission's instructions, the Accredited Officers established a four-member ad hoc task force comprised of officials from the State of Montana and the Province of Alberta water management agencies, and United States and Canadian Field Representatives for the St. Mary-Milk River Treaty.

The task force commenced activities in the fall of 1987 with a tour of the basin and a meeting with a local member of the Montana State Legislature. In the spring of 1988, a meeting was held to inform ranchers of both countries of the formation and activities of the task force. In addition, a miscellaneous streamflow measurement program was conducted. During April 1988 an informal meeting was held in Washington, D.C. between some members of the task force and Commissioners Fulton and Totten and IJC engineering and legal advisors. At this meeting the fourth status report of the Accredited Officers and the activity schedule of the task force were discussed. Since that time a three-year ground-water study has been commissioned and undertaken by the United States

members of the task force. These will provide the framework for 1989 activities of the task force.

EASTERN TRIBUTARIES OF THE MILK RIVER

The waters of the eastern tributaries of the Milk River are divided in accordance with the Order of the International Joint Commission, dated October 4, 1921, which stipulates under Rule III that "The natural flow of the eastern (otherwise known as the Saskatchewan or northern) tributaries of the Milk River at the points where they cross the International Boundary shall be divided equally between the two countries." This order might well be interpreted as requiring that the division of water be made on a continuing basis; however, the physical limitation due to transit time in the flow system was recognized. Further analysis showed that the minimum practical time frame for compilation of the natural flows at the International Boundary was every 10 days.

Prior to 1937, Canadian use along the eastern tributaries consisted of domestic irrigation, and the Canadian share of the natural flow was not fully used. In the late 1930's, the Government of Canada constructed three dams on the Frenchman River creating: Eastend Reservoir (station 11AC055), Huff Lake (station 11AC063), and Newton Lake (station 11AC056), and subsequently an operational division of flow on this tributary became necessary by 1937. In 1938, dams were constructed at both ends of Cypress Lake (station 11AC037) on the Battle Creek-Frenchman River divide to allow interbasin storage and transfers of water. In the early 1950's the redevelopment of several private irrigation projects and the construction of the Vidora Irrigation Project resulted in increased use

of Battle Creek water in Canada and made an operational division of flow on this tributary necessary by 1957. In 1960, construction of Altawan Reservoir (station 11AB089) and the Spangler Irrigation Project on Lodge Creek made an operational division of flow on this tributary necessary by 1961.

During the period March 1 to October 31, 10-day computations of the natural flow of Lodge Creek, Battle Creek, and the Frenchman River are made to determine each country's share. If use by Canada is in excess of its share, then a delivery of an equivalent quantity of water is made to the United States at the earliest opportunity. During some years, the United States may request that delivery of deficit water be delayed to allow more efficient use by United States' irrigators. Canada may honor this request if no flow regulation problems are anticipated by delaying the delivery of water to refund the deficit.

Regular interim reports on the progress of the division of the natural flows of Lodge Creek, Battle Creek, and Frenchman River at the International Boundary are distributed to interested agencies during the irrigation season. Generally, no division of flow is made during the winter, as flow and use are low and streamflow records are impractical to obtain.

Lyons Creek is monitored but does not have sufficient use in Canada at this time to warrant an operational division of flow. No flow was recorded on this tributary from March 1 to October 31, 1988.

A review of water rights licenses on Lyons Creek and the other presently non-apportioned eastern tributaries (Whitewater Creek, Rock Creek, Horse Creek, East Fork Battle Creek, Woodpile Coulee, and McEachern Creek) was conducted in 1988. The last review had been conducted in 1978. It was determined that water uses in these basins were such that operational division of flow was still not required.

In 1988, the only changes to the network of hydrometric stations in the eastern tributaries were the addition of the following stations: Frenchman River at 50-Mile (11AC023), Frenchman River below Val Marie (11AC051), and Denniel Creek East Tributary (11AC073). These stations were established to evaluate the possibility of determining net depletion in the Val Marie area using an inflow/outflow method.

Usage figures for unmeasured diversions to private irrigation projects in the Lodge Creek, Battle Creek, and Frenchman River basins in Saskatchewan were based on year-end reports provided by the Saskatchewan Water Corporation, and for the Lodge Creek and Battle Creek basins in Alberta, by Alberta Environment. These reports are compiled from individual reports received from operators of individual projects and from on-site inspections. An additional adjustment is made for domestic projects in the Battle Creek and Frenchman River basins, based on the results of studies conducted by Canada on domestic use.

For the interim reports prepared at the end of division periods, estimates of minor diversion use were made based on a correlation between

annual natural flows and reported use for previous years. The total natural flow for the current year was derived from computed natural flow to date, plus an estimate of runoff volume for the rest of the year, dependent on runoff conditions. At mid-year and at year-end, estimates of minor diversions were updated based on reports received from Alberta Environment and the Saskatchewan Water Corporation on minor diversion usage in their respective provinces. Consequently, some discrepancy exists between interim and final division computations. Lists of reported diversions are contained in Appendix B.

At the end of February, the combined usable storage of the six major Canadian reservoirs was 48 000 dam^3 (38,900 acre-feet), or 34 per cent of the total usable storage of 142 100 dam^3 (115,200 acre-feet). By the end of April, spring flows had increased the usable storage to 40 per cent of the total. By the end of October, irrigation usage, evaporation, and releases from the reservoirs depleted the usable storage to 10 100 dam^3 (8,190 acre-feet), or 7 per cent of the total. Further details on storage in the major Canadian reservoirs are provided in Table 16, Appendix A.

The severe climatic drought which affected the entire basins of the eastern tributaries was a causative factor in deficit deliveries occurring in the Frenchman, Battle, and Lodge basins. Also, there were significant differences between figures used in the interim operational divisions and the final season-end division. In future, a mid-season

review will be conducted on the interim operational divisions to alleviate the problem of significant differences with the final division computations.

LODGE CREEK

The computed natural flow of Lodge Creek at the International Boundary from March 1 to October 31, 1988, was 2 990 dam^3 (2,420 acre-feet) or 8 per cent of the average natural flow of the previous 38 years of record. Each country is entitled to 50 per cent of the natural flow or 1 500 dam^3 (1,220 acre-feet). A total flow of 1 370 dam^3 (1,110 acre-feet) was recorded at Lodge Creek below McRae Creek at International Boundary (station 11AB083) from March 1 to October 31.

Deficit deliveries were recorded in 8 of the 24 division periods during the season. In the interim divisions all deficits were refunded satisfactorily by June 30. In the final computations a deficit of 121 dam^3 (98 acre-feet) remained at the end of October. The discrepancy between the interim and the final computations was primarily a result of minor diversions being 487 dam^3 (395 acre-feet) greater in the final report than in the interim report.

The four periods from May 21 to June 30 were combined into two periods: May 21 to June 10, and June 11 to June 30. This was done to eliminate discrepancies in the natural flow calculations which would have occurred as a result of overlapping periods of release, diversion, and flow at the boundary.

No return flow was recorded at Squaw Coulee near Willow Creek (station 11AB103) from the 2 510 dam^3 (2,030 acre-feet) diverted from Lodge Creek by Spangler Ditch (station 11AB060).

The division of the Lodge Creek natural flow is summarized in Tables 3 and 3A, which follow. The detailed computation of the natural flow is given in Table 10 and the historical summary in Table 11 of Appendix A.

TABLE 3

SUMMARY OF LODGE CREEK DIVISION

1988**

QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	44	22	0		22
MAR 11 - MAR 20	37	19	0		19
MAR 21 - MAR 31	352	176	8		168
APR 1 - APR 10	1 284	642	7		635
APR 11 - APR 20	595	298	436	138	
APR 21 - APR 30	260	130	616	486	
MAY 1 - MAY 10	218	109	80		29
MAY 11 - MAY 20	94	47	4		43
MAY 21 - MAY 31 / JUN 1 - JUN 10 (Periods Combined)	0	0	1	1	
JUN 11 - JUN 20 / JUN 21 - JUN 30 (Periods Combined)	0	0	208	208	
JUL 1 - JUL 10	100	50	13		37
JUL 11 - JUL 20	0	0	0	0	
JUL 21 - JUL 31	0	0	0	0	
AUG 1 - AUG 10	4	2	0		2
AUG 11 - AUG 20	0	0	0	0	
AUG 21 - AUG 31	0	0	0	0	
SEP 1 - SEP 10	0	0	0	0	
SEP 11 - SEP 20	0	0	0	0	
SEP 21 - SEP 30	0	0	0	0	
OCT 1 - OCT 10	0	0	0	0	
OCT 11 - OCT 20	0	0	0	0	
OCT 21 - OCT 31	0	0	0	0	
TOTAL	2 987	1 495	1 373		

** This is a summary of data from Table 10, Appendix A.

TABLE 3A

SUMMARY OF LODGE CREEK DIVISION

1988**

QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	36	18	0		18
MAR 11 - MAR 20	30	15	0		15
MAR 21 - MAR 31	285	143	6		136
APR 1 - APR 10	1,041	520	6		515
APR 11 - APR 20	482	242	353	112	
APR 21 - APR 30	211	105	499	394	
MAY 1 - MAY 10	177	88	65		24
MAY 11 - MAY 20	76	38	3		35
MAY 21 - MAY 31 / JUN 1 - JUN 10 (Periods Combined)	0	0	1	1	
JUN 11 - JUN 20 / JUN 21 - JUN 30 (Periods Combined)	0	0	169	169	
JUL 1 - JUL 10	81	41	11		30
JUL 11 - JUL 20	0	0	0	0	
JUL 21 - JUL 31	0	0	0	0	
AUG 1 - AUG 10	3	2	0		2
AUG 11 - AUG 20	0	0	0	0	
AUG 21 - AUG 31	0	0	0	0	
SEP 1 - SEP 10	0	0	0	0	
SEP 11 - SEP 20	0	0	0	0	
SEP 21 - SEP 30	0	0	0	0	
OCT 1 - OCT 10	0	0	0	0	
OCT 11 - OCT 20	0	0	0	0	
OCT 21 - OCT 31	0	0	0	0	
TOTAL	2,422	1,212	1,113		

** All values are conversions of data from Table 3. Totals and shares may not add or subtract exactly as a result of rounding.

BATTLE CREEK

The computed natural flow of Battle Creek at the International Boundary from March 1 to October 31, 1988, was 9 940 dam^3 (8,060 acre-feet) or 30 per cent of the average natural flow of the previous 48 years of record. Each country is entitled to 50 per cent of the natural flow or 4 970 dam^3 (4,030 acre-feet). A total flow of 4 650 dam^3 (3,770 acre-feet) was recorded at Battle Creek at International Boundary (station 11AB027) from March 1 to October 31.

Deficit deliveries were recorded in 14 of the 24 division periods during the season. In the interim computations a deficit of 432 dam^3 (350 acre-feet) remained at the end of October. In the final computations a deficit of 978 dam^3 (793 acre-feet) remained at the end of October. The discrepancy between the interim and final computations was a result of several factors: minor diversions were 334 dam^3 (271 acre-feet) greater in the final report than in the interim report; flow at the International Boundary station was 132 dam^3 (107 acre-feet) less in the final report than in the interim report; and net depletion in Canada was 251 dam^3 (203 acre-feet) greater in the final report than in the interim report.

The deficit of 432 dam^3 (350 acre-feet) in the interim report had existed since July 25 and an attempt was made to make up the deficit in mid-September by releasing water from Cypress Lake. However, due to the

low level of Cypress Lake an outflow of only 0.179 m^3/s (6.32 cfs) could be achieved. During monitoring of the September release it became apparent that if Canada was to refund the deficit, water would have to be pumped from Cypress Lake into Battle Creek. As well, a substantial volume of water would be required to satisfy the significant channel losses before any water would reach the boundary. The Field Representatives held discussions at the end of September to determine if there was a need for water by the users in the United States portion of Battle Creek. The United States Field Representative indicated that the users realized the dry conditions of the channel and had not requested any water. Considering the difficulty of getting the water out of Cypress Lake and the large channel losses being incurred, it was decided that the deficit on Battle Creek would not be refunded.

A return flow of 35 per cent of diversion, based on a 1972-76 study, was used for the Gaff Ditch diversion from Battle Creek. The recorded flow at Gaff Ditch near Merryflat from March 1 to October 31, 1988, was 1 520 dam^3 (1,230 acre-feet), with the return flow computed at 35 per cent or 533 dam^3 (432 acre-feet). During the irrigation period the return flow was computed to be 22 per cent for Vidora, Richardson, and McKinnon ditches, and 23 per cent for Nashlyn Canal.

The division of the Battle Creek natural flow is summarized in Tables 4 and 4A, which follow. The detailed computation of the natural flow is given in Table 12 and the historical summary in Table 13 of Appendix A.

TABLE 4

SUMMARY OF BATTLE CREEK DIVISION

1988**

QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 14	472	236	472	236	
MAR 15 - MAR 25	750	375	732	357	
MAR 26 - APR 4	1 660	830	893	63	
APR 5 - APR 14	2 424	1 212	925		287
APR 15 - APR 24	1 384	692	252		440
APR 25 - MAY 4	814	407	110		297
MAY 5 - MAY 14	727	364	155		209
MAY 15 - MAY 25	475	238	96		142
MAY 26 - JUN 4	752	376	612	236	
JUN 5 - JUN 14	211	106	192	86	
JUN 15 - JUN 24	159	80	159	79	
JUN 25 - JUL 4	19	10	19	9	
JUL 5 - JUL 14	32	16	29	13	
JUL 15 - JUL 25	12	6	8	2	
JUL 26 - AUG 4	10	5	0		5
AUG 5 - AUG 14	29	15	0		15
AUG 15 - AUG 25	2	1	0		1
AUG 26 - SEP 4	1	1	0		1
SEP 5 - SEP 14	0	0	0	0	
SEP 15 - SEP 24	1	1	0		1
SEP 25 - OCT 4	1	1	0		1
OCT 5 - OCT 14	1	1	0		1
OCT 15 - OCT 25	4	2	0		2
OCT 26 - OCT 31	2	1	0		1
TOTAL	9 942	4 976	4 654		

** This a summary of data from Table 12, Appendix A.

TABLE 4A

SUMMARY OF BATTLE CREEK DIVISION

1988**

QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 14	383	191	383	191	
MAR 15 - MAR 25	608	304	593	289	
MAR 26 - APR 4	1,346	673	724	51	
APR 5 - APR 14	1,965	983	750		233
APR 15 - APR 24	1,122	561	204		357
APR 25 - MAY 4	660	330	89		241
MAY 5 - MAY 14	589	295	126		169
MAY 15 - MAY 25	385	193	78		115
MAY 26 - JUN 4	610	305	496	191	
JUN 5 - JUN 14	171	86	156	70	
JUN 15 - JUN 24	129	65	129	64	
JUN 25 - JUL 4	15	8	15	7	
JUL 5 - JUL 14	26	13	24	11	
JUL 15 - JUL 25	10	5	6	2	
JUL 26 - AUG 4	8	4	0		4
AUG 5 - AUG 14	24	12	0		12
AUG 15 - AUG 25	2	1	0		1
AUG 26 - SEP 4	1	1	0		1
SEP 5 - SEP 14	0	0	0	0	
SEP 15 - SEP 24	1	1	0		1
SEP 25 - OCT 4	1	1	0		1
OCT 5 - OCT 14	1	1	0		1
OCT 15 - OCT 25	3	2	0		2
OCT 26 - OCT 31	2	1	0		1
TOTAL	8,060	4,034	3,773		

** All values are conversions of data from Table 4. Totals and shares may not add or subtract exactly as a result of rounding.

FRENCHMAN RIVER

The computed natural flow of the Frenchman River at the International Boundary from March 1 to October 31, 1988, was 13 500 dam^3 (10,900 acre-feet) or 16 per cent of the average natural flow of the previous 48 years of record. Each country is entitled to 50 per cent of the natural flow or 6 750 dam^3 (5,470 acre-feet). A total flow of 6 050 dam^3 (4,900 acre-feet) was recorded at Frenchman River at International Boundary (station 11AC041).

Deficit deliveries were recorded in 9 of the 24 division periods during the season. In the interim computations a deficit of 49 dam^3 (40 acre-feet) remained at the end of October. In the final computations a deficit of 715 dam^3 (580 acre-feet) remained at the end of October. The discrepancy between the interim and final computations was a result of several factors: minor diversions were 420 dam^3 (340 acre-feet) greater in the final report than in the interim report; flow at the International Boundary station was 515 dam^3 (418 acre-feet) less in the final report than in the interim report; and net depletion in Canada was 54 dam^3 (44 acre-feet) greater in the final report than in the interim report.

The division of the Frenchman River natural flow is summarized in Tables 5 and 5A, which follow. The detailed computation of the natural flow is given in Table 14 and the historical summary in Table 15 of Appendix A.

TABLE 5

SUMMARY OF FRENCHMAN RIVER DIVISION

1988**

QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	467	234	202		32
MAR 11 - MAR 20	1 022	511	130		381
MAR 21 - MAR 31	1 491	746	148		598
APR 1 - APR 10	3 827	1 914	45		1 869
APR 11 - APR 20	2 442	1 221	28		1 193
APR 21 - APR 30	1 179	590	47		543
MAY 1 - MAY 10	519	260	61		199
MAY 11 - MAY 20	441	221	397	176	
MAY 21 - MAY 31	521	261	240		21
JUN 1 - JUN 10	189	95	927	832	
JUN 11 - JUN 20	396	198	1 224	1 026	
JUN 21 - JUN 30	51	26	965	939	
JUL 1 - JUL 10	793	397	1 484	1 087	
JUL 11 - JUL 20	120	60	116	56	
JUL 21 - JUL 31	36	18	28	10	
AUG 1 - AUG 10	5	3	5	2	
AUG 11 - AUG 20	0	0	0	0	
AUG 21 - AUG 31	0	0	0	0	
SEP 1 - SEP 10	0	0	0	0	
SEP 11 - SEP 20	0	0	0	0	
SEP 21 TO SEP 30	13	7	0		7
OCT 1 - OCT 10	0	0	0	0	
OCT 11 - OCT 20	0	0	0	0	
OCT 21 - OCT 31	0	0	0	0	
TOTAL	13 512	6 762	6 047		

** This is a summary of data from Table 14, Appendix A.

TABLE 5A

SUMMARY OF FRENCHMAN RIVER DIVISION

1988**

QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 10	379	190	164		26
MAR 11 - MAR 20	829	414	105		309
MAR 21 - MAR 31	1,209	605	120		485
APR 1 - APR 10	3,103	1,552	36		1,515
APR 11 - APR 20	1,980	990	23		967
APR 21 - APR 30	956	478	38		440
MAY 1 - MAY 10	421	211	49		161
MAY 11 - MAY 20	358	179	322	143	
MAY 21 - MAY 31	422	212	195		17
JUN 1 - JUN 10	153	77	752	675	
JUN 11 - JUN 20	321	161	992	832	
JUN 21 - JUN 30	41	21	782	761	
JUL 1 - JUL 10	643	322	1,203	881	
JUL 11 - JUL 20	97	49	94	45	
JUL 21 - JUL 31	29	15	23	8	
AUG 1 - AUG 10	4	2	4	2	
AUG 11 - AUG 20	0	0	0	0	
AUG 21 - AUG 31	0	0	0	0	
SEP 1 - SEP 10	0	0	0	0	
SEP 11 - SEP 20	0	0	0	0	
SEP 21 - SEP 30	11	6	0		6
OCT 1 - OCT 10	0	0	0	0	
OCT 11 - OCT 20	0	0	0	0	
OCT 21 - OCT 31	0	0	0	0	
TOTAL	10,954	5,482	4,902		

** All values are conversions of data from Table 5. Totals and shares may not add or subtract exactly as a result of rounding.

ANNEX A

TREATY BETWEEN THE UNITED STATES AND GREAT BRITAIN RELATING TO BOUNDARY WATERS, AND QUESTIONS ARISING BETWEEN THE UNITED STATES AND CANADA - ARTICLE VI

INTERNATIONAL JOINT COMMISSION
1921 Order

TREATY
BETWEEN THE UNITED STATES AND GREAT BRITAIN
RELATING TO BOUNDARY WATERS,
AND QUESTIONS ARISING BETWEEN THE
UNITED STATES AND CANADA

ARTICLE VI

The High Contracting Parties agree that the St. Mary and Milk Rivers and their tributaries (in the State of Montana and the Provinces of Alberta and Saskatchewan) are to be treated as one stream for the purposes of irrigation and power, and the waters thereof shall be apportioned equally between the two countries, but in making such equal apportionment more than half may be taken from one river and less than half from the other by either country so as to afford a more beneficial use to each. It is further agreed that in the division of such waters during the irrigation season, between the 1st of April and 31st of October, inclusive, annually, the United States is entitled to a prior appropriation of 500 cubic feet per second of the waters of the Milk River, or so much of such amount as constitutes three-fourths of its natural flow, and that Canada is entitled to a prior appropriation of 500 cubic feet per second of the flow of St. Mary River, or so much of such amount as constitutes three-fourths of its natural flow.

The Channel of the Milk River in Canada may be used at the convenience of the United States for the conveyance, while passing through Canadian territory, of waters diverted from the St. Mary River. The provisions of Article II of this treaty shall apply to any injury resulting to property in Canada from the conveyance of such waters through the Milk River.

The measurement and apportionment of the water to be used by each country shall from time to time be made jointly by the properly constituted reclamation officers of the United States and the properly constituted irrigation officers of His Majesty under the direction of the International Joint Commission.

INTERNATIONAL JOINT COMMISSION

ORDER

IN THE MATTER OF THE MEASUREMENT AND APPORTIONMENT OF THE WATERS OF THE ST. MARY AND MILK RIVERS AND THEIR TRIBUTARIES IN THE STATE OF MONTANA AND THE PROVINCES OF ALBERTA AND SASKATCHEWAN.

Whereas by Article VI of the Treaty entered into between the United States of America and His Majesty, the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India, signed at Washington on the 11th of January, 1909;

And whereas, the said Reclamation and Irrigation Officers have been unable to agree as to the manner in which the waters mentioned in the said Article VI should be measured and apportioned;

And whereas, before giving directions as to the measurement and apportionment of the said waters, the International Joint Commission deemed it proper to hear such representations and suggestions thereon as the Governments of the United States and Canada, the Provinces of Alberta and Saskatchewan, and the State of Montana, and as corporations and persons interested might see fit to make, and for such purposes sittings of the Commission were held at the following times and places: At the city of St. Paul, in the State of Minnesota, on the 24th, 25th, 26th, 27th, and 28th days of May, 1915; at the city of Detroit, in the State of Michigan, on the 15th, 16th, and 17th days of May, 1917; at the city of Ottawa, in the Province of Ontario, on the 3rd, 4th, and 5th days of May, 1920; at the village of Chinook, in the State of Montana, on the 15th day of September, 1921; and at the city of Lethbridge, in the Province of Alberta, on the 17th day of September, 1921, when counsel and representatives of the said Governments, corporations, and persons appeared and presented their views;

And whereas, pending final decision as to the proper method of measuring and apportioning said waters, interim orders with reference thereto have been made by the International Joint Commission from time to time, the last of such orders bearing the date of 5th day of April, 1921;

And whereas the members of the International Joint Commission have unanimously determined that the said Reclamation and Irrigation Officers should be guided in the measurement and apportionment of said waters by the directions and instructions hereinafter set forth;

IT IS THEREFORE ORDERED AND DIRECTED by the Commission in pursuance of the powers conferred by the said Article VI of the said Treaty that the Reclamation and Irrigation Officers of the United States and Canada shall, until this order is varied, modified, or withdrawn by the Commission, make jointly the measurement and apportionment of the water to be used by the United States and Canada in accordance with the following rules:

St. Mary River

I. (a) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is six hundred and sixty-six (666) cubic feet per second or less Canada shall be entitled to three-fourths and the United States to one-fourth of such flow.

(b) During the irrigation season when the natural flow of the St. Mary River at the point where it crosses the international boundary is more than six hundred and sixty-six (666) cubic feet per second Canada shall be entitled to a prior appropriation of five hundred (500) cubic feet per second, and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.

(c) During the non-irrigation season the natural flow of the St. Mary River at the point where it crosses the international boundary shall be divided equally between the two countries.

Milk River

II. (a) During the irrigation season when the natural flow of the Milk River at the point where it crosses the international boundary for the last time (commonly and hereafter called the Eastern Crossing) is six hundred and sixty-six (666) cubic feet per second or less, the United States shall be entitled to three-fourths and Canada to one-fourth of such natural flow.

(b) During the irrigation season when the natural flow of the Milk River at the Eastern Crossing is more than six hundred and sixty-six (666) cubic feet per second the United States shall be entitled to a prior appropriation of five hundred (500) cubic feet per second and the excess over six hundred and sixty-six (666) cubic feet per second shall be divided equally between the two countries.

(c) During the non-irrigation season the natural flow of the Milk River at the Eastern Crossing shall be divided equally between the two countries.

Eastern Tributaries of Milk River

III. The natural flow of the eastern (otherwise known as the Saskatchewan or northern) tributaries of the Milk River at the points where they cross the international boundary shall be divided equally between the two countries.

Waters not naturally crossing the boundary

IV. Each country shall be apportioned such waters of the said rivers and of any tributaries thereof as rise in that country but do not naturally flow across the international boundary.

V. For the purpose of carrying out the apportionment directed in Paragraphs I, II, and III hereof the said Reclamation and Irrigation Officers shall jointly take steps:

(a) To ascertain and keep a daily record of the natural flow of the St. Mary River at the international boundary, of the Milk River at the Eastern Crossing, and of the eastern tributaries of the Milk River at the international boundary by measurement in each case:

(1) At the gauging station at the international boundary;

(2) At all places where any of the waters which would naturally flow across the international boundary at that particular point are diverted in either country prior to such crossing;

(3) At all places where any of the waters which would naturally flow across the international boundary at that particular point are stored, or the natural flow thereof increased or decreased prior to such crossing.

(b) To fix the amount of water to which each country is entitled in each case by applying the directions contained in paragraphs 1, 2, and 3 hereof to the total amount of the natural flow so ascertained in each case.

(c) To communicate the amount so fixed to all parties interested, so that the apportionment of the said waters may be fully carried out by both countries in accordance with the said directions.

VI. Each country may receive its share of the said waters as so fixed at such point or points as it may desire. A gauging station shall be established and maintained by the Reclamation or Irrigation Officers of the country in which any diversion, storage, increase or decrease of the natural flow shall be made at every point where such diversion, storage, increase, or decrease takes place.

VII. International gauging stations shall be maintained at the following points:

St. Mary River near international boundary; the north branch of Milk River near international boundary; the south branch of Milk River near international boundary; Milk River at Eastern Crossing; Lodge Creek, Battle Creek, and Frenchman River, near international boundary; and gauging stations shall be established and maintained at such other points as the Commission may from time to time approve.

VIII. The said Reclamation and Irrigation Officers are hereby further authorized and directed:

(a) To make such additional measurements and to take such further and other steps as may be necessary or advisable in order to insure the

apportionment of the said waters in accordance with the directions herein set forth.

(b) To operate the irrigation works of either country in such a manner as to facilitate the use by the other country of its share of the said waters and subject hereto to secure to the two countries the greatest beneficial use thereof.

(c) To report to the Commission the measurements made at all international and other gauging stations established pursuant to this order.

IX. In the event of any disagreement in respect to any matter or thing to be done under this order the said Reclamation and Irrigation Officers shall report to the Commission, setting forth fully the points of difference and the facts relating thereto.

X. The said order of the Commission, dated the 6th day of April 1921, is hereby withdrawn, except with respect to the report to be furnished to the Commission thereunder.

Dated at Ottawa, Canada, this 4th day of October, 1921.

O. GARDNER,
C. A. MACGRATH,
C. D. CLARK,
HENRY A. POWELL,
W. H. HEARST,
MARK A. SMITH.

ANNEX B

International System of Units

(SI) Conversions

INCH-POUND TO INTERNATIONAL SYSTEM OF UNITS (SI) CONVERSION

Since 1975, the Report to the International Joint Commission on the Division of the Waters of the St. Mary and Milk Rivers has used dual units (SI and inch-pound).

The two inch-pound units that were used in previous reports were cfs-days and acre-feet.

1 cfs-day = 86,400 cubic feet

1 acre-foot = 43,560 cubic feet

1 cfs-day = 1.9835 acre-feet

The SI unit replacing the inch-pound units is the cubic decametre (dam^3).

1 dam^3 = 1000 cubic metres

1 cubic metre = 35.315 cubic feet

1 dam^3 = 35,315 cubic feet

1 acre-foot = 1.2335 dam^3

1 cfs-day = 2.4466 dam^3

1 dam^3 = 0.8107 acre-foot

ANNEX C

List of Gauging Stations

INTERNATIONAL GAUGING STATIONS OPERATED JOINTLY BY THE UNITED STATES AND CANADA ST. MARY AND MILK RIVER DRAINAGE BASINS 1988

Map Index	Station Name
	ST. MARY RIVER BASIN
05AE027	St. Mary River at International Boundary
05AE029	St. Mary Canal at St. Mary Crossing near Babb, Montana
05AE033	Swiftcurrent Creek at Sherburne, Montana
05AE036	Lake Sherburne at Sherburne, Montana
	MILK RIVER BASIN
11AA001	North Milk River near International Boundary
11AA005	Milk River at Milk River
11AA025	Milk River at Western Crossing of International Boundary
11AA031	Milk River at Eastern Crossing of International Boundary
11AA032	North Fork Milk River above St. Mary Canal near Browning, Montana.
11AA033	South Fork Milk River near Babb, Montana
11AA038	Verdigris Coulee near the Mouth
	LODGE CREEK TRIBUTARY BASIN
11AB008	Middle Creek above Lodge Creek
11AB001	Middle Creek below Middle Creek Reservoir
11AB108	Middle Creek near Govenlock
11AB009	Middle Creek near Saskatchewan Boundary
11AB060	Spangler Ditch near Govenlock
11AB080	Middle Creek Reservoir
11AB083	Lodge Creek below McRae Creek at International Boundary
11AB089	Altawan Reservoir near Govenlock

BATTLE CREEK TRIBUTARY BASIN

11AB018	Nashlyn Canal near Consul
11AB027	Battle Creek at International Boundary
11AB044	McKinnon Ditch near Consul
11AB058	Richardson Ditch near Consul
11AB075	Lyons Creek at International Boundary
11AB077	Cypress Lake West Outflow Canal
11AB078	Cypress Lake West Inflow Canal
11AB084	Vidora Ditch near Consul
11AB085	Cypress Lake West Inflow Canal Drain
11AB102	Gaff Ditch near Merryflat

FRENCHMAN RIVER TRIBUTARY BASIN

11AC001	Frenchman River below Eastend Reservoir
11AC037	Cypress Lake
11AC041	Frenchman River at International Boundary
11AC052	Eastend Canal near Eastend
11AC054	Newton Lake Main Canal
11AC055	Eastend Reservoir
11AC056	Newton Lake
11AC060	Cypress Lake East Outflow Canal
11AC062	Frenchman River below Newton Lake
11AC063	Huff Lake
11AC064	Belanger Creek Diversion to Cypress Lake
11AC065	Huff Lake Gravity Canal
11AC066	Huff Lake Pumping Canal

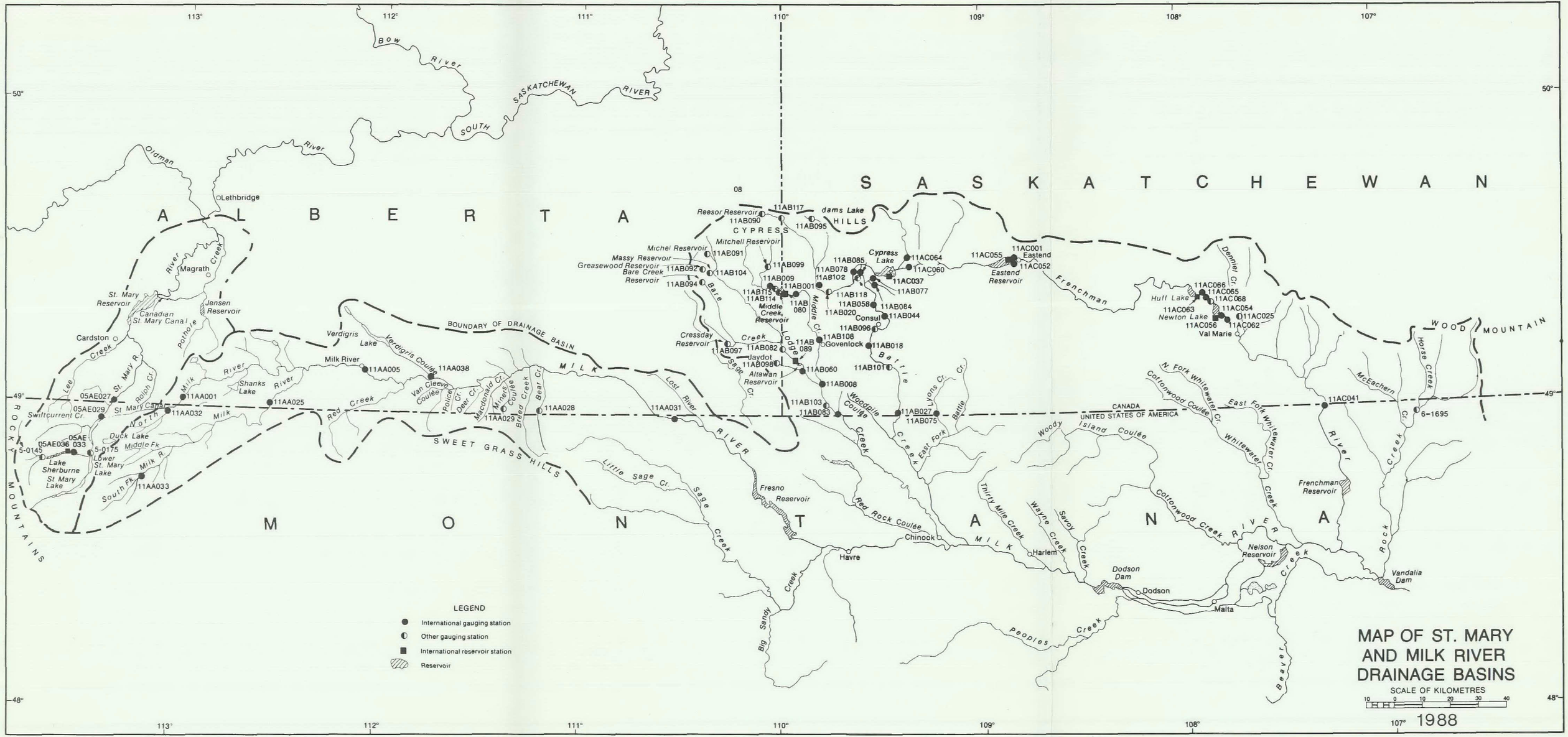
GAUGING STATIONS OPERATED INDEPENDENTLY BY EITHER THE UNITED STATES OR CANADA IN THE HEADWATERS OF THE ST. MARY AND MILK RIVER DRAINAGE BASINS 1988

Map Index	Station Name	Operated By
	ST. MARY RIVER BASIN	
5-0145*	Swiftcurrent Creek at Many Glacier, Montana	U.S.A.
5-0175*	St. Mary River near Babb, Montana	U.S.A.
	MILK RIVER BASIN	
11AA028*	Bear Creek near International Boundary	Canada
11AA029*	Miners Coulee near International Boundary	Canada
	LODGE CREEK TRIBUTARY BASIN	
11AB082*	Lodge Creek at Alberta Boundary	Canada
11AB091	Michel Reservoir near Elkwater	Canada
11AB092	Greasewood Reservoir near Elkwater	Canada
11AB094	Bare Creek Reservoir near Elkwater	Canada
11AB097	Cressday Reservoir near Cressday	Canada
11AB098	Jaydot Reservoir near Jaydot	Canada
11AB099	Mitchell Reservoir near Elkwater	Canada
11AB103	Squaw Coulee near Willow Creek	Canada
11AB104	Massy Reservoir near Elkwater	Canada
11AB114	Middle Creek Reservoir Bedford Outlet	Canada
11AB115	Middle Creek Reservoir Flood Spillway	Canada

*Data not included in this report or appendices.

Map Index	Station Name	Operated By
	BATTLE CREEK TRIBUTARY BASIN	
11AB020*	Shepherd Ditch near Consul	Canada
11AB090	Reesor Reservoir near Elkwater	Canada
11AB095	Adams Lake	Canada
11AB096*	Battle Creek near Consul	Canada
11AB101*	Battle Creek below Nashlyn Project	Canada
11AB117*	Battle Creek at Alberta Boundary	Canada
11AB118*	Battle Creek below Wilson's Weir	Canada
	FRENCHMAN RIVER TRIBUTARY BASIN	
11AC023*	Frenchman River at 50-Mile	Canada
11AC025*	Denniel Creek near Val Marie	Canada
11AC051*	Frenchman River below Val Marie	Canada
11AC068	Val Marie Pump No. 1	Canada
11AC073	Denniel Creek East Tributary	Canada
	ROCK CREEK TRIBUTARY BASIN	
6-1695*	Rock Creek below Horse Creek near International Boundary	U.S.A.

* Data not included in this report or appendices


MAP OF ST. MARY AND MILK RIVER DRAINAGE BASINS
SCALE OF KILOMETRES
10 0 10 20 30 40
1988
LEGEND
International gauging station
Other gauging station
International reservoir station
Reservoir
ALBERTA
SASKATCHEWAN
MONTANA
CANADA
UNITED STATES OF AMERICA
BOUNDARY OF DRAINAGE BASIN
MILK RIVER
SWEET GRASS HILLS
ROCKY MOUNTAINS
WOOD MOUNTAIN
CYPRESS HILLS
Bow River
SOUTH SASKATCHEWAN RIVER
Oldman River
Lethbridge
St. Mary Reservoir
Canadian St. Mary Canal
Jensen Reservoir
Magrath
Cardston
Milk River
Verdigris Lake
Verdigris Coulee
Shanks Lake
Red Creek
Lost River
Fresno Reservoir
Havre
Chinook
Harlem
Dodson
Dodson Dam
Malta
Vandalia Dam
Nelson Reservoir
Frenchman Reservoir
Eastend
Eastend Reservoir
Val Marie
Newton Lake
Huff Lake
Reesor Reservoir
Mitchell Reservoir
Michel Reservoir
Massy Reservoir
Greasewood Reservoir
Bare Creek Reservoir
Cypress Lake
Middle Creek Reservoir
Consul
Govenlock
Cressday Reservoir
Jaydot
Altawan Reservoir
Woodpile Coulee
Thirty Mile Creek
Wayne Creek
Savoy Creek
Cottonwood Creek
Frenchman
Big Sandy Creek
Peoples Creek
Beaver Creek
Rock Creek
Horse Creek
McEachern
Dennler Cr.
Lyons Cr.
Battle Creek
Sage Creek
Little Sage Cr.
Red Rock Coulee
Woody Island Coulee
N Fork Whitewater Cr.
East Fork Whitewater Cr.
Whitewater Creek
Cottonwood Coulee
Swiftcurrent Cr.
Duck Lake
Middle Fk
Lower St. Mary Lake
Lake Sherburne
St Mary Lake
South Fk
Milk R
Ralph Cr
Lee Creek
Police Cr.
Deer Cr.
Macdonald Cr.
Miners Coulee
Bleed Creek
Bear Cr.
Van Cleeve Coulee
Pothole Creek
Middle Cr.
Bare Creek
11AA001
11AA005
11AA025
11AA028
11AA029
11AA031
11AA032
11AA033
11AA038
05AE027
05AE029
05AE036
05AE033
5-0145
5-0175
6-1695
11AB117
11AB090
11AB095
11AB091
11AB092
11AB104
11AB094
11AB099
11AB009
11AB001
11AB115
11AB114
11AB080
11AB085
11AB078
11AB102
11AB118
11AB058
11AB020
11AB084
11AB044
11AB096
11AB108
11AB089
11AB082
11AB097
11AB098
11AB060
11AB008
11AB103
11AB083
11AB101
11AB018
11AB077
11AC037
11AC064
11AC060
11AC055
11AC001
11AC052
11AC066
11AC065
11AC068
11AC063
11AC054
11AC025
11AC056
11AC062
11AC041
11AB027
11AB075
08
48°
49°
50°
107°
108°
109°
110°
111°
112°
113°

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