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Report to

THE INTERNATIONAL JOINT COMMISSION

on

THE DIVISION OF THE WATERS OF THE

ST. MARY AND MILK RIVERS

1987

by

Philip Cohen
representing the United States

and

D.A. Davis
representing Canada

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March 1988

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

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, 1987.

Respectfully submitted,

Philip Cohen
Accredited Officer of the United States

D. A. Davis
Accredited Officer of Her Majesty

SYNOPSIS

During the 1987 irrigation season, the natural flow of the St. Mary and Milk Rivers was 83 per cent and 41 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, 1987, was 601 000 cubic decametres (dam^3) (487,000 acre-feet). Under the terms of the Treaty, the Canadian share was 373 000 dam^3 (302,000 acre-feet). The total flow recorded at the International Boundary during the irrigation season was 108 per cent of the Canadian allotment.

The natural flow of Milk River at the Eastern Crossing of the International Boundary from March 1 to October 31, 1987, was 58 300 dam^3 (47,300 acre-feet). Under the terms of the Treaty, the United States' allotment was 40 900 dam^3 (33,200 acre-feet). Computations indicated that the United States received 142 per cent of its allotment at Eastern Crossing, in addition to a portion of its share of St. Mary River water diverted into the Milk River by the St. Mary Canal.

The division of the waters of the southern tributaries of the Milk River is not clearly outlined in the 1921 I.J.C. Order. In December 1986 the I.J.C. directed the Accredited Officers to attempt to resolve the issue

over waters arising in the United States and flowing northerly into Canada. Consequently, a four-member ad hoc task force was formed to investigate the situation and develop a pragmatic solution. The Accredited Officers reported to the Commission in April and October, 1987, which included describing the results of an August 1987 tour of the basin and plans for the future.

The March to October natural flow of the three eastern tributaries of the Milk River that are apportioned, Lodge Creek, Battle Creek and Frenchman River, was 88, 112 and 95 per cent, respectively, of the long-term averages. The combined natural flow of these tribuaries was 147 000 dam^3 (119,000 acre-feet), of which the United States received 98 600 dam^3 (79,900 acre-feet). All deficits which were incurred on Battle Creek and Lodge Creek were satisfactorily refunded. A small deficit of 79 dam^3 (64 acre-feet) remained on the Frenchman River at the end of the season.

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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 1987 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 published in SI units. United States' data 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. 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. 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. Boals was appointed during 1987, replacing Mr. B.N. Johnson. This report was prepared jointly by personnel of the United States Geological Survey and the Environment Canada, Water Resources Branch under the supervision of Messrs. Moreland, Boals, and Morton.

The annual conference of Field Representatives was held in Great Falls, Montana on January 28, 1988. Streamflow records collected jointly by the

United States and Canada were reviewed and approved. Mutual problems, future plans, and changes in computational procedures were discussed and a schedule of field operations for 1988 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 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 percent 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 flows for later diversion to the Milk River. This water, which passes through Canada, is used by the United States for irrigation in the eastern Milk River valley.

Storage in Lake Sherburne (station 05AE036) was 38 700 dam^3 (31,400 acre-feet) on October 31, 1987. It increased to 54 600 dam^3 (44,300 acre-feet) on March 4, 1987, and, subsequently, decreased to 35 000 dam^3 (28,400 acre-feet) on March 31, 1987, just prior to the commencement of the irrigation season. Maximum storage was 84 100 dam^3 (68,200 acre-feet) on June 16, 1987, and storage decreased to 43 400 dam^3 (35,200 acre-feet) by the end of the irrigation season on October 31, 1987.

Water was diverted from the St. Mary River into the Milk River via the St. Mary Canal from March 5 to September 10, 1987. 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, 1986, to October 31, 1987, was 687 000 dam^3 (557,000 acre-feet) of which 601 000 dam^3 (487,000 acre-feet) occurred

during the irrigation season, April 1 to October 31, 1987. For the irrigation season, Canada's and the United States' shares were 373 000 dam^3 (302,000 acre-feet) and 228 000 dam^3 (185,000 acre-feet), respectively. A total discharge of 401 000 dam^3 (325,000 acre-feet) was recorded at the International Boundary, which was 107 per cent of the Canadian share. The computed natural flow during the irrigation season was 83 per cent of the average of the previous 85 years of record.

Deficit deliveries were recorded in 5 of the 14 division periods during the 1987 irrigation season. The deficits that occurred in June and July, coupled with a dry summer, resulted in a request by Canada to take 3 910 dam^3 (3,170 acre-feet) of the refund from the Milk River, rather than from the St. Mary River during June, July and August to permit the Canadian users to continue irrigating. During this period, the Canadian share of the Milk River natural flow was often less than the demand by water users along the Milk River in Canada. The mutual 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. 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]

1987

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.	39 968	60 063	19 676	40 387	- 419	4 407	15 269	15 688	36 691
MAY	110 467	190 306	82 528	107 778	2 689	42 549	39 979	37 290	31 519
JUN.	81 493	128 389	51 976	76 413	5 080	1 182	50 794	45 714	40 133
JUL.	70 638	108 731	41 857	66 874	3 764	- 213	42 070	38 306	36 771
AUG.	48 436	65 615	20 185	45 430	3 006	-26 785	46 970	43 964	42 224
SEP.	35 094	34 074	8 576	25 498	9 596	-12 599	21 175	11 579	22 791
OCT.	14 425	13 613	3 405	10 208	4 217	- 812	4 217	0	3 384
TOTAL IRRIGATION SEASON	400 521	600 791	228 203	372 588	27 933	7 729	220 474	192 541	213 513

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
APR 1 TO APR 15	16 990	12 743	13 422	679	
APR 16 TO APR 30	43 073	27 644	26 546		1 098
MAY 1 TO MAY 15	103 316	57 765	61 214	3 449	
MAY 16 TO MAY 31	86 990	50 013	49 253		760
JUN 1 TO JUN 15	75 462	43 840	51 231	7 391	
JUN 16 TO JUN 30	52 927	32 573	30 262		2 311
JUL 1 TO JUL 15	31 554	21 833	20 921		912
JUL 16 TO JUL 31	77 177	45 041	49 717	4 676	
AUG 1 TO AUG 15	33 826	23 021	22 663		358
AUG 16 TO AUG 31	31 789	22 409	25 773	3 364	
SEP 1 TO SEP 15	22 109	16 525	22 397	5 872	
SEP 16 TO SEP 30	11 965	8 973	12 697	3 724	
OCT 1 TO OCT 15	7 470	5 602	9 003	3 401	
OCT 16 TO OCT 31	6 143	4 606	5 422	816	

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

TABLE 1A

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

1987

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.	32,402	48,693	15,951	32,742	- 340	3,573	12,379	12,718	29,745
MAY	89,556	154,281	66,905	87,376	2,180	34,494	32,411	30,231	25,552
JUN.	60,066	104,085	42,137	61,948	4,118	958	41,179	37,060	32,536
JUL.	57,266	88,148	33,933	54,215	3,051	- 173	34,106	31,055	29,810
AUG.	39,267	53,194	16,364	36,830	2,437	-21,715	38,079	35,642	34,231
SEP.	28,451	27,624	6,953	20,671	7,779	-10,214	17,167	9,387	18,477
OCT.	11,694	11,036	2,760	8,276	3,419	- 658	3,419	0	2,743
TOTAL IRRIGATION SEASON	324,702	487,061	185,004	302,057	22,645	6,266	178,738	156,093	173,095

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
APR 1 TO APR 15	13,774	10,331	10,881	550	
APR 16 TO APR 30	34,919	22,411	21,521		890
MAY 1 TO MAY 15	83,758	46,830	49,626	2,796	
MAY 16 TO MAY 31	70,523	40,546	39,929		616
JUN 1 TO JUN 15	61,177	35,541	41,533	5,992	
JUN 16 TO JUN 30	42,908	26,407	24,533		1,874
JUL 1 TO JUL 15	25,581	17,700	16,961		739
JUL 16 TO JUL 31	62,567	36,515	40,306	3,791	
AUG 1 TO AUG 15	27,423	18,663	18,373		290
AUG 16 TO AUG 31	25,771	18,167	20,894	2,727	
SEP 1 TO SEP 15	17,924	13,397	18,157	4,760	
SEP 16 TO SEP 30	9,700	7,274	10,293	3,019	
OCT 1 TO OCT 15	6,056	4,542	7,299	2,757	
OCT 16 TO OCT 31	4,980	3,734	4,396	662	

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

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 inter-basin transfer of water in Canada. During 1987, the estimated consumptive uses were 8 290 dam^3 (6,720 acre-feet) or 14 per cent of the natural flow of the Milk River at the eastern crossing during the period March 1 to October 31, 1987. For the same period, the Canadian transfer of water into the Milk River from Verdigris Coulee near the Mouth (station 11AA038) was 3 700 dam^3 (3,000 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 1987, these arrangements were made during the period June 29 to August 15.

The natural flow of the Milk River at the eastern crossing of the International Boundary from March 1 to October 31, 1987, was 58 300 dam^3 (47,300 acre-feet). This flow was 41 per cent of the average computed natural flow of the previous 75 years of record. It is important to note, however, that natural flow computations prior to 1985 did not account for consumptive use. Natural flow values since that date, therefore, aren't directly comparable with natural flows of previous years. The respective shares of the United States and Canada were 40 900 dam^3 (33,200 acre-feet) and 17 400 dam^3 (14,100 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]

1987

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	1 326	663	663	-	-	+ 663	+ 663
FEB 1 - FEB 28	2 311	1 156	1 156	-	-	+ 1 156	+ 1 819
MAR 1 - MAR 31	9 512	4 756	4 756	25 879	16 924	+ 4 812	+ 6 631
APR 1 - APR 30	20 199	14 694	5 505	36 691	17 631	+ 5 593	+ 12 224
MAY 1 - MAY 31	4 561	3 421	1 140	31 519	30 715	+ 1 003	+ 13 227
JUN 1 - JUN 30	2 756	2 067	689	40 133	41 803	+ 796	+ 14 024
JUL 1 - JUL 31	6 669	5 002	1 667	36 771	33 970	+ 679	+ 14 703
AUG 1 - AUG 31	6 042	4 531	1 510	42 224	38 350	+ 1 145	+ 15 848
SEP 1 - SEP 30	5 817	4 363	1 454	22 791	17 757	+ 1 822	+ 17 670
OCT 1 - OCT 31	2 742	2 056	685	3 384	-	+ 1 328	+ 18 998
NOV 1 - NOV 30	2 506	1 253	1 253	-	-	+ 1 294	+ 20 292
DEC 1 - DEC 31	1 555	778	778	-	-	+ 778	+ 21 070
TOTALS	65 997	44 740	21 258	239 393	197 151	+ 21 070	+ 21 070

[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]

1987

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	1,075	538	538	-	-	+ 538	+ 538
FEB 1 - FEB 28	1,874	937	937	-	-	+ 937	+ 1,475
MAR 1 - MAR 31	7,712	3,856	3,856	20,981	13,721	+ 3,901	+ 5,376
APR 1 - APR 30	16,376	11,912	4,463	29,746	14,294	+ 4,534	+ 9,911
MAY 1 - MAY 31	3,698	2,773	924	25,553	24,901	+ 813	+ 10,724
JUN 1 - JUN 30	2,235	1,676	559	32,536	33,890	+ 646	+ 11,369
JUL 1 - JUL 31	5,407	4,055	1,352	29,811	27,540	+ 551	+ 11,920
AUG 1 - AUG 31	4,898	3,673	1,224	34,231	31,091	+ 928	+ 12,848
SEP 1 - SEP 30	4,716	3,537	1,179	18,477	14,396	+ 1,477	+ 14,325
OCT 1 - OCT 31	2,223	1,667	556	2,744	-	+ 1,077	+ 15,402
NOV 1 - NOV 30	2,032	1,016	1,016	-	-	+ 1,049	+ 16,451
DEC 1 - DEC 31	1,261	630	630	-	-	+ 631	+ 17,082
TOTALS	53,505	36,271	17,234	194,079	159,833	+ 17,082	+ 17,082

[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 a United States and Canadian Field Representative for the St. Mary-Milk River Treaty. In August of 1987, the Field Representatives, the State of Montana representative, and a Canadian International Joint Commission staff member made a tour of the basin. Included in their tour was a meeting with a member of the Montana State Legislature who was knowledgeable on water issues in the State.

The Accredited Officers reported to the Commission in April and October 1987. Included in their reports were the formation of an ad hoc task force, plans of action for 1987, results of the aforementioned field tour, and plans for future activities of the ad hoc 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. To allow interbasin storage and transfers of water, dams were constructed in 1938 at both ends of Cypress Lake (station 11AC037) on the Battle Creek-Frenchman River divide.

The redevelopment of several private irrigation projects and the construction of the Vidora Irrigation Project during the early fifties

resulted in increased use of Battle Creek water in Canada and made an operational division of flow on this tributary necessary by 1957.

Construction of Altawan Reservoir (station 11AB089) and the Spangler Irrigation Project on Lodge Creek in 1960 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 on Battle Creek be delayed to allow more efficient use by United States' irrigators. Canada may honor this request if no 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 throughout 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. A flow of 379 dam^3 (307 acre-feet) was recorded on this tributary from March 1 to October 31, 1987.

In 1987, there were no changes to the network of hydrometric stations in the eastern tributaries. Water use data 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 in 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 by 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 diversions were 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 for 1987 are contained in Appendix B.

At the end of February, the combined usable storage of the six major Canadian reservoirs was 46 700 dam^3 (37,900 acre-feet), or 33 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 60 per cent of the total. Irrigation usage, evaporation, and releases from the reservoirs depleted the usable storage to 48 800 dam^3 (39,600 acre-feet), or 34 per cent of the total, by the end of October. Further details of the status of available storage in the major Canadian reservoirs during 1987 are provided in Table 16, Appendix A.

LODGE CREEK

The computed natural flow of Lodge Creek at the International Boundary from March 1 to October 31, 1987, was 31 300 dam^3 (25,400 acre-feet) or 88 per cent of the average natural flow of the previous 37 years of record. Each country is entitled to 50 per cent of the natural flow or 15 600 dam^3 (12,700 acre-feet). A total flow of 20 700 dam^3 (16,800 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 9 of the 24 division periods during the season. All deficits were refunded satisfactorily.

A return flow of 84 dam^3 (68 acre-feet) was recorded at Squaw Coulee near Willow Creek (station 11AB103) from the 2 390 dam^3 (1,940 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[1]

1987

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	13 820	6 910	9 554	2 644	
MAR 11 - MAR 20	5 240	2 620	3 994	1 374	
MAR 21 - MAR 31	3 470	1 735	1 766	31	
APR 1 - APR 10	4 778	2 389	2 452	63	
APR 11 - APR 20	1 587	794	1 172	378	
APR 21 - APR 30	617	309	553	244	
MAY 1 - MAY 10	312	156	287	131	
MAY 11 - MAY 20	185	92	194	102	
MAY 21 - MAY 31	266	133	139	6	
JUN 1 - JUN 10	224	112	69		43
JUN 11 - JUN 20	92	46	36		10
JUN 21 - JUN 30	35	18	42	24	
JUL 1 - JUL 10	48	24	1		23
JUL 11 - JUL 20	5	2	1		1
JUL 21 - JUL 31	58	29	0		29
AUG 1 - AUG 10	459	229	0		229
AUG 11 - AUG 20	2	1	0		1
AUG 21 - AUG 31	47	23	0		23
SEP 1 - SEP 10	20	10	0		10
SEP 11 - SEP 20	0	0	0	0	
SEP 21 TO SEP 30	0	0	0	0	
OCT 1 - OCT 10	0	0	391	391	
OCT 11 - OCT 20	13	7	13	7	
OCT 21 - OCT 31	3	2	3	2	
TOTAL	31 280	15 640	20 667		

[1] This is a summary of data from Table 10, Appendix A.

TABLE 3A

SUMMARY OF LODGE CREEK DIVISION[1]

1987

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	11,204	5,602	7,745	2,143	
MAR 11 - MAR 20	4,248	2,124	3,238	1,114	
MAR 21 - MAR 31	2,813	1,407	1,432	25	
APR 1 - APR 10	3,874	1,937	1,988	51	
APR 11 - APR 20	1,287	644	950	306	
APR 21 - APR 30	500	251	448	198	
MAY 1 - MAY 10	253	126	233	106	
MAY 11 - MAY 20	150	75	157	83	
MAY 21 - MAY 31	216	108	113	5	
JUN 1 - JUN 10	182	91	56		35
JUN 11 - JUN 20	75	37	29		8
JUN 21 - JUN 30	28	15	34	19	
JUL 1 - JUL 10	39	19	1		19
JUL 11 - JUL 20	4	2	1		1
JUL 21 - JUL 31	47	24	0		24
AUG 1 - AUG 10	372	185	0		186
AUG 11 - AUG 20	2	1	0		1
AUG 21 - AUG 31	38	19	0		19
SEP 1 - SEP 10	16	8	0		8
SEP 11 - SEP 20	0	0	0	0	
SEP 21 - SEP 30	0	0	0	0	
OCT 1 - OCT 10	0	0	317	317	
OCT 11 - OCT 20	11	6	11	6	
OCT 21 - OCT 31	2	2	2	2	
TOTAL	25,360	12,680	16,755		

[1] 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, 1987, was 36 400 dam^3 (29,500 acre-feet) or 112 per cent of the average natural flow of the previous 47 years of record. Each country is entitled to 50 per cent of the natural flow or 18 200 dam^3 (14,800 acre-feet). A total flow of 18 500 dam^3 (15,000 acre-feet) was recorded at Battle Creek at International Boundary (station 11AB027) from March 1 to October 31. Deficit deliveries were recorded in 7 of the 24 division periods during the season. All deficits were satisfactorily 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, 1987, was 1 770 dam^3 (1,430 acre-feet), with the computed return flow being 618 dam^3 (501 acre-feet). Return flow values were computed for the Consul Projects (Vidora, Richardson, and McKinnon ditches) and the Nashlyn Canal, but they were found to be unrealistic due to local rainstorms. Consequently, it was decided to use the normal return valve of 25 per cent for these projects.

A supplementary gauging station has been operated since 1981 on Shepherd Ditch, a private diversion on Battle Creek, located downstream from

Gaff Ditch. A total diversion of 872 dam^3 (707 acre-feet) was recorded at this station during 1987, and is included in the list of minor diversions for Battle Creek in Appendix B.

Domestic use was estimated at 50 per cent of irrigation use. This is less than the value of 70 per cent derived from a curve relating domestic use to irrigation use. It was felt that 70 per cent was too high, based on the wet antecedent conditions in the fall of 1986 and field observations in the spring of 1987, which indicated most depression storage areas were full.

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.

FRENCHMAN RIVER

The computed natural flow of the Frenchman River at the International Boundary from March 1 to October 31, 1987, was 79 600 dam^3 (64,500 acre-feet) or 95 per cent of the average natural flow of the previous 47 years of record. Each country is entitled to 50 percent of the natural flow or 39 800 dam^3 (32,300 acre-feet). A total flow of 59 500 dam^3 (48,200 acre-feet) was recorded at Frenchman River at International Boundary (station 11AC041) from March 1 to October 31.

TABLE 4

SUMMARY OF BATTLE CREEK DIVISION[1]

1987

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	7 457	3 729	3 390		339
MAR 15 - MAR 25	4 775	2 388	1 201		1 187
MAR 26 - APR 4	5 053	2 527	2 504		23
APR 5 - APR 14	5 824	2 912	2 115		797
APR 15 - APR 24	3 484	1 742	983		759
APR 25 - May 4	1 905	953	1 340	387	
MAY 5 - MAY 14	1 518	759	1 105	346	
MAY 15 - MAY 25	895	448	905	457	
MAY 26 - JUN 4	1 174	587	1 182	595	
JUN 5 - JUN 14	480	240	537	297	
JUN 15 - JUN 24	374	187	408	221	
JUN 25 - JUL 4	256	128	122		6
JUL 5 - JUL 14	24	12	21	9	
JUL 15 - JUL 25	61	31	58	27	
JUL 26 - AUG 4	660	330	658	328	
AUG 5 - AUG 14	472	236	346	110	
AUG 15 - AUG 25	185	93	181	88	
AUG 26 - SEP 4	571	286	312	26	
SEP 5 - SEP 14	187	94	51		43
SEP 15 - SEP 24	65	33	50	17	
SEP 25 - OCT 4	175	88	171	83	
OCT 5 - OCT 14	259	130	255	125	
OCT 15 - OCT 25	357	179	354	175	
OCT 26 - OCT 31	214	107	212	105	
TOTAL	36 425	18 219	18 461		

[1] This a summary of data from Table 12, Appendix A.

TABLE 4A

SUMMARY OF BATTLE CREEK DIVISION[1]

1987

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	6,045	3,023	2,748		275
MAR 15 - MAR 25	3,871	1,936	974		962
MAR 26 - APR 4	4,096	2,049	2,030		19
APR 5 - APR 14	4,722	2,361	1,715		646
APR 15 - APR 24	2,824	1,412	797		615
APR 25 - May 4	1,544	773	1,086	314	
MAY 5 - MAY 14	1,231	615	896	281	
MAY 15 - MAY 25	726	363	734	370	
MAY 26 - JUN 4	952	476	958	482	
JUN 5 - JUN 14	389	195	435	241	
JUN 15 - JUN 24	303	152	331	179	
JUN 25 - JUL 4	208	104	99		5
JUL 5 - JUL 14	19	10	17	7	
JUL 15 - JUL 25	49	25	47	22	
JUL 26 - AUG 4	535	268	533	286	
AUG 5 - AUG 14	383	191	281	89	
AUG 15 - AUG 25	150	75	147	71	
AUG 26 - SEP 4	463	232	253	21	
SEP 5 - SEP 14	152	76	41		35
SEP 15 - SEP 24	53	27	41	14	
SEP 25 - OCT 4	142	71	139	67	
OCT 5 - OCT 14	210	105	207	101	
OCT 15 - OCT 25	289	145	287	142	
OCT 26 - OCT 31	173	87	172	85	
TOTAL	29,530	14,770	14,966		

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

Deficit deliveries were recorded in 11 of the 24 division periods during the season. A deficit accumulated through periods 6 to 13 (April 21 to July 10) was refunded by period 15 (July 21-31). A deficit occurring in the August 1-10 period was refunded by August 20, and a deficit occurring in the September 1-10 period was refunded by September 30. A deficit of 102 dam^3 (83 acre-feet) accumulated in periods 22 and 23 (October 1-20) was partially refunded with a small deficit of 79 dam^3 (64 acre-feet) remaining at the end of the season (October 31).

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[1]

1987

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	13 144	6 572	10 085	3 513	
MAR 11 - MAR 20	13 800	6 900	11 453	4 553	
MAR 21 - MAR 31	15 195	7 598	13 029	5 431	
APR 1 - APR 10	12 759	6 380	10 359	3 979	
APR 11 - APR 20	7 479	3 740	4 744	1 004	
APR 21 - APR 30	2 918	1 459	1 439		20
MAY 1 - MAY 10	1 547	774	441		333
MAY 11 - MAY 20	1 175	588	481		107
MAY 21 - MAY 31	1 321	661	947	286	
JUN 1 - JUN 10	1 618	809	306		503
JUN 11 - JUN 20	806	403	91		312
JUN 21 - JUN 30	321	161	50		111
JUL 1 - JUL 10	195	98	23		75
JUL 11 - JUL 20	278	139	739	600	
JUL 21 - JUL 31	4 428	2 214	3 916	1 702	
AUG 1 - AUG 10	1 574	787	738		49
AUG 11 - AUG 20	298	149	288	139	
AUG 21 - AUG 31	67	34	95	61	
SEP 1 - SEP 10	78	39	25		14
SEP 11 - SEP 20	64	32	40	8	
SEP 21 TO SEP 30	0	0	47	47	
OCT 1 - OCT 10	223	112	30		82
OCT 11 - OCT 20	111	56	36		20
OCT 21 - OCT 31	187	94	117	23	
TOTAL	79 586	39 799	59 519		

[1] This is a summary of data from Table 14, Appendix A.

TABLE 5A

SUMMARY OF FRENCHMAN RIVER DIVISION[1]

1987

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	10,656	5,328	8,176	2,848	
MAR 11 - MAR 20	11,188	5,594	9,285	3,691	
MAR 21 - MAR 31	12,319	6,160	10,563	4,403	
APR 1 - APR 10	10,344	5,172	8,398	3,226	
APR 11 - APR 20	6,063	3,032	3,846	814	
APR 21 - APR 30	2,366	1,183	1,167		16
MAY 1 - MAY 10	1,254	627	358		270
MAY 11 - MAY 20	953	477	390		87
MAY 21 - MAY 31	1,071	536	768	232	
JUN 1 - JUN 10	1,312	656	248		408
JUN 11 - JUN 20	653	327	74		253
JUN 21 - JUN 30	260	131	41		90
JUL 1 - JUL 10	158	79	19		61
JUL 11 - JUL 20	225	113	599	486	
JUL 21 - JUL 31	3,590	1,795	3,175	1,380	
AUG 1 - AUG 10	1,276	638	598		40
AUG 11 - AUG 20	242	121	233	113	
AUG 21 - AUG 31	54	28	77	49	
SEP 1 - SEP 10	63	32	20		11
SEP 11 - SEP 20	52	26	32	6	
SEP 21 - SEP 30	0	0	38	38	
OCT 1 - OCT 10	181	91	24		66
OCT 11 - OCT 20	90	45	29		16
OCT 21 - OCT 31	152	76	95	19	
TOTAL	67,520	32,265	48,252		

[1] 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

1987

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
	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

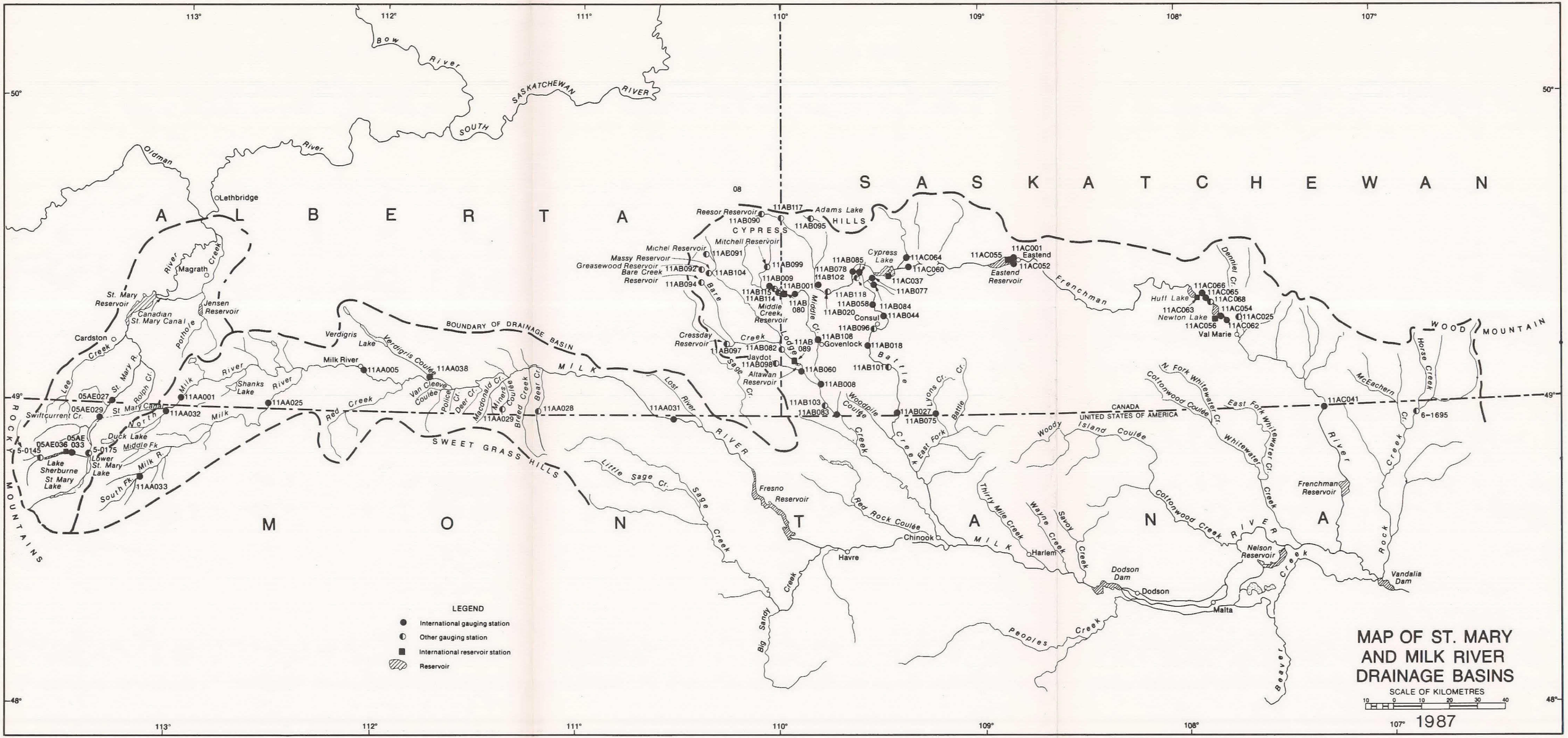
* Data not included in this report or appendices

GAUGING STATIONS OPERATED INDEPENDENTLY BY EITHER THE UNITED STATES OR CANADA IN THE HEADWATERS OF THE ST. MARY AND MILK RIVER DRAINAGE BASINS 1987

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

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	
11AC025*	Denniel Creek near Val Marie	Canada
11AC068	Val Marie Pump No. 1	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
1987
LEGEND
International gauging station
Other gauging station
International reservoir station
Reservoir
ALBERTA
SASKATCHEWAN
MONTANA
CANADA
UNITED STATES OF AMERICA
BOUNDARY OF DRAINAGE BASIN
ROCKY MOUNTAINS
CYPRESS HILLS
SWEET GRASS HILLS
WOOD MOUNTAIN
MILK RIVER
SOUTH SASKATCHEWAN RIVER
Bow River
Oldman River
Lethbridge
Magrath
St. Mary Reservoir
Canadian St. Mary Canal
Jensen Reservoir
Cardston
Verdigris Lake
Milk River
Shanks Lake
Reesor Reservoir
Adams Lake
Mitchell Reservoir
Michel Reservoir
Massy Reservoir
Greasewood Reservoir
Bare Creek Reservoir
Cypress Lake
Middle Creek Reservoir
Cressday Reservoir
Altawan Reservoir
Consul
Govenlock
Eastend
Eastend Reservoir
Huff Lake
Newton Lake
Val Marie
Fresno Reservoir
Havre
Chinook
Harlem
Dodson Dam
Dodson
Malta
Nelson Reservoir
Frenchman Reservoir
Vandalia Dam
11AB117
11AB090
11AB095
11AB091
11AB092
11AB104
11AB094
11AB099
11AB009
11AB001
11AB115
11AB114
11AB080
11AB078
11AB102
11AB085
11AB118
11AB058
11AB020
11AB084
11AB044
11AB096
11AB108
11AB018
11AB082
11AB089
11AB097
11AB098
11AB060
11AB101
11AB008
11AB103
11AB083
11AB027
11AB075
11AC064
11AC060
11AC037
11AC077
11AC055
11AC001
11AC052
11AC066
11AC065
11AC068
11AC054
11AC063
11AC025
11AC056
11AC062
11AC041
05AE027
05AE029
05AE036 033
5-0145
5-0175
11AA001
11AA032
11AA033
11AA005
11AA038
11AA025
11AA028
11AA029
11AA031
6-1695
St. Mary R.
Milk River
Lee Creek
Swiftcurrent Cr.
Duck Lake
Middle Fk
Lower St. Mary Lake
Lake Sherburne
St Mary Lake
South Fk
Milk R.
Red Creek
Van Cleeve Coulée
Police Cr.
Deer Cr.
Macdonald Cr.
Bear Cr.
Lost River
Little Sage Cr.
Sage Creek
Big Sandy Creek
Red Rock Coulée
Woodpile Coulée
Battle Creek
Lodge Creek
Bare Creek
Frenchman
Thirty Mile Creek
Wayne Creek
Savoy Creek
Woody Island Coulée
Cottonwood Coulée
Cottonwood Creek
N Fork Whitewater Cr.
East Fork Whitewater Cr.
Whitewater Cr.
Denniel Cr.
McEachern Cr.
Horse Creek
Rock Creek
Peoples Creek
Beaver Creek

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