

Report to

THE INTERNATIONAL JOINT COMMISSION

on

THE DIVISION OF THE WATERS OF

THE ST. MARY AND MILK RIVERS

1998



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Cover photo:

Release Gate at Altawan Reservoir, September 1998.

Photo by Hugh Nelson, Water Survey of Canada, Regina, Saskatchewan.

Report to
THE INTERNATIONAL JOINT COMMISSION
on
THE DIVISION OF THE WATERS OF
THE ST. MARY AND MILK RIVERS

1998

by

David J. Lystrom
representing the United States

and

R.A. Halliday
representing Canada

March 1999

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

Commissioners;

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, 1998.

Respectfully submitted,



David J. Lystrom
Accredited Officer of the United States



R.A. Halliday
Accredited Officer of Her Majesty

SYNOPSIS

During the 1998 irrigation season, the natural flows of the St. Mary and Milk Rivers were 88 percent and 76 percent, respectively, of the long-term averages.

The natural flow of the St. Mary River at the International Boundary during the irrigation season, April 1 to October 31, 1998, was 632 000 cubic decametres (dam^3) (512,000 acre-feet). Under the terms of the Boundary Waters Treaty, the Canadian share was 380 000 dam^3 (308,000 acre-feet). The total flow recorded at the International Boundary during the irrigation season was 106 percent of the Canadian allotment.

The natural flow of the Milk River at the Eastern Crossing of the International Boundary from March 1 to October 31, 1998, was 109 000 dam^3 (88,400 acre-feet). Under the terms of the Treaty, the United States' allotment was 78 500 dam^3 (63,600 acre-feet). The United States received 171 percent 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.

The March to October natural flows of the three apportioned tributaries of the Milk River; Lodge Creek, Battle Creek, and Frenchman River; were 10 percent, 38 percent, and 24 percent, respectively, of the long-term averages.

The annual meeting of the Field Representatives was held in Cypress Hills, Saskatchewan, on February 18, 1999. Mutual problems, future plans, and changes in computational procedures were discussed and a schedule of field operations for 1999 was adopted.

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INTRODUCTION

The apportionment of the waters of the St. Mary and Milk Rivers is governed by Article VI of the Boundary Waters Treaty of 1909 between Great Britain and the United States. The terms of the Treaty were further clarified by the 1921 Order of the International Joint Commission. A copy of the 1921 Order, including Article VI, is 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 36 international gauging stations on a cooperative basis. An additional 30 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 was used to improve the accuracy of natural-flow computations.

This report summarizes the 1998 natural-flow computations, apportionment of the natural flow, unusual occurrences during the year, and 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 adopted 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. R.A. Halliday, as Accredited Officer of Her Majesty, was represented in the field by Mr. R.G. Boals, Environment Canada, Prairie and Northern Region. Mr. David J. Lystrom, United States Geological Survey, as Accredited Officer of the United States, was represented in the field by Mr. R.E. Davis, District Chief, United States Geological Survey, Helena, Montana. This report was

prepared jointly by personnel of Environment Canada, Hydrometric Monitoring Division, and the United States Geological Survey, under the supervision of Messrs. Boals and Davis.

The annual meeting of the Field Representatives was held in Cypress Hills, Saskatchewan, on February 18, 1999. Mutual problems, future plans, and changes in computational procedures were discussed and a schedule of field operations for 1999 was 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. Flow in excess of that quantity is 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 percent of the natural flow. Occasionally, water is diverted into the St. Mary Canal during the non-irrigation season, necessitating additional 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 34 400 dam³ (27,900 acre-feet) on October 31, 1997 and increased to 41 100 dam³ (33,300 acre-feet) on March 20, 1998, when releases began. Maximum storage was 82 900 dam³ (67,200 acre-feet) on June 29, 1998 and storage decreased to 7 020 dam³ (5,690 acre-feet) by the end of the irrigation season on October 31, 1998.

Water was diverted from the St. Mary River into the Milk River via the St. Mary Canal from March 17 through October 9, 1998. The total flow recorded at the gauging station on the St. Mary Canal at St. Mary Crossing (station 05AE029) was 264 000 dam³ (214,000 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 computed natural flow of the St. Mary River at the International Boundary from November 1, 1997 to October 31, 1998 was 694 000 dam³ (563,000 acre-feet) of which 632 000 dam³ (512,000 acre-feet) occurred during the irrigation season, April 1 to October 31, 1998. For the irrigation season, Canada's and the United States' shares were 380 000 dam³ (308,000 acre-feet) and 252 000 dam³ (204,000 acre-feet), respectively. A total discharge of 402 000 dam³ (326,000 acre-feet) was recorded at the International Boundary, which was 106 percent of the Canadian share. The computed natural flow during the irrigation season was 88 percent of the average of the previous 95 years of record.

Deficit deliveries were recorded in 8 of the 14 division periods during the 1998 irrigation season. Deficits were refunded by the middle of October but a small deficit was incurred during the last division period.

The division of St. Mary River natural flow is summarized in Tables 1 and 1A and Figure 1, which follow. The detailed computation of the natural flow is given in Table 6 and the historical summary is given in Table 7 of Appendix A.

TABLE 1
SUMMARY OF ST. MARY RIVER DIVISION FOR 1998¹
QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	CANADA'S SHARE	RECEIVED BY CANADA	RECEIVED BY CANADA	
				ABOVE SHARE	BELOW SHARE
APR 1 - APR 15	11 878	8 909	5 797		3 112
APR 16 - APR 30	27 396	18 275	19 033	758	
MAY 1 - MAY 15	97 783	55 001	54 633		368
MAY 16 - MAY 31	103 782	58 407	58 375		32
JUNE 1 - JUNE 15	96 964	54 590	56 271	1 681	
JUNE 16 - JUNE 30	110 370	61 293	79 613	18 320	
JULY 1 - JULY 15	66 039	39 130	43 956	4 826	
JULY 16 - JULY 31	39 463	26 248	25 037		1 211
AUG 1 - AUG 15	26 460	18 908	17 945		963
AUG 16 - AUG 31	15 522	11 644	11 173		471
SEPT 1 - SEPT 15	10 236	7 676	7 201		475
SEPT 16 - SEPT 30	9 892	7 417	9 674	2 257	
OCT 1 - OCT 15	8 526	6 394	7 676	1 282	
OCT 16 - OCT 31	7 543	5 657	5 615		42
TOTAL	631 854	379 549	401 999		

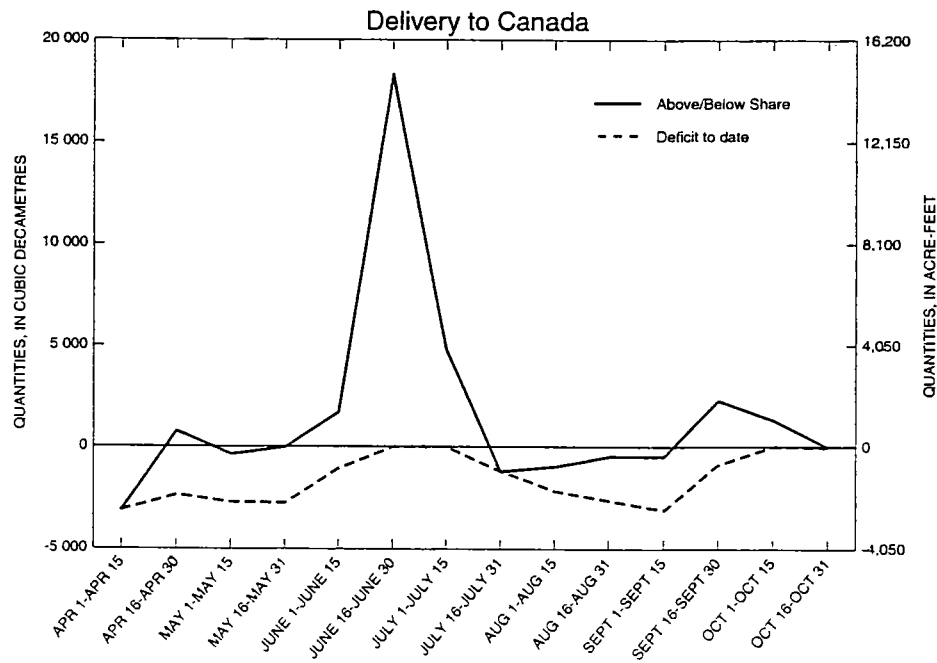
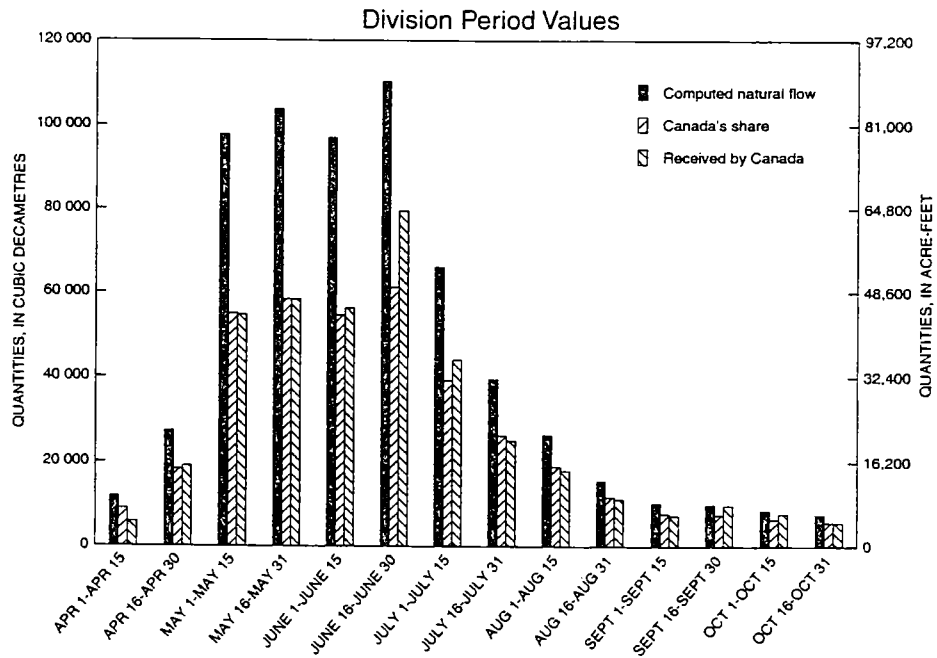
¹This is a summary of data from Table 6, Appendix A.

TABLE 1A
SUMMARY OF ST. MARY RIVER DIVISION FOR 1998¹
QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	CANADA'S SHARE	RECEIVED BY CANADA	RECEIVED BY CANADA	
				ABOVE SHARE	BELOW SHARE
APR 1 - APR 15	9,630	7,223	4,700		2,523
APR 16 - APR 30	22,210	14,816	15,430	615	
MAY 1 - MAY 15	79,273	44,589	44,291		298
MAY 16 - MAY 31	84,136	47,351	47,325		26
JUNE 1 - JUNE 15	78,609	44,256	45,619	1,363	
JUNE 16 - JUNE 30	89,477	49,690	64,542	14,852	
JULY 1 - JULY 15	53,538	31,723	35,635	3,912	
JULY 16 - JULY 31	31,993	21,279	20,298		982
AUG 1 - AUG 15	21,451	15,329	14,548		781
AUG 16 - AUG 31	12,584	9,440	9,058		382
SEPT 1 - SEPT 15	8,298	6,223	5,838		385
SEPT 16 - SEPT 30	8,019	6,013	7,843	1,830	
OCT 1 - OCT 15	6,912	5,184	6,223	1,039	
OCT 16 - OCT 31	6,115	4,586	4,552		34
TOTAL	512,245	307,701	325,901		

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

FIGURE 1
ST. MARY RIVER DIVISION, 1998



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 1970's, 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 1998, the United States' and Canada's respective estimated consumptive uses were 5 050 dam³ (4,090 acre-feet) and 5 160 dam³ (4,180 acre-feet). An interbasin transfer of 262 dam³ (212 acre-feet) from Verdigris Coulee near the Mouth (station 11AA038) was credited to the Canadian consumptive use.

The computed natural flow of the Milk River at the Eastern Crossing of the International Boundary from March 1 to October 31, 1998 was 109 000 dam³ (88,400 acre-feet). This flow was 76 percent of the average computed natural flow of the previous 86 years of record. It is important to note, however, that natural-flow computations prior to 1985 did not account for consumptive use. Consequently, natural-flow values after 1985 are not directly comparable with natural flows of previous years. The respective shares of the United States and Canada were 78 500 dam³ (63,600 acre-feet) and 30 300 dam³ (24,600 acre-feet). The United States received 171 percent 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.

Deficit deliveries were recorded in 4 of the 16 division periods during the season. All deficits were satisfactorily refunded by October 31.

TABLE 2
SUMMARY OF MILK RIVER DIVISION FOR 1998¹
QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 15	3 031	1 519	4 550	1 519	
MAR 16 - MAR 31	2 865	1 433	4 298	1 433	
APR 1 - APR 15	24913	18 248	31 594	6 681	
APR 16 - APR 30	23 610	17 427	29 794	6 184	
MAY 1 - MAY 15	2 045	1 531	2 553	508	
MAY 16 - MAY 31	5 203	3 902	5 523	320	
JUNE 1 - JUNE 15	6 896	5 171	7 662	766	
JUNE 16 - JUNE 30	11 058	7 991	13 804	2 746	
JULY 1 - JULY 15	18417	13 249	23 015	4 598	
JULY 16 - JULY 31	1 797	1 346	1 546		251
AUG 1 - AUG 15	1 545	1 157	1 386		159
AUG 16 - AUG 31	653	491	234		419
SEPT 1 - SEPT 15	794	595	629		165
SEPT 16 - SEPT 30	762	570	980	218	
OCT 1 - OCT 15	2 211	1 659	2 812	601	
OCT 16 - OCT 31	2 977	2 232	3 757	780	
TOTAL	108 777	78 521	134 137		

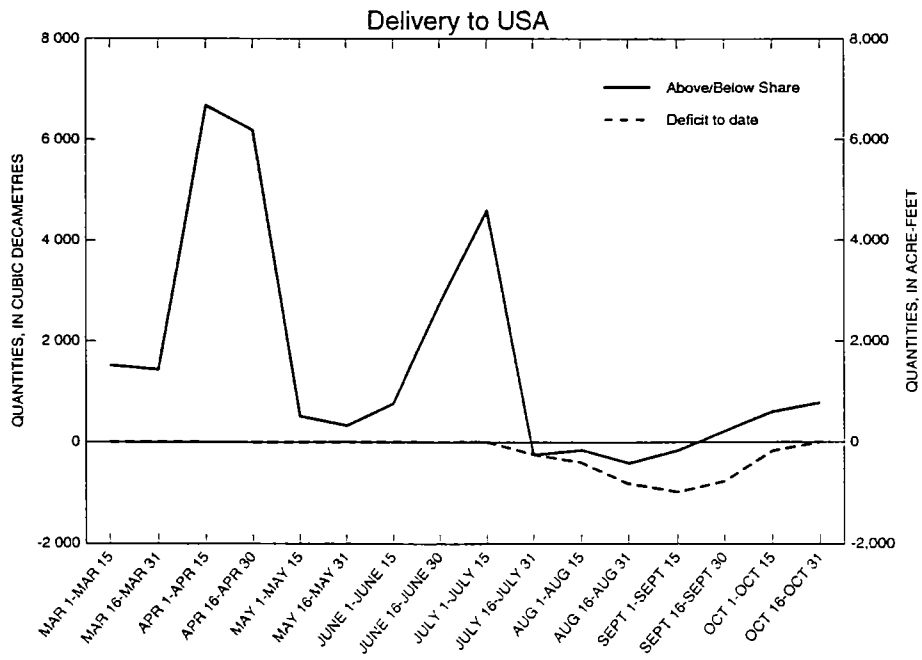
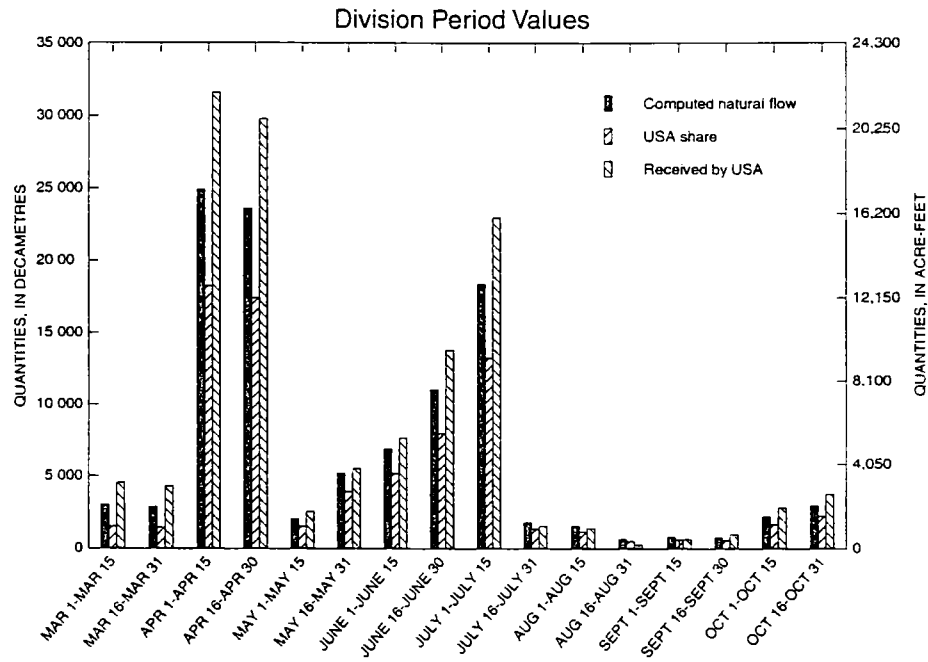
¹This is a summary of data from Table 8, Appendix A.

TABLE 2A
SUMMARY OF MILK RIVER DIVISION FOR 1998¹
QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 15	2,457	1,231	3,689	1,231	
MAR 16 - MAR 31	2,323	1,162	3,484	1,162	
APR 1 - APR 15	20,197	14,794	25,613	5,416	
APR 16 - APR 30	19,141	14,128	24,154	5,013	
MAY 1 - MAY 15	1,658	1,241	2,070	412	
MAY 16 - MAY 31	4,218	3,163	4,478	259	
JUNE 1 - JUNE 15	5,591	4,192	6,212	621	
JUNE 16 - JUNE 30	8,965	6,478	11,191	2,226	
JULY 1 - JULY 15	14,931	10,741	18,658	3,728	
JULY 16 - JULY 31	1,457	1,091	1,253		203
AUG 1 - AUG 15	1,253	938	1,124		129
AUG 16 - AUG 31	529	398	190		340
SEPT 1 - SEPT 15	644	482	510		134
SEPT 16 - SEPT 30	618	462	794	177	
OCT 1 - OCT 15	1,792	1,345	2,280	487	
OCT 16 - OCT 31	2,413	1,809	3,046	632	
TOTAL	88,186	63,657	108,745		

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

FIGURE 2
MILK RIVER DIVISION, 1998



SOUTHERN TRIBUTARIES OF THE MILK RIVER

Responding to concerns expressed by Canadian water users, the International Joint Commission at its executive session on December 8, 1986, agreed in principle that the issue of utilization of the southern tributaries should be addressed in an informal, pragmatic manner. The Commission instructed the Accredited Officers to proceed with discussion to resolve Canadian concerns. 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 the United States and Canadian field representatives for the St. Mary-Milk River Treaty.

The task force met with United States and Canadian water users, conducted public meetings, toured water-use projects, compiled information on water availability and use, investigated ground-water supplies, and considered various options for resolving issues. The task force determined that United States water users were reluctant to participate in options that might limit their use of water and jeopardize their water claims in future adjudication of water rights. They also determined that basic Canadian water-user needs for domestic and stock-water use were being satisfied with wells and dugouts. Solutions to water-utilization problems were limited because cost of storage facilities, pumpage from the Milk River, and formal apportionment of southern tributary waters would not be cost effective.

In September 1991, the Montana Department of Natural Resources and Conservation, in response to requests from the task force and others, issued an Order to close the southern tributaries to issuance of additional water permits.

The final report was forwarded to the International Joint Commission in May 1994. At its Executive session on September 21, 1994, the Commission agreed that the task force should be terminated as recommended. The Commission also agreed not to act at that time on the three recommendations related to the adjudication process, but requested that the Accredited Officers continue to monitor the situation and report annually, or more frequently if appropriate, on such matters as complaints by Canadian ranchers and changes in the status of basin adjudication.

Communication with officials from Alberta Environment and the Montana Department of Natural Resources and Conservation in January 1999 indicated no Canadian complaints or changes in the Montana adjudication process in 1998.

Flows for March through October 1998 for the southern tributaries were as follows:

- o Bear Creek near International Boundary - No flow was recorded during the season.
- o Miners Coulee near International Boundary - 1.4 dam³ (1.1 acre-feet)

EASTERN TRIBUTARIES OF THE MILK RIVER

The waters of the eastern tributaries of the Milk River are divided in accordance with the 1921 Order of the International Joint Commission, 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 ten days. In 1994 the time frame was increased to twice monthly to reduce lag-time anomalies, reduce costs, and conform to St. Mary and Milk Rivers computation periods.

Prior to 1937, Canadian use along the eastern tributaries consisted of domestic projects, 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 (11AC063), and Newton Lake (station 11AC056) and necessitated an operational division of flow on this tributary by 1937. In 1938, dams were constructed at both ends of Cypress Lake (station 11AC037) near 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 the flow on this tributary necessary by 1957. In 1960, construction of Altawan reservoir (station 11AB089) and Spangler Irrigation Project (station 11AB060) on Lodge Creek made an operational division of flow on this tributary necessary by 1961.

During the period March 1 to October 31, twice-monthly 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. When mutually agreed to, the United States or Canada may request that deficit deliveries be delayed to allow for more efficient use of the water.

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. Additional computations may be made to account for significant usages before October 31. Generally, no division of flow is made during winter as flow and use are low and streamflow records are impractical to obtain.

Lyons Creek is monitored by Canada, but does not have sufficient use in Canada at this time to warrant an operational division of flow. No flow was recorded on Lyons Creek in 1998.

Volumes 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 Environmental Protection. These reports are compiled from reports received from operators of irrigation 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 Interim reports prepared at the end of each division period, estimates of minor diversions were made based on field conditions and historical usages. At mid-year and at year-end, estimates of minor diversions were updated based on usage reports received from Alberta Environmental Protection and the Saskatchewan Water Corporation. Consequently, some discrepancy exists between interim and the final division computations. Lists of reported diversions are contained in Appendix B.

Below average runoff and near normal water use by local irrigators occurred in 1998. A rainstorm in late June reduced the stress on the water resource and provided additional water for irrigations and to make up deficits later in the year. Month-end reservoir contents for most of the reservoirs in Lodge Creek, Battle Creek and Frenchman River basins were generally below average throughout the year. Cypress Lake, however, remained above average throughout the year as a result of the previous year's inflows.

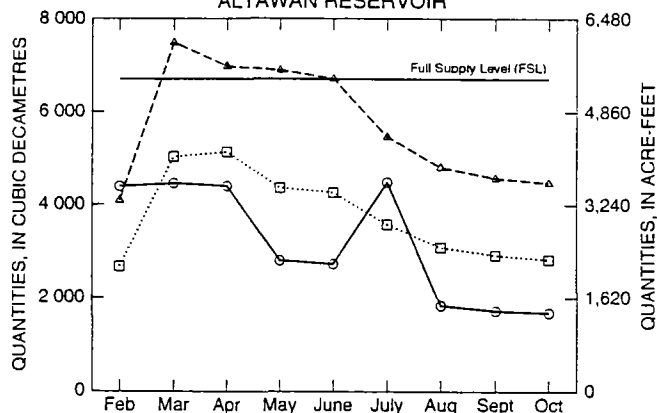
On the Frenchman River, construction to increase the capacity of Eastend reservoir was initiated.

At the end of February, the combined usable storage of Altawan Reservoir, Cypress Lake, Eastend Reservoir, Huff Lake, and Newton Lake was 97 000 dam³ (78,600 acre-feet), or 78 percent of the total usable storage of 124 000 dam³ (101,000 acre-feet). By the end of April, runoff had increased the combined storage to the yearly maximum of 102 000 dam³ (82,700 acre-feet), or 83% of the total usable storage. By the end of October, irrigation usage, evaporation, and releases from the reservoirs depleted the combined usable storage to 76 900 dam³ (62,300 acre-feet) or 62% of the total usable storage. Further details on storage in the major Canadian reservoirs are provided in Figure 3, and in Table 16 of Appendix B.

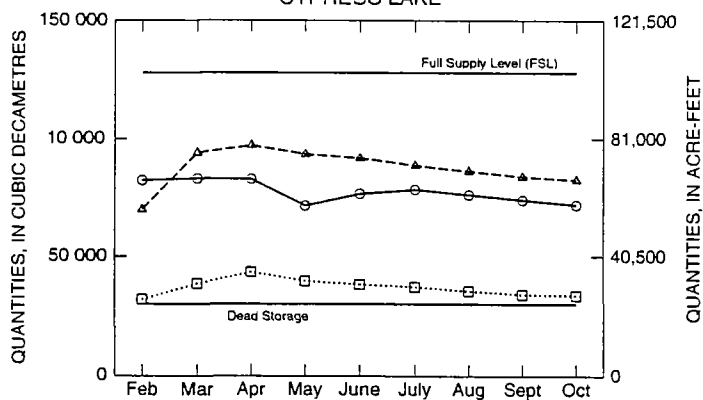
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FIGURE 3

RESERVOIRS IN LODGE, BATTLE, AND FRENCHMAN BASINS MONTH-END CONTENTS, 1997, 1998, AND 1988-97 MEAN

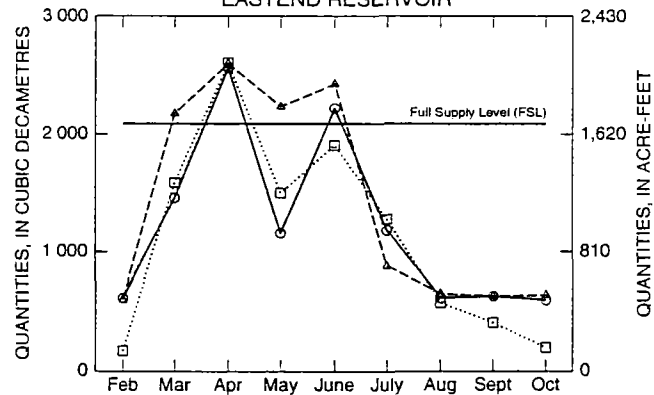
ALTAWAN RESERVOIR



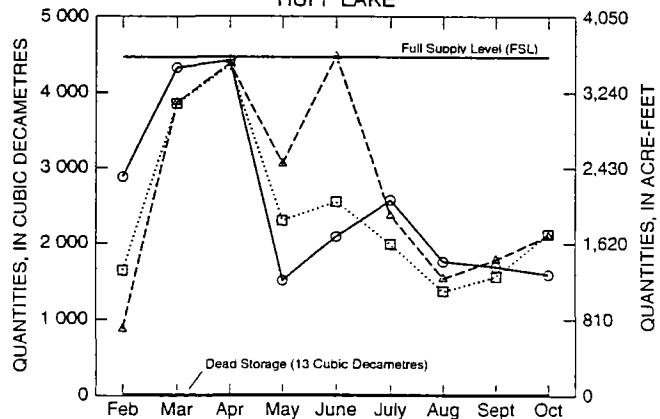
CYPRESS LAKE



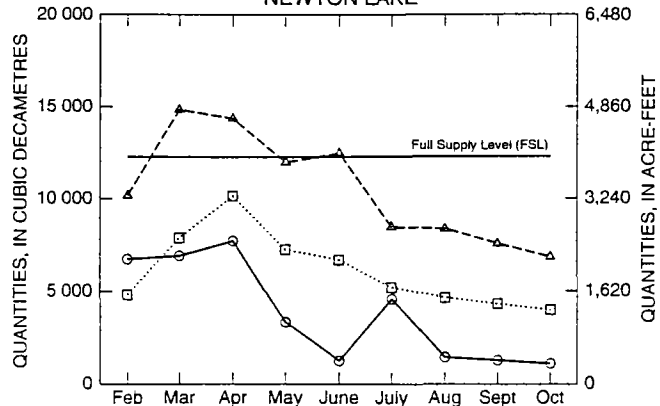
EASTEND RESERVOIR



HUFF LAKE



NEWTON LAKE



EXPLANATION

- 1998
- ▲ 1997
- 1988-97 MEAN

LODGE CREEK

The computed natural flow of Lodge Creek at the International Boundary from March 1 to October 31, 1998, was 3 390 dam³ (2,750 acre-feet). This volume is 10 percent of the average natural flow of the previous 48 years of record. Each country is entitled to 50 percent of the natural flow -- 1 700 dam³ (1,380 acre-feet). A total flow of 1 620 dam³ (1,310 acre-feet) was recorded at Lodge Creek below McRae Creek at the International Boundary (station 11AB083) from March 1 to October 31.

Deficit deliveries were recorded in 7 of the 16 division periods during the season. An attempt was made in early August to refund the 1 540 dam³ (1,250 acre-feet) deficit which resulted from irrigation usages in early July. Although most of the deficit was refunded, a deficit of 149 dam³ (121 acre-feet) remained at the end of October.

The division of the Lodge Creek natural flow is summarized in Tables 3 and 3A and Figure 4 which follow. The detailed computation of the natural flow is given in Table 10 and the historical summary is given in Table 11 of Appendix A.

TABLE 3
SUMMARY OF LODGE CREEK DIVISION FOR 1998¹
QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 15	0	0	0	0	
MAR 16 - MAR 31	29	14	0		14
APR 1 - APR 15	62	31	0		31
APR 16 - APR 30	61	31	2		29
MAY 1 - MAY 15	31	16	0		16
MAY 16 - MAY 31	0	0	0	0	
JUNE 1 - JUNE 15	30	15	176	161	
JUNE 16 - JUNE 30	150	75	41		34
JULY 1 - JULY 15	2 980	1 490	9		1 481
JULY 16 - JULY 31	41	21	0		21
AUG 1 - AUG 15	0	0	1 383	1 383	
AUG 16 - AUG 31	8	4	8	4	
SEPT 1 - SEPT 15	0	0	0	0	
SEPT 16 - SEPT 30	0	0	0	0	
OCT 1 - OCT 15	0	0	0	0	
OCT 16 - OCT 31	0	0	0	0	
TOTAL	3 392	1 697	1 619		

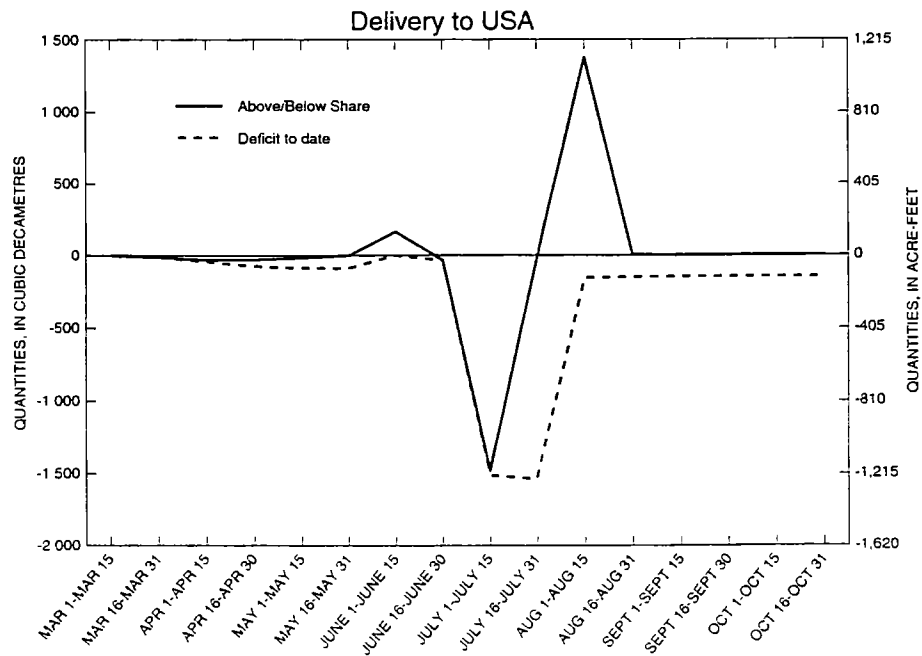
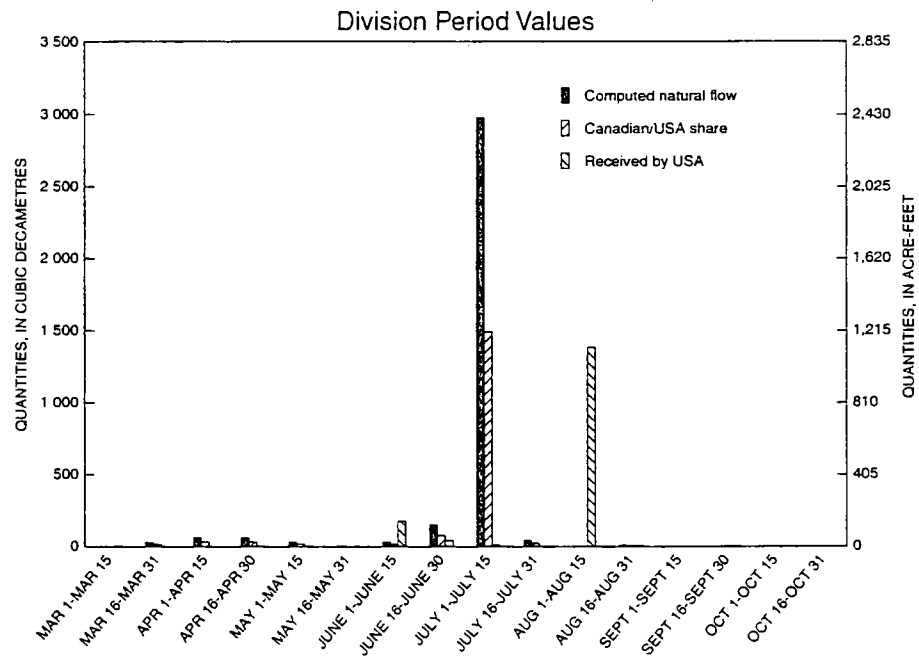
¹This is a summary of data from Table 10, Appendix A. Totals and shares may not add or subtract exactly as a result of rounding.

TABLE 3A
SUMMARY OF LODGE CREEK DIVISION FOR 1998¹
QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 15	0	0	0	0	
MAR 16 - MAR 31	24	11	0		11
APR 1 - APR 15	50	25	0		25
APR 16 - APR 30	49	25	2		24
MAY 1 - MAY 15	25	13	0		13
MAY 16 - MAY 31	0	0	0	0	
JUNE 1 - JUNE 15	24	12	143	131	
JUNE 16 - JUNE 30	122	61	33		28
JULY 1 - JULY 15	2,416	1,208	7		1,201
JULY 16 - JULY 31	33	17	0		17
AUG 1 - AUG 15	0	0	1,121	1,121	
AUG 16 - AUG 31	6	3	6	3	
SEPT 1 - SEPT 15	0	0	0	0	
SEPT 16 - SEPT 30	0	0	0	0	
OCT 1 - OCT 15	0	0	0	0	
OCT 16 - OCT 31	0	0	0	0	
TOTAL	2,750	1,376	1,313		

¹ All values are conversions of data from Table 3. Totals and shares may not add or subtract exactly as a result of rounding.

FIGURE 4
 LODGE CREEK DIVISION, 1998



BATTLE CREEK

The computed natural flow of Battle Creek at the International Boundary from March 1 to October 31, 1998, was 12 100 dam³ (9,800 acre-feet). This volume is 38 percent of the average natural flow of the previous 58 years of record. Each country is entitled to 50 percent of the natural flow -- 6 050 dam³ (4,900 acre-feet). A total flow of 6 300 dam³ (5,100 acre-feet) was recorded at Battle Creek at International Boundary (station 11AB027) from March 1 to October 31.

Deficit deliveries were recorded in 5 of the 16 division periods during the season. An attempt was made in early October to refund the 1 910 dam³ (1,550 acre-feet) deficit which occurred during July. Most of the deficit was refunded but a deficit of 211 dam³ (171 acre-feet) still remained at the end of October.

The division of the Battle Creek natural flow is summarized in Tables 4 and 4A and Figure 5 which follow. The detailed computation of the natural flow is given in Table 12 and the historical summary is given in Table 13 of Appendix A.

TABLE 4
SUMMARY OF BATTLE CREEK DIVISION FOR 1998¹
QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 25	627	314	627	313	
MAR 26 - APR 9	1 287	644	608		36
APR 10 - APR 24	776	388	159		229
APR 25 - MAY 9	617	309	39		270
MAY 10 - MAY 25	387	194	197	3	
MAY 26 - JUNE 9	383	192	843	651	
JUNE 10 - JUNE 24	224	112	137	25	
JUNE 25 - JULY 9	3 970	1 985	797		1 188
JULY 10 - JULY 25	2 347	1 174	456		718
JULY 26 - AUG 9	205	103	150	47	
AUG 10 - AUG 25	264	132	262	130	
AUG 26 - SEPT 9	64	32	62	30	
SEPT 10 - SEPT 24	2	1	2	1	
SEPT 25 - OCT 9	102	51	498	447	
OCT 10 - OCT 25	657	329	1 273	944	
OCT 26 - OCT 31	194	97	194	97	
TOTAL	12 106	6 057	6 304		

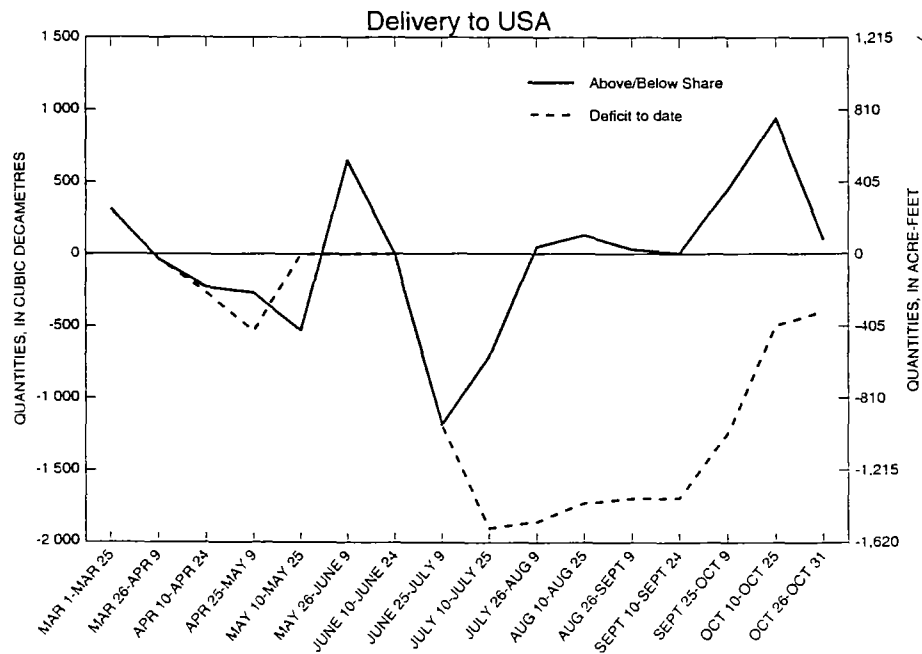
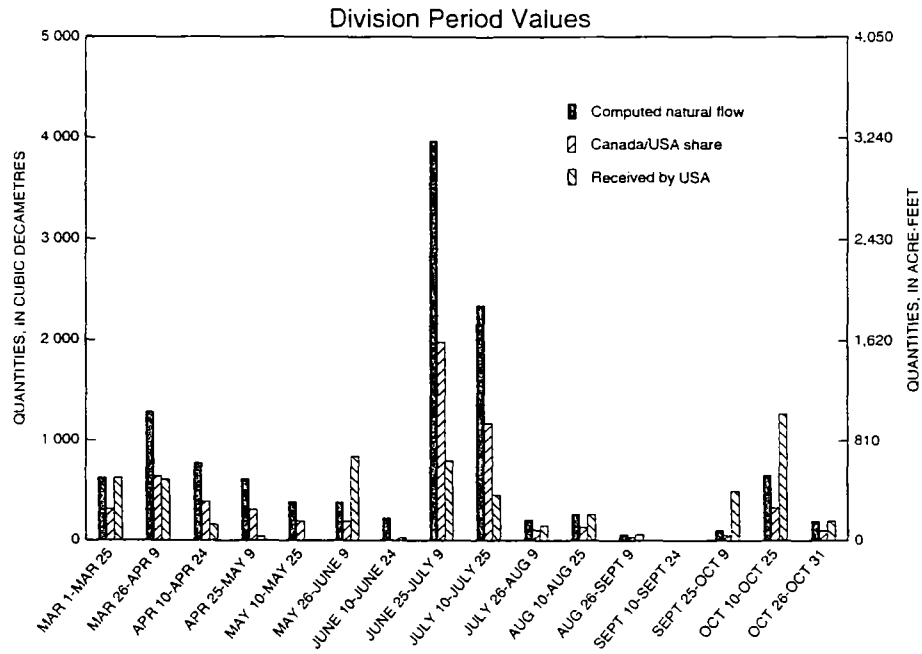
¹This is a summary of data from Table 12, Appendix A. Totals and shares may not add or subtract exactly as a result of rounding.

TABLE 4A
SUMMARY OF BATTLE CREEK DIVISION FOR 1998¹
QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 25	508	255	508	254	
MAR 26 - APR 9	1,043	522	493		29
APR 10 - APR 24	629	315	129		186
APR 25 - MAY 9	500	251	32		219
MAY 10 - MAY 25	314	157	160	2	
MAY 26 - JUNE 9	310	156	683	528	
JUNE 10 - JUNE 24	182	91	111	20	
JUNE 25 - JULY 9	3,218	1,609	646		963
JULY 10 - JULY 25	1,903	952	370		582
JULY 26 - AUG 9	166	84	122	38	
AUG 10 - AUG 25	214	107	212	105	
AUG 26 - SEPT 9	52	26	50	24	
SEPT 10 - SEPT 24	2	1	2	1	
SEPT 25 - OCT 9	83	41	404	362	
OCT 10 - OCT 25	533	267	1,032	765	
OCT 26 - OCT 31	157	79	157	79	
TOTAL	9,814	4,910	5,111		

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

FIGURE 5
BATTLE CREEK DIVISION, 1998



FRENCHMAN RIVER

The computed natural flow of the Frenchman River at the International Boundary from March 1 to October 31, 1998, was 19 500 dam³ (15,800 acre-feet). This volume is 24 percent of the average natural flow of the previous 58 years of record. Each country is entitled to 50 percent of the natural flow -- 9 750 dam³ (7,900 acre-feet). A total flow of 9 500 dam³ (7,900 acre-feet) was recorded at Frenchman River at International Boundary (station 11AC041) from March 1 to October 31.

Deficit deliveries were recorded in 9 of the 15 division periods during the season. The June 16-30 and July 1-15 periods were combined to account for a large rainfall event that spanned the two periods. The attempts in late-August and October to refund the accumulated seasonal deficit failed to prevent a deficit of 269 dam³ (218 acre-feet) from occurring at the end of October.

The division of the Frenchman River natural flow is summarized in Tables 5 and 5A and Figure 6 which follow. The detailed computation of the natural flow is given in Table 14 and the historical summary is given in Table 15 of Appendix A.

TABLE 5
SUMMARY OF FRENCHMAN RIVER DIVISION FOR 1998¹
QUANTITIES IN CUBIC DECAMETRES

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 15	693	346	106		240
MAR 16 - MAR 31	1 076	538	181		357
APR 1 - APR 15	2 125	1 062	91		971
APR 16 - APR 30	895	447	21		426
MAY 1 - MAY 15	505	253	45		208
MAY 16 - MAY 31	1 160	580	835	255	
JUNE 1 - JUNE 15	455	227	1 525	1 298	
JUNE 16 - JUNE 30 PERIODS COMBINED					
JULY 1 - JULY 15	10 201	5 101	4 180		921
JULY 16 - JULY 31	521	260	6		254
AUG 1 - AUG 15	634	317	344	27	
AUG 16 - AUG 31	781	391	1 545	1 154	
SEPT 1 - SEPT 15	41	21	8		13
SEPT 16 - SEPT 30	0	0	0	0	
OCT 1 - OCT 15	126	63	4		59
OCT 16 - OCT 31	321	160	606	446	
TOTAL	19 534	9 767	9 497		

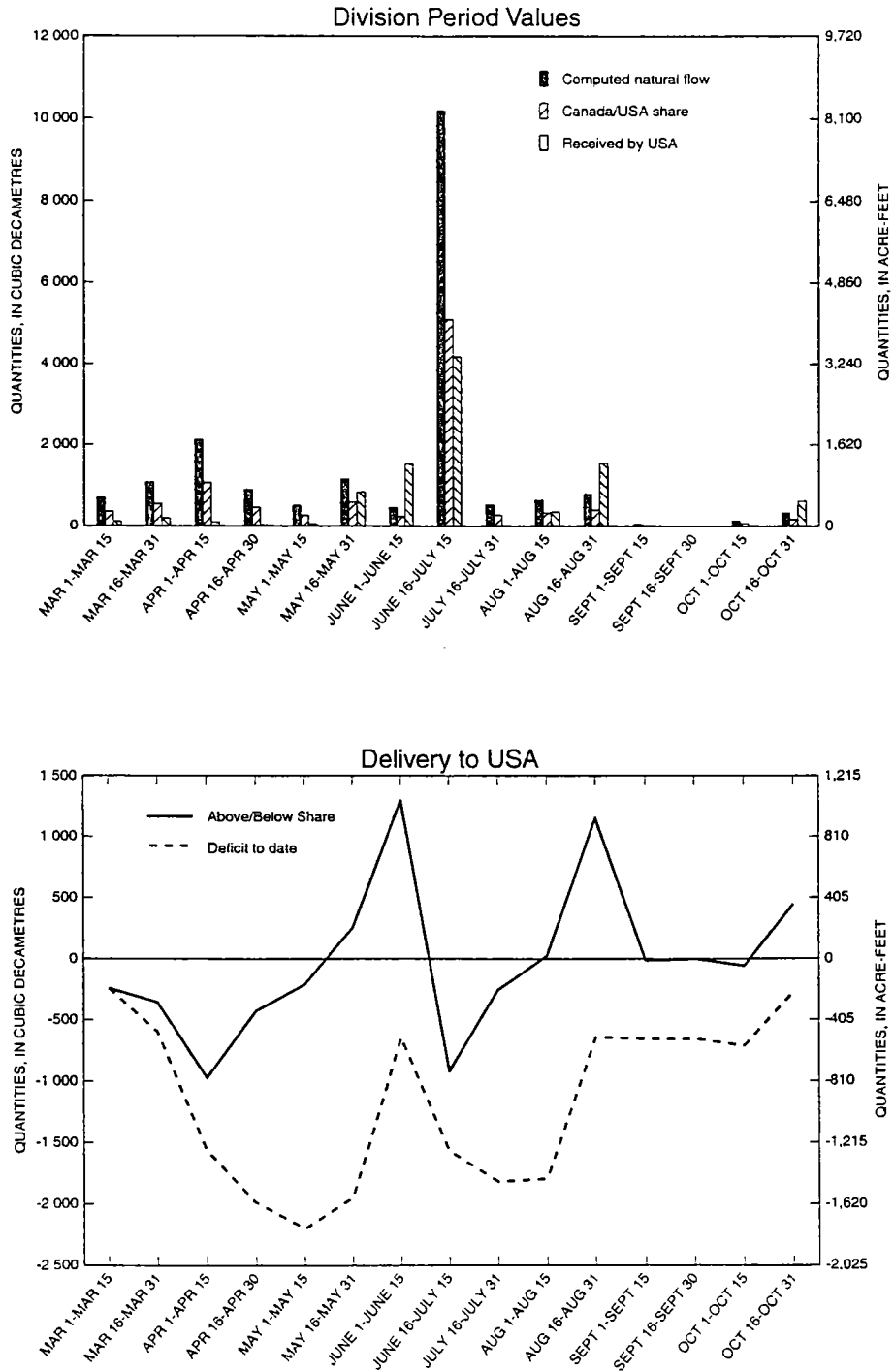
¹This is a summary of data from Table 14, Appendix A. Totals and shares may not add or subtract exactly as a result of rounding.

TABLE 5A
SUMMARY OF FRENCHMAN RIVER DIVISION FOR 1998¹
QUANTITIES IN ACRE-FEET

DIVISION PERIOD AT INTERNATIONAL BOUNDARY	COMPUTED NATURAL FLOW	U.S.A. SHARE	RECEIVED BY U.S.A.	RECEIVED BY U.S.A.	
				ABOVE SHARE	BELOW SHARE
MAR 1 - MAR 15	562	281	86		195
MAR 16 - MAR 31	872	436	147		289
APR 1 - APR 15	1,723	861	74		787
APR 16 - APR 30	726	362	17		345
MAY 1 - MAY 15	409	205	36		169
MAY 16 - MAY 31	940	470	677	207	
JUNE 1 - JUNE 15	369	184	1,236	1,052	
JUNE 16 - JUNE 30 PERIODS COMBINED					
JULY 1 - JULY 15	8,270	4,135	3,389	0	747
JULY 16 - JULY 31	422	211	5		206
AUG 1 - AUG 15	514	257	279	22	
AUG 16 - AUG 31	633	317	1,253	936	
SEPT 1 - SEPT 15	33	17	6		11
SEPT 16 - SEPT 30	0	0	0	0	
OCT 1 - OCT 15	102	51	3		48
OCT 16 - OCT 31	260	130	491	362	
TOTAL	15,836	7,918	7,699		

¹All values are conversions of data from Table 5. Totals and shares may not add or subtract exactly as a result of rounding.

FIGURE 6
FRENCHMAN RIVER DIVISION, 1998



ANNEX A

1921 ORDER OF THE INTERNATIONAL JOINT COMMISSION
RESPECTING THE ST. MARY-MILK RIVERS

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, it is provided as follows:

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.

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. MAGRATH,
C.D. CLARK,
HENRY A. POWELL,
W.H. HEARST,
MARK A. SMITH.

ANNEX B

Conversion Factors

FACTORS FOR CONVERSION BETWEEN INCH-POUND UNITS
AND INTERNATIONAL SYSTEM (SI) UNITS

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 = 1 000 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-feet

ANNEX C

List of Gauging Stations

INTERNATIONAL GAUGING STATIONS OPERATED JOINTLY
BY
THE UNITED STATES AND CANADA
ST. MARY AND MILK RIVER BASINS
1998

<u>Map Index</u>	<u>Station Name</u>
<u>ST. MARY RIVER BASIN</u>	
05AE027	St. Mary River at International Boundary
05AE029	St. Mary Canal at St. Mary Crossing near Babb, Montana
05AE036	Lake Sherburne at Sherburne, Montana
<u>MILK RIVER BASIN</u>	
11AA001	North Milk River near International Boundary
11AA005	Milk River at Milk River, Alberta
11AA025	Milk River at Western Crossing of International Boundary
11AA031	Milk River at Eastern Crossing of International Boundary
11AA032	N. Fork Milk River above St. Mary Canal near Browning, Montana
11AA038	Verdigris Coulee near the Mouth
<u>LODGE CREEK TRIBUTARY BASIN</u>	
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
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
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

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
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
ST. MARY AND MILK RIVER BASINS
1998

*Data for these stations are not included in this report or appendices

Map Index	Station Name	Operated by
<u>ST. MARY RIVER BASIN</u>		
5-0145*	Swiftcurrent Creek at Many Glacier, Montana	U.S.A.
5-0160*	Swiftcurrent Creek at Sherburne, Montana	U.S.A.
5-0175*	St. Mary River near Babb, Montana	U.S.A.
<u>MILK RIVER BASIN</u>		
6-1322*	South Fork Milk River near Babb, Montana	U.S.A.
11AA028*	Bear Creek near International Boundary	Canada
11AA029*	Miners Coulee near International Boundary	Canada
<u>LODGE CREEK TRIBUTARY BASIN</u>		
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

BATTLE CREEK TRIBUTARY BASIN

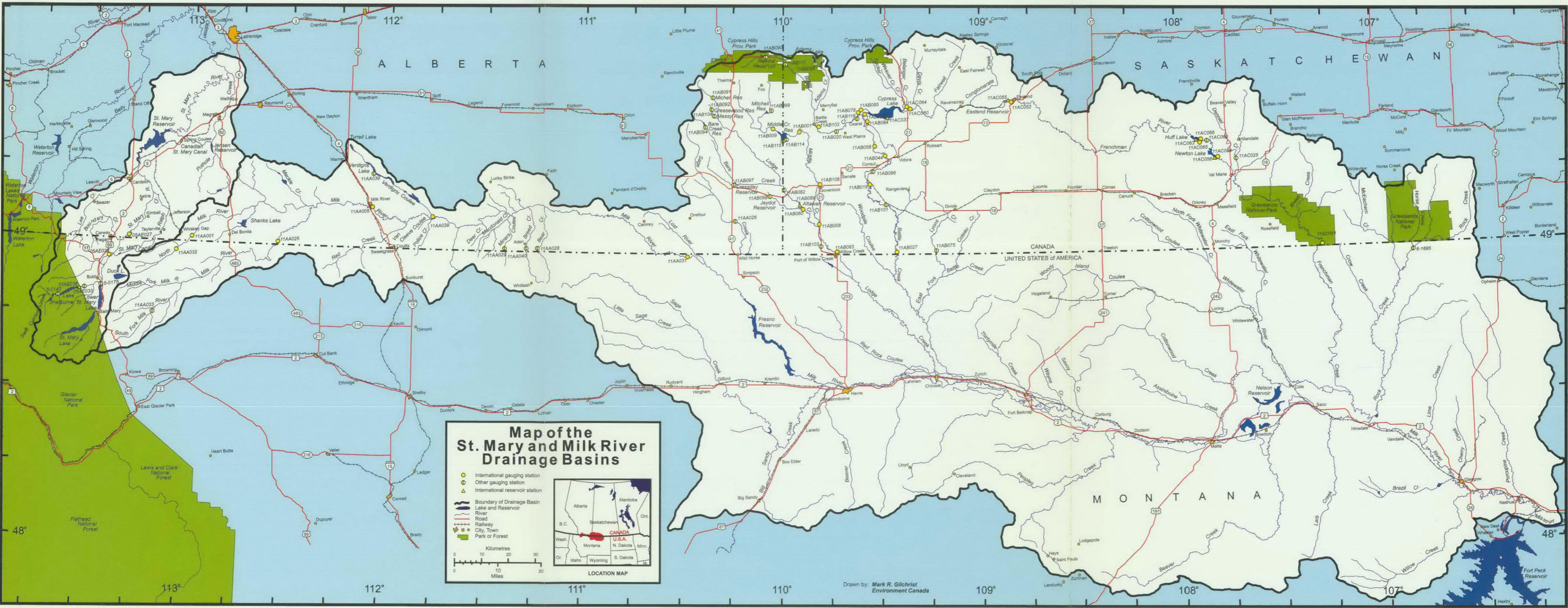
11AB020*	Shepherd Ditch near Consul	Canada
11AB075	Lyons Creek at International Boundary	Canada
11AB090	Reesor Reservoir near Elkwater	Canada
11AB095*	Adams Lake	Canada
11AB096*	Battle Creek near Consul	Canada
11AB101*	Battle Creek below Nashlyn Project	Canada
11AB117*	Battle Creek at Alberta Boundary	Canada
11AB118*	Battle Creek below Wilson's Weir	Canada

FRENCHMAN RIVER TRIBUTARY BASIN

11AC001*	Frenchman River Below Eastend Reservoir	Canada
11AC025*	Denniel Creek near Val Marie	Canada
11AC062*	Frenchman River below Newton Lake	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.
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Map of the St. Mary and Milk River Drainage Basins

- International gauging station
- Other gauging station
- ▲ International reservoir station
- Boundary of Drainage Basin
- Lake and Reservoir
- River
- Road
- Railway
- City, Town
- Park or Forest

Kilometres
0 10 20 30
Miles
0 10 20

LOCATION MAP

The location map shows the drainage basins in southern Alberta, Canada, in relation to neighboring provinces (B.C., Saskatchewan, Manitoba, Ontario) and states (Wash., Idaho, Wyoming, Montana, N. Dakota, Minn., S. Dakota, Iowa, Missouri). The U.S.A. and CANADA borders are indicated.

Drawn by: Mark R. Gilchrist
Environment Canada

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