

**WESTWARD FLOWING TRIBUTARIES
OF
EASTWARD FLOWING STREAMS
APPORTIONMENT STUDY**

MAY 1986

PPWB REPORT # 65



February 10, 1986

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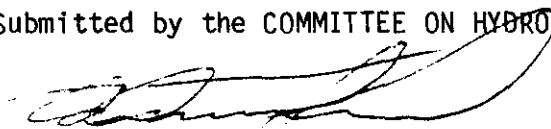
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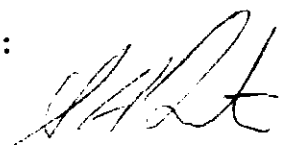
Re: Westward Flowing Tributaries of Eastward Flowing Streams

Apportionment of westward flowing waters was discussed at the ninth meeting of the Prairie Provinces Water Board on November 6, 1973. The Board agreed that it would be appropriate to consider the apportionment of westward flowing waters and directed the Committee on Hydrology to "identify westward flowing streams and tributaries, consider possible apportionment problems, and speculate on solutions, taking into account any relevant precedents."

The Committee on Hydrology has prepared the attached report on westward flowing tributaries of eastward flowing streams. It recommends approaches that may be considered to apportion each westward flowing tributary when the need arises.

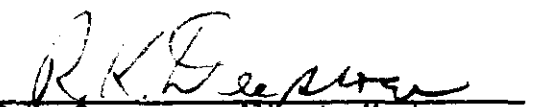
Submitted by the COMMITTEE ON HYDROLOGY:

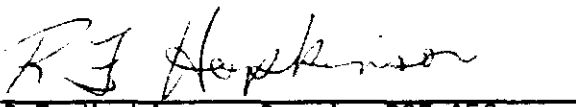

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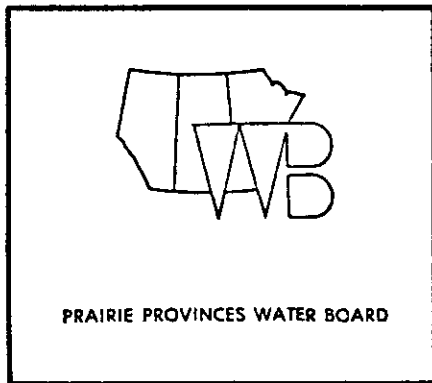

 R.B. Godwin, PPWB, Chairman

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APPORTIONMENT STUDY**

MAY 1986

**Prepared by:
Committee on Hydrology
Prairie Provinces Water Board**

**This report, as submitted to the Board on February 10, 1986,
was approved at PPWB Meeting No. 36 on April 29, 1986**



SYNOPSIS

Schedules A and B of the 1969 Master Agreement on Apportionment provide direction regarding the apportionment of eastward flowing waters among the Provinces of Alberta, Saskatchewan, and Manitoba but no specific reference is made in that Agreement to the apportionment of flows that cross interprovincial boundaries in a westerly direction. Such flows may be divided into two categories: those that are westward flowing tributaries of eastward flowing streams and those that are westward flowing streams. This report deals with westward flowing tributaries of eastward flowing streams. It interprets the intent of the 1969 Apportionment Agreement as it relates to westward flowing tributaries, outlines the extent of problems of such westward flowing tributaries, investigates the effects of using alternative methods of apportioning these tributaries, and makes recommendations on how these types of interprovincial waters may be apportioned.

It is recommended that the "Rational" Method described in this report be considered for the apportionment of westward flowing tributaries of eastward flowing streams. Method One (the Mutual Agreement Method) may also be considered for dealing with specific problem areas if the Rational Method is not deemed appropriate. Use of either the Rational Method or the Mutual Agreement Method would not require amendment of the existing Agreement.

The only westward flowing tributaries that may require monitoring of apportionment in the near future are Boxelder Creek and the Martineau River.

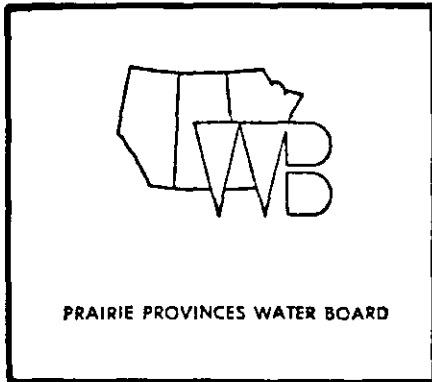


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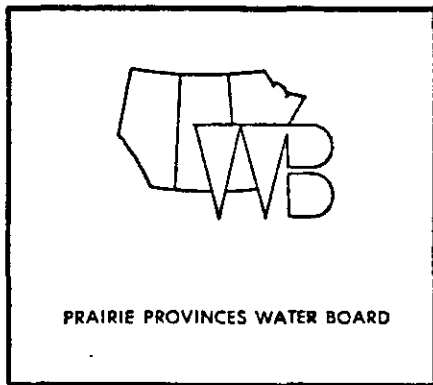
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CHAPTER 1

INTRODUCTION

Apportionment of westward flowing waters was discussed at the ninth meeting of the Prairie Provinces Water Board on November 6, 1973. It was noted that the Master Agreement on Apportionment and Schedules A and B make specific reference only to water flowing from Alberta to Saskatchewan, and/or from Saskatchewan to Manitoba. The following excerpts from the preamble to the Master Agreement on Apportionment corroborate this.

"WHEREAS under natural conditions the waters of the watercourses hereinafter referred to arising in or flowing through the Province of Alberta would flow into the Province of Saskatchewan and under the said conditions the waters of some of the said watercourses arising in or flowing through the Province of Saskatchewan would flow into the Province of Manitoba;"

"AND WHEREAS Alberta and Saskatchewan have entered into an agreement, which agreement is attached to this agreement as Schedule A, that permits the Province of Alberta to make a net depletion of one-half the natural flow of water arising in or flowing through the Province of Alberta and that permits the remaining one-half of the natural flow of each such watercourse to flow into the Province of Saskatchewan, subject to certain prior rights as are set forth in the said agreement;"

"AND WHEREAS Saskatchewan and Manitoba have entered into an agreement, which agreement is attached to this agreement as Schedule B, that permits the Province of Saskatchewan to make a net depletion of one-half the

natural flow of water arising in, and one-half of the water flowing into the Province of Saskatchewan, and that permits the remaining one-half of the flow of each such watercourse to flow into the Province of Manitoba, subject to such conditions and agreements as therein contained..."

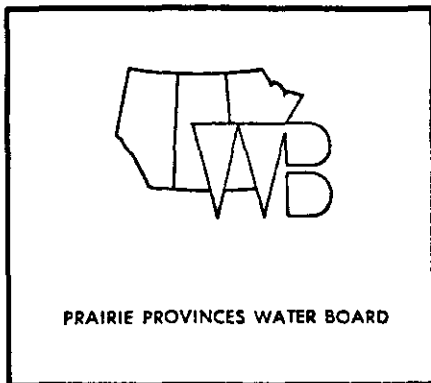
The Board felt it would be appropriate to consider the apportionment of westward flowing waters. Board Minute 9-35 records agreement to proceed with a study of westward flowing waters;

"...the Committee on Hydrology, with the aid of the Secretariat, should identify westward flowing streams and tributaries, consider possible apportionment problems, and speculate on solutions taking into account any relevant precedents."

Two types of westward flowing waters were identified:

1. Westward Flowing Tributaries of Eastward Flowing Streams - streams that cross an interprovincial boundary in a westerly direction and are tributary to eastward flowing streams.
2. Westward Flowing Streams- streams whose final crossing of an interprovincial boundary is in a westerly direction and are not tributary to eastward flowing streams.

This report deals with the apportionment of westward flowing tributaries of eastward flowing streams. The intent of the 1969 Agreement in relation to westward flowing tributaries is interpreted and the extent of the problem is outlined. The alternative methods that may be used to apportion westward flowing tributaries of eastward flowing streams are identified and assessed. More detailed information on the determination of unit yield for each identified tributary is given in Appendix A. The shares of flow that would be available to each province, if the proposed methods were used, are assessed and discussed in Appendix B and the 1969 Master Agreement on Apportionment is reproduced in Appendix C. Westward flowing streams will be discussed in a separate report.



CHAPTER 2

DEFINITIONS

The following words and phrases have specific meanings that must be defined for the purposes of this report.

Agreement - the Master Agreement on Apportionment (including Schedules A to D) executed October 30, 1969 by Canada, Alberta, Saskatchewan, and Manitoba.

Apportionment Period - the Agreement states in Article 3 of Schedule A that the apportionment period for volumetric flow between Alberta and Saskatchewan shall be the calendar year. Similarly, Article 3 of Schedule B specifies that the apportionment period between Saskatchewan and Manitoba shall be the period from April 1 of each year to March 31 of the following year.

Board - the Prairie Provinces Water Board (PPWB).

Discharge - a rate of streamflow.

Eastward Flowing Streams - streams whose final crossing of an interprovincial boundary is in an easterly direction.

Flow - a volume of streamflow.

Gross Drainage Area - the area, enclosed by its drainage divide, that contributes runoff to a specified location under extremely wet conditions. The gross drainage boundary is the drainage divide or the height of land between adjoining drainage basins.

Master Agreement - the Master Agreement on Apportionment not including Schedules A to D.

Member - member of the Prairie Provinces Water Board.

Natural Flow - the quantity of water that would naturally flow in any watercourse had the flow not been affected by human interference or human intervention. Schedule A of the Agreement excludes any water that is part of the natural flow in Alberta but is not available for the use of Alberta because of the provisions of any international treaty which is binding on Alberta.

PPWB - Prairie Provinces Water Board.

Secretariat - the operational unit established by the Board to carry out its day-to-day affairs.

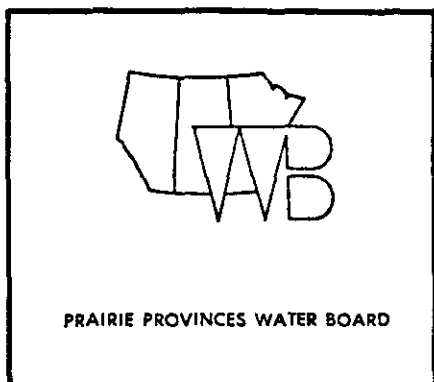
Schedule A - the Agreement between Alberta and Saskatchewan apportioning eastward flowing waters between Alberta and Saskatchewan.

Schedule B - the Agreement between Saskatchewan and Manitoba apportioning eastward flowing waters between Saskatchewan and Manitoba.

Watercourse - In accordance with Schedules A and B of the 1969 Agreement, watercourse means any river, stream, creek, or other natural channel which from time to time carries a flowing body of water from the Province of Alberta to the Province of Saskatchewan or from the Province of Saskatchewan to the Province of Manitoba and includes all tributaries of each such river, stream, creek, or natural channel that do not themselves cross the common boundary between the Provinces of Alberta and Saskatchewan or between the Provinces of Saskatchewan and Manitoba. Any tributaries that cross the boundaries between the Provinces of Alberta and Saskatchewan or the Provinces of Saskatchewan and Manitoba are also deemed to be "watercourses" for the purpose of the agreement.

Westward Flowing Streams - streams whose final crossing of an interprovincial boundary is in a westerly direction and are not tributary to eastward flowing streams.

Westward Flowing Tributaries of Eastward Flowing Streams - streams that cross an interprovincial boundary in a westerly direction and are tributary to eastward flowing streams.



CHAPTER 3

INTERPRETATION OF THE 1969
APPORTIONMENT AGREEMENT

It is not clear whether the flow that arises in an easterly province, passes through a westerly province, and subsequently returns to the easterly province is covered by the 1969 Master Agreement on Apportionment. Specific questions must be considered to interpret the status of westward flowing tributaries as they relate to the 1969 Agreement. These questions are:

1. Is a westward flowing tributary a watercourse, and therefore subject to apportionment:
 - (a) if it crosses the boundary only once, in a westerly direction?
 - (b) if it crosses the boundary twice, first in an easterly direction and then in a westerly direction? In this case, is the point of apportionment:
 - at the easterly crossing point?
 - at the westerly crossing point?
2. Is the natural flow of a westward flowing tributary included in the natural flow of the main stem which is subject to apportionment at the point where it crosses the boundary?

Interpretation of "Watercourse"

Articles 1(b) of Schedule A and Schedule B define "watercourse" as:

Article 1(b) - Schedule A

"Watercourse" means any river, stream, creek, or other natural channel which from time to time carries a flowing body of water from the Province of Alberta to the Province of Saskatchewan and includes all tributaries of each such river, stream, creek, or natural channel which do not themselves cross the common boundary between the Provinces of Alberta and Saskatchewan. Such tributaries as do themselves cross the said common boundary between the Provinces of Alberta and Saskatchewan shall be deemed to be "watercourses" for the purpose of this agreement.

Article 1(b) - Schedule B

Watercourse" means any river, stream, creek, or other natural channel which from time to time carries a flowing body of water from the Province of Saskatchewan to the Province of Manitoba and includes all tributaries of each such river, stream, creek, or natural channel which do not themselves cross the common boundary between the Provinces of Saskatchewan and Manitoba. Such tributaries as do themselves cross the said common boundary between the Provinces of Saskatchewan and Manitoba shall be deemed to be "watercourses" for the purpose of this agreement.

From the above definitions, it may be inferred that a westward flowing tributary of an eastward flowing stream which carries water from an easterly province to a westerly province is not a "watercourse" as defined in the 1969 Agreement.

Illustration of Westward Flowing Tributary

To illustrate the interpretation of what is and what is not a watercourse, consider four types of tributaries as shown in Figure 1.

Case 1 is a tributary that crosses the interprovincial boundary in an easterly direction and joins the main stem (watercourse) in an easterly province. The tributary is clearly a watercourse and therefore subject to apportionment at Point B. The main stem is subject to apportionment at Point A. The North Saskatchewan River and the Battle River crossing the Alberta-Saskatchewan Boundary provide a typical example of this case. This may have been the only type of tributary the drafters of the Agreement had in mind when they set up their definitions.

Case 2 illustrates a tributary arising in an easterly province and flowing westerly across a provincial boundary to join an eastward flowing stream in the westerly province. The tributary crosses the boundary from east

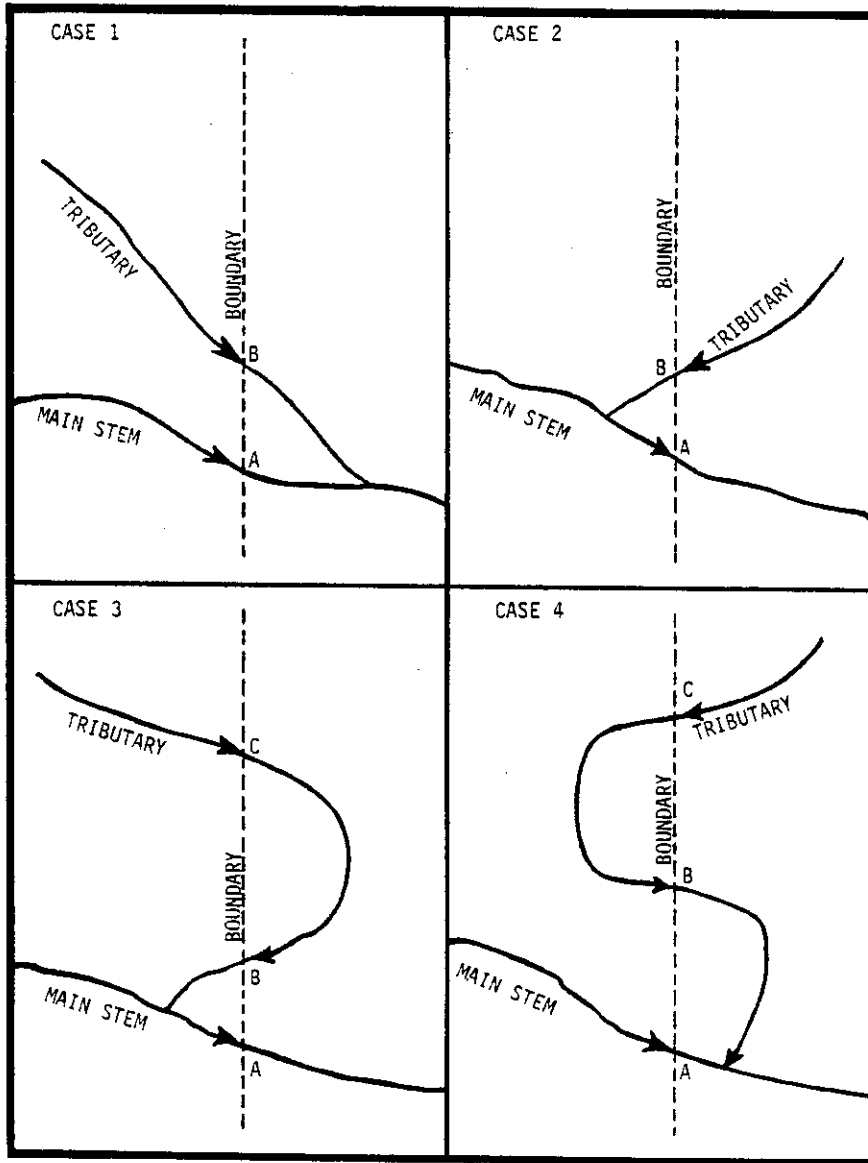


Figure 1. Types of Tributaries Crossing an Interprovincial Boundary.

to west; therefore, it is not a watercourse and is not subject to apportionment at Point B. Natural flow of the main stem is subject to apportionment at Point A. A typical example is Little Boggy Creek, a tributary of the Assiniboine River.

Case 3 is an extension of Case 2. This type of tributary zig zags across the interprovincial boundary finally crossing the boundary from east to west and joining an eastward flowing stream in a westerly province. As in Case 2, flows at Point B are not subject to apportionment. At Point C, however, the tributary is a watercourse and flows are subject to apportionment. Flow in the main stem is subject to apportionment at Point A. The Reindeer River basin system provides an example of this type of tributary.

Case 4 illustrates a tributary that flows from east to west across the boundary, then flows easterly across the boundary again and joins an eastward flowing stream (watercourse) in an easterly province. Point C cannot be considered as an apportionment point, but flows at both Points A and B are subject to apportionment. The Blackfoot Creek and Battle River which cross the Alberta-Saskatchewan boundary provide an example of this case.

Interpretation of "Natural Flow"

Schedule A and Schedule B define "natural flow" as:

Article 1(a) Schedule A

"Natural flow" means the quantity of water which would naturally flow in any watercourse had the flow not been affected by human interference or human intervention, excluding any water which is part of the natural flow in Alberta but is not available for the use of Alberta because of the provisions of any international treaty which is binding on Alberta.

Article 1(a) Schedule B

"Natural flow" means the quantity of water which would naturally flow in any watercourse had the flow not been affected by human interference or human intervention.

The above definitions of natural flow would seem to include the contribution of westward flowing tributaries and necessitate their inclusion in the

total available for apportionment where the eastward flowing watercourse crosses a boundary. Thus the natural flow at Point B in Case 2 becomes part of the apportioned natural flow at Point A.

The phrase specifying the exclusion of "...any water... not available for the use of Alberta..."[Schedule A, 1(a)] referred to international treaties. If, on the other hand, that same phrase is considered to define a general principle, the flow from westward flowing tributaries should not be included in the total available for apportionment in the main stem.

The first interpretation of natural flow, that all flow in the watercourse is included, would make a western province responsible for apportioning water it has no jurisdiction over; the second interpretation relies on an assumption that a particular case can be extrapolated to a general principle.

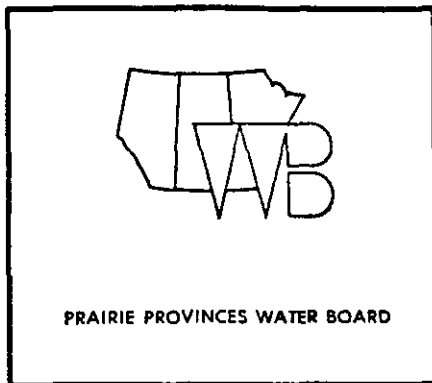
The Agreement deals clearly with eastward flowing streams and tributaries but not with westward flowing streams or tributaries that cross an interprovincial boundary. Thus, there is a need to develop guidelines that may be used to deal with westward flowing waters, and to allow the upstream and downstream provinces to share these waters equitably.

Conclusions

It is concluded that:

1. Streams flowing from Manitoba to Saskatchewan and from Saskatchewan to Alberta are not watercourses as defined in the 1969 Agreement.
2. Waters flowing from Manitoba to Saskatchewan and from Saskatchewan to Alberta are not specifically covered by the 1969 Agreement. There is no specific provision in the 1969 Agreement for Saskatchewan to share westward flowing waters with Alberta, or for Manitoba to share similar waters with Saskatchewan. At the same time, these waters are not specifically excluded from the Agreement.

3. There is a need to develop guidelines that may be used to deal with westward flowing waters, and to allow the upstream and downstream provinces to share these waters equitably.



CHAPTER 4

EXTENT OF THE PROBLEM

The purpose of this chapter is to quantify the extent of the problem, in terms of gross drainage areas and yields of westward flowing tributaries of eastward flowing streams, and to comment on the significance of the problem in relation to apportionment of eastward flowing streams.

Figure 2 shows the locations of westward flowing tributaries of eastward flowing streams. Five of those streams cross the Alberta-Saskatchewan Boundary and eight cross the Saskatchewan-Manitoba Boundary.

Gross Drainage Areas of Westward Flowing Tributaries of Eastward Flowing Streams

The total gross drainage area contributing to westward flowing tributaries is 7 700 km² (square kilometres) at the Alberta-Saskatchewan Boundary and 38 100 km² at the Saskatchewan-Manitoba Boundary making a total of 45 800 km².

The tributaries to Reindeer Lake are the largest westward flowing tributaries and represent 71 percent of the total westward flowing tributary drainage areas. The remainder of the basins are relatively insignificant in size. A summary of the gross drainage area of each westward flowing tributary is given in Table 1.

Average Annual Yields and Unit Yields

The estimated average annual yield from all westward flowing tributaries is 8 352 000 dam³ (cubic decametres). About 5 percent or 452 000 dam³

Figure 2. Geographic Locations of Westward Flowing Tributary Areas.

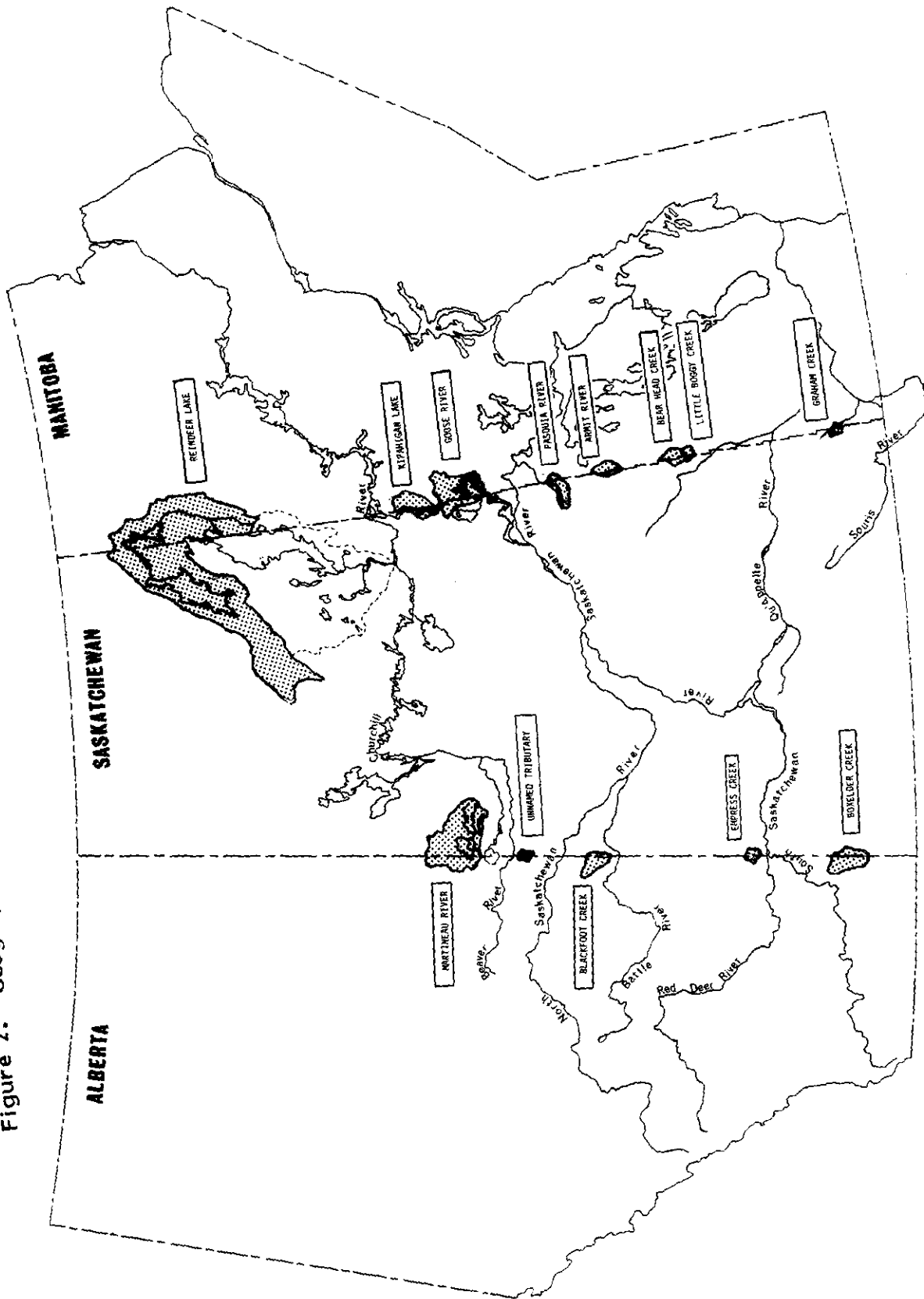


TABLE 1: GROSS DRAINAGE AREAS AND YIELDS OF WESTWARD FLOWING TRIBUTARIES OF EASTWARD FLOWING STREAMS

	Westward Flowing Tributary Basin	Eastward Flowing Stream	* Gross Drainage Area (km ²)	Estimated Annual Unit Yield (dam ³ /km ²)	*Estimated Annual Yield (dam ³)
Between Saskatchewan and Alberta	Blackfoot Creek	Battle River	704	9	6 300
	Boxelder Creek	S. Saskatchewan R.	1 126	16	18 000
	Empress Creek	Red Deer River	322	5	1 600
	Martineau River	Waterhen River	5 345	79	422 000
	Unnamed Tributary	Redspring Creek	216	17	3 700
	*Sub-total		7 700		452 000
Between Manitoba and Saskatchewan	Armit River	Armit River	429	56	24 000
	Bear Head Creek	Bear Head Creek	551	46	25 400
	Goose River	Saskatchewan River	2 615	112	293 000
	Graham Creek	Graham Creek	263	3	790
	Kipahigan Lake	Churchill River	1 142	112	128 000
	Little Boggy Creek	Assiniboine River	60	27	1 620
	Pasquia River	Pasquia River	661	75	49 600
Reindeer Lake	Churchill River	32 380	228	7 383 000	
	*Sub-total		38 100		7 900 000
	*TOTAL		45 800		8 352 000

* Figures have been rounded.

originates upstream from the Alberta-Saskatchewan Boundary, and 95 percent or 7 900 000 dam³ originates upstream from the Saskatchewan-Manitoba Boundary.

The estimated annual yield of westward flowing tributaries to Reindeer Lake is 7 383 000 dam³, 88 percent of the total yield of identified westward flowing tributaries of eastward flowing streams. Table 1 summarizes unit yield and average annual yield for each of the 13 westward flowing tributary drainage areas and a detailed map and a description of each westward flowing tributary of an eastward flowing stream is given in Appendix A.

Alberta-Saskatchewan Boundary

The Martineau River is the largest of the five westward flowing tributaries crossing the Saskatchewan-Alberta Boundary (see Figure A-4 on page A-10

of Appendix A). Apportionment of Martineau River flow may become a concern if heavy oil plants are developed in the region.

Boxelder Creek crosses the interprovincial boundary in a westerly direction and drains to Many Island Lake which straddles the boundary between Alberta and Saskatchewan (see Figure A-2 on Page A-6 of Appendix A). Natural flow of Boxelder Creek at the Alberta-Saskatchewan Boundary includes water from drainage areas in both Alberta and Saskatchewan with two thirds of the total gross drainage area in Alberta and one third in Saskatchewan. The interprovincial apportionment problems of Boxelder Creek have been referred to the Committee on Interjurisdictional Agreements Administration.

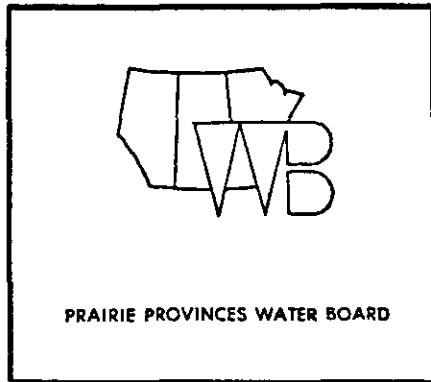
The remaining three creeks may have local problems with regard to apportionment but their total flow is so small that they will, in total, have no measurable effect at the Alberta-Saskatchewan Boundary on the rivers they are tributary to and no effect on apportionment at the Saskatchewan-Manitoba Boundary.

Saskatchewan-Manitoba Boundary

Apportionment of the eight streams crossing the Saskatchewan-Manitoba Boundary involves only those two provinces. In some cases, apportionment of tributary flows may have to be taken into consideration when apportioning the main stems. Reindeer Lake Basin and Goose River Basin are relatively large tributaries but, at the present time, there are no interprovincial problems involving them or any of the other six westward flowing tributaries.

Conclusion

With the exceptions of Boxelder Creek and the Martineau River, there are currently no problems that may require monitoring of apportionment of these waters at this time.



CHAPTER 5

**ALTERNATIVE METHODS
FOR THE APPORTIONMENT
OF WESTWARD FLOWING TRIBUTARIES
OF EASTWARD FLOWING STREAMS**

The purpose of this chapter is to discuss five apportionment methods that were considered to deal with westward flowing tributaries of eastward flowing streams and to recommend the most suitable apportionment method. The approaches considered would divide the flow between two or more jurisdictions. No attempt was made to introduce either the current state of regulation or the current use of water in developing alternative apportionment methods.

The five methods considered are discussed in the following sections.

Method 1: Mutual Agreement Method

In Method 1, westward flowing tributary basins are treated as a part of the total basin (i.e. eastward flowing stream basin) in which flow at provincial boundaries is subject to apportionment based on the terms of the 1969 Agreement. Flow that arises in a westward flowing tributary basin is included in computation of the flow subject to apportionment of the eastward flowing stream.

Flow arising in the westward flowing tributary basin is apportioned by mutual agreement between the provinces providing the terms of the 1969 Agreement are met. Any withdrawal from the tributary basin by either province is a charge to that province when apportioning flow at the apportionment points of the eastward flowing streams.

The primary advantage of this method is that flow arising in westward flowing tributary basins is recognized as a part of eastward flowing streams and the natural flow of eastward flowing streams is apportioned as usual.

The provinces could, based on current and future water requirements, make individual arrangements on each westward flowing tributary of an eastward flowing stream to best suit their combined purposes.

Method 2: Straight Half Method

In Method 2, natural flow originating in an upstream province is equally divided each time an interprovincial boundary crossing is encountered. The total provincial share for the tributary is the sum of the flows apportioned to that province on that tributary. A schematic diagram showing how this tributary flow is apportioned is shown in Figure B-1 on page B-3 of Appendix B.

The complexity of this method increases rapidly as the number of boundary crossings increases. The share of flow for each province depends upon the number of boundary crossings encountered. Thus, a province's share of the water originating in that province will increase as the number of downstream boundary crossings increases and more boundary crossings will result in more flow being apportioned to the upstream province.

Method 3: Conveyance Method

Schedules A and B define how water flowing from Alberta to Saskatchewan and from Saskatchewan to Manitoba should be apportioned. Apportionment of westward flowing tributaries of eastward flowing streams may be determined by considering the approach described in Schedule A and Schedule B of the 1969 Agreement. In Method 3, flow is apportioned in a west to east direction. All flow arising in the Alberta portion of westward flowing tributaries is apportioned as in Article 3 of Schedule A in that Alberta retains 50 percent of the flow originating in Alberta and passes the remaining 50 percent to Saskatchewan. Similarly, with reference to Article 3 of Schedule B, flow originating in the Saskatchewan portion of westward flowing tributaries and recorded flow passing from Alberta are apportioned equally between Manitoba and Saskatchewan (see Figure B-4 on page B-6 of Appendix B).

The natural flow arising in the Alberta portion of the westward flowing tributaries is considered part of the natural flow at the Alberta-Saskatchewan Boundary. Natural flow originating in the Saskatchewan portion of the westward flowing tributaries is included in the computation of natural flow at the Saskatchewan-Manitoba Boundary. Flow from any source area is apportioned only once at each province. If multiple crossings occur, the tributary is treated as a conveyance channel with waters not subject to re-apportionment each time a boundary is crossed.

Method 4: Exclusion Method

In Method 4, the Exclusion Method, Saskatchewan has no provision to share westward flowing waters with Alberta, and Manitoba has no provision to share similar waters with Saskatchewan. Waters arising in westward draining areas are not subject to apportionment under the 1969 Agreement; therefore, as there is no sharing required, the province in which westward flowing water originates may retain 100 percent of these flows.

This method is similar to Method 3 (Conveyance Method) but water arising in a westward draining area is not subject to apportionment. Saskatchewan can retain 100 percent of the flow arising in the Saskatchewan portion of a westward draining area, and similarly, 100 percent of the water arising in Manitoba can be used by that province (see Figure B-7 on page B-10 of Appendix B).

This method is included as an alternative to acknowledge the fact that the 1969 Apportionment Agreement does not mention westward flowing waters.

Method 5: Rational Method

In Method 5, the province in which the water originates is entitled to 50 percent of that water and the rest of the water is divided equally between the downstream provinces (see Figure B-10 on page B-14 of Appendix B).

The method is similar to Method 3 in that water from any area is apportioned only once. The essential difference is that any province through which water flows from its origin to its destination is considered in the apportionment. For example, water originating in Saskatchewan and flowing into Alberta enroute to Manitoba is apportioned 50 percent to Saskatchewan, 25 percent to Alberta, and 25 percent to Manitoba. The apportionment is between provinces, not between various regions, so a province is allowed to remove its apportionment entitlement wherever it is most convenient, provided that in so doing the depletion is equitable.

Discussion of the Five Alternative Methods

Method 5, the Rational Method, is considered to be the best and most equitable method to apportion the flow of westward flowing tributaries of eastward flowing streams because the resultant shares of water for each province would closely adhere to the spirit and intent of the 1969 Master Agreement on Apportionment. No amendment of the existing Agreement is required to adopt the Rational Method of apportionment because it does not affect the apportionment of interprovincial water in eastward flowing watercourses.

Method 1 (Mutual Agreement Method) suggests that westward flowing tributaries of eastward flowing streams be apportioned according to a mutually agreeable apportionment ratio. This method may require individual arrangements between the provinces affected to be administered effectively.

Method 2 (Straight Half Method) treats each boundary crossing as a new boundary of a totally different province. It is impractical when dealing with westward flowing tributaries that have multiple boundary crossings and is less effective than Method 5 where the flow is apportioned only once.

The essential difference between Method 3 (Conveyance Method) and Method 5 is that Method 3 does not recognize that both easterly and westerly provinces should have the opportunity to share westward interprovincial flow. In Method 3 water arising in a westerly province is shared only with an easterly province while Method 5 considers the province through which the water flows

from its origin to its destination in the apportionment. Consequently, Method 3 penalizes the province receiving westward flowing water that must be returned to the downstream province(s). Regardless of which boundary crossing is considered, the most westerly province would receive more than its fair share.

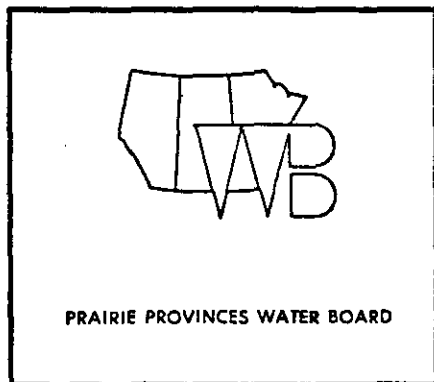
If Method 4 (Exclusion Method) is used the province in which the westward flowing water originates can retain 100 percent of the flow without sharing it with the downstream provinces. This concept departs from the intent of the 1969 Agreement that interprovincial flow be apportioned equitably among the provinces.

The five methods are assessed in more detail in Appendix B.

Conclusions

It is concluded that any westward flowing tributary of an eastward flowing stream may be apportioned following the basic principles and intent of the 1969 Apportionment Agreement and that, in so doing, there is no violation of that Agreement.

Therefore, it is recommended that the Rational Method described in this report be considered for the apportionment of westward flowing tributaries of eastward flowing streams. For such westward flowing waters the Rational Method specifies that the province in which the water originates is entitled to 50 percent of that water and the other 50 percent is divided equally between the downstream provinces. Method one (the Mutual Agreement Method) may also be considered for dealing with specific problem areas if the Rational Method is not deemed appropriate.



APPENDIX A

DETERMINATION OF YIELDS
OF WESTWARD FLOWING TRIBUTARIES
OF EASTWARD FLOWING STREAMS

This appendix provides maps of westward flowing tributaries of eastward flowing streams, narrative descriptions of the tributary areas, and the probable average yields from these tributaries.

The maps show the identified tributary that crosses the provincial boundary and the eastward flowing stream into which the westward flowing tributary drains.

The text describes the areas and gives details of the estimated unit yield that was developed. Average annual flows, gross drainage areas, and periods of record for gauging stations used in the computations are given. The rationale for the station used is discussed and problems encountered are also described.

Data Sources

In many cases, the period of record at the gauging station used to determine yields is quite short (four to six years). Yields during the years 1974 to 1975 were above average in most of the areas under consideration and, with a short period of record, these years can greatly influence the mean value. Short records were adjusted where possible to offset this tendency by using a nearby long term station. The adjusted value at the short term station was derived by multiplying the mean annual flow by a ratio of the mean for the full period to the mean of the short period at the long term station.

At some of the stations, only a seasonal record is available. When the winter flows are zero, seasonal records are adequate but in some cases it was

necessary to estimate winter flow. This was done by assuming a winter recession using the hydrograph shape at a nearby station. The estimates of winter flow were made in the fastest and simplest manner possible and, while they are adequate for the purposes intended, the reader is cautioned against their use in more detailed water resource evaluations.

Index to Maps and Descriptions of
Identified Westward Flowing Tributary Basins

Boundary Area	Westward Flowing Tributary Basin	Page Number
Between Saskatchewan and Alberta	Blackfoot Creek	A- 4
	Boxelder Creek	A- 6
	Empress Creek	A- 8
	Martineau River	A-10
	Unnamed Tributary	A-12
Between Manitoba and Saskatchewan	Armit River	A-14
	Bear Head Creek	A-16
	Goose River	A-18
	Graham Creek	A-20
	Kipahigan Lake	A-22
	Little Boggy Creek	A-24
	Pasquia River	A-26
Reindeer Lake	A-28	

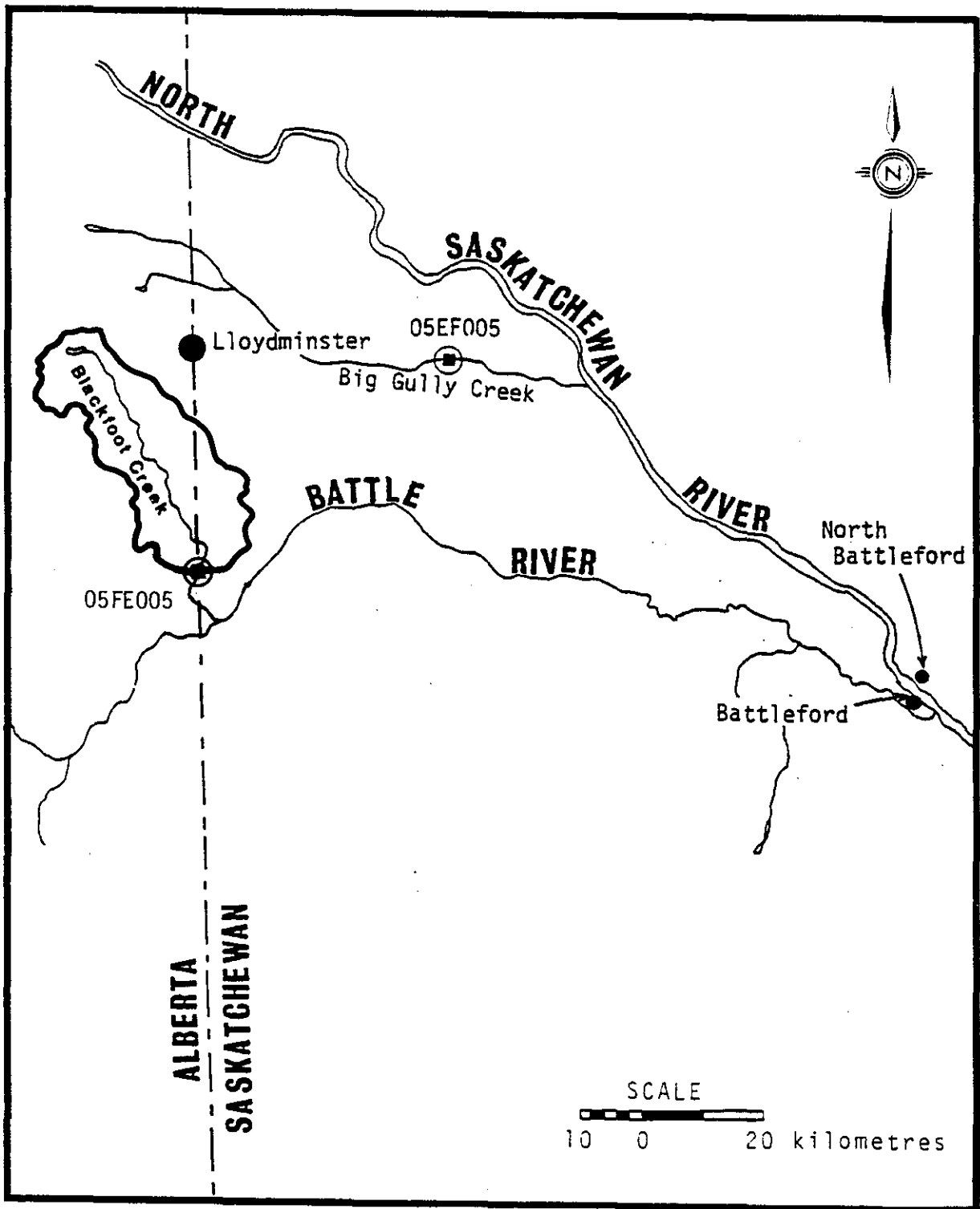


Figure A- 1 BLACKFOOT CREEK BASIN Tributary to the Alberta-Saskatchewan Boundary.

BLACKFOOT CREEK BASIN

The headwater area of Blackfoot Creek is approximately 20 km west of the City of Lloydminster. The creek flows first in a southeasterly direction for about 30 km then primarily in a southerly direction crossing the Alberta-Saskatchewan Boundary three times before it joins the Battle River in Saskatchewan.

The area tributary to Big Gully Creek near Maidstone (05EF005), with a period of record extending from 1971 to 1981, was used to determine unit yield for the Blackfoot Creek basin.

A hydrometric gauging station, Blackfoot Creek near the Alberta Boundary (05FE005), installed in 1980, has two years (1980-81) of flow record available. The two years of flow record were used to adjust the annual yield determined at Big Gully Creek near Maidstone station. Unit yield of the Blackfoot Creek basin was estimated as follows:

Big Gully Creek near Maidstone (05EF005) 1971-1981 = 20 100 dam³/yr
 Big Gully Creek near Maidstone (05EF005) 1980-1981 = 5 765 dam³/yr
 Blackfoot Creek near Alberta Boundary (05FE005) 1980-1981 = 1 770 dam³/yr
 Blackfoot Creek near Alberta Boundary corrected for length of record =

$$1\ 770 \times \frac{20\ 100}{5\ 765} = 6\ 170\ \text{dam}^3/\text{yr}$$

Gross Drainage Area of Blackfoot Creek Basin = 704 km²
 Unit Yield = 9 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Alberta portion of the basin	547	4 900
Saskatchewan portion of the basin	157	1 400
TOTAL	704	6 300

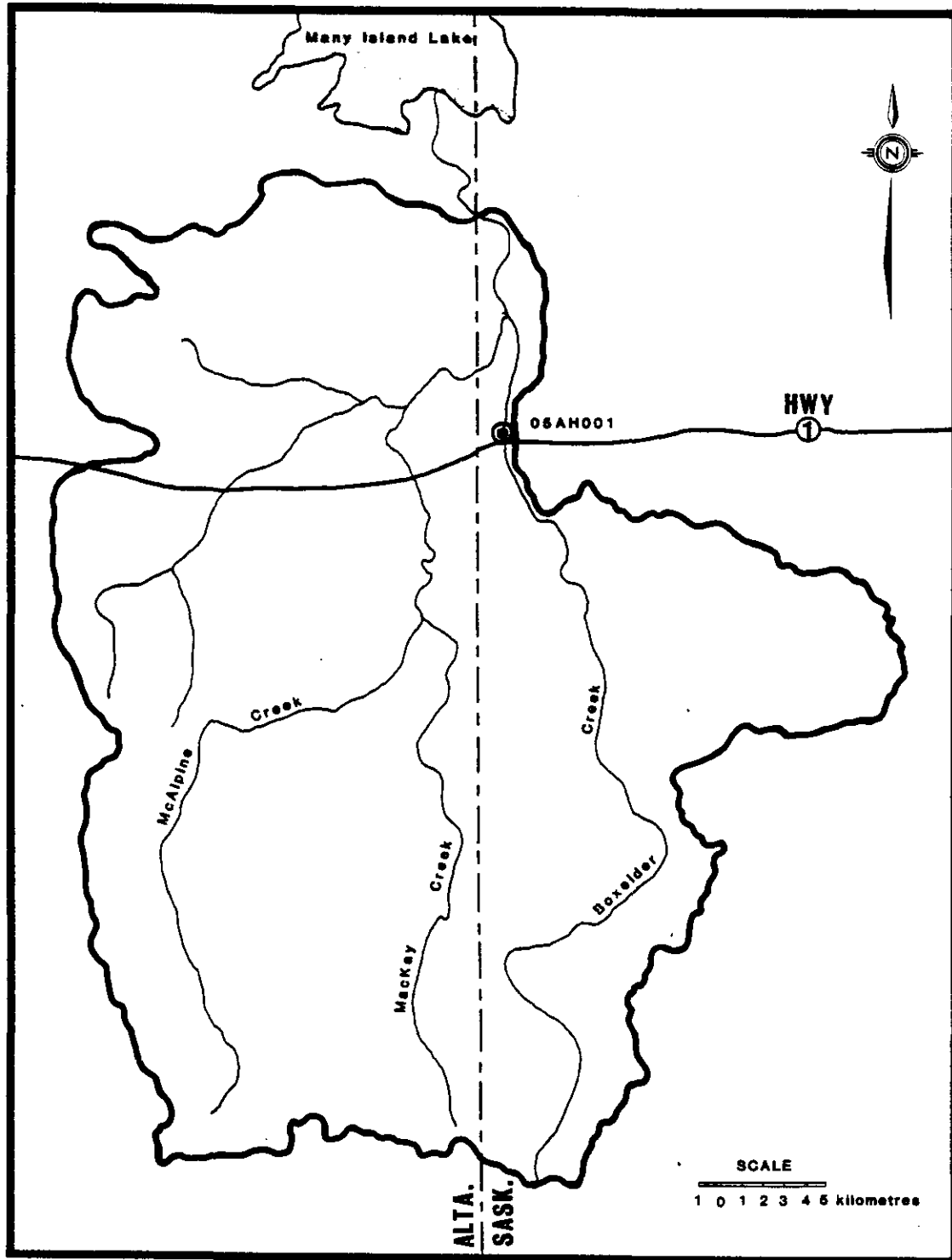


Figure A- 2 BOXELDER CREEK BASIN Tributary to the Alberta-Saskatchewan Boundary.

BOXELDER CREEK BASIN

The Many Island Lake Basin is an internal drainage basin straddling the Alberta-Saskatchewan Boundary and Boxelder Creek is a tributary to Many Island Lake. The creek rises in Saskatchewan and flows primarily north until it crosses the Saskatchewan-Alberta Boundary. In a normal year the water of Many Island Lake does not contribute flow to an eastward flowing stream, therefore, the creek may be called a westward flowing stream. In a flood year, however, the water overflows from the lake to Bigstick Lake. Therefore, to some extent, the creek may be considered a westward flowing tributary of an eastward flowing stream.

MacKay Creek is the main tributary to Boxelder Creek. The creek rises on the north slopes of the Cypress Hills in Alberta, flows in a northerly direction, then turns east and crosses the Alberta-Saskatchewan Boundary to join Boxelder Creek in Saskatchewan. Because the creek flows from Alberta to Saskatchewan, it may be classified as either an eastward flowing stream or an eastward flowing tributary.

The gross drainage area of Boxelder Creek at the Alberta-Saskatchewan Boundary is 1 126 km². Natural flows at the Alberta-Saskatchewan Boundary for the years 1911 to 1978 were estimated by Water Survey of Canada in a report entitled "Natural Flow - Boxelder Creek and MacKay Creek at Alberta-Saskatchewan Boundary." Average annual natural flow at the boundary ranged from 843 to 90 912 dam³ with an average of 18 506 dam³. Unit yield of the area was estimated as follows:

Gross Drainage Area at Alberta-Saskatchewan Boundary = 1 126 km²
Unit Yield = 16 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Alberta portion of the basin	750	12 000
Saskatchewan portion of the basin	376	6 000
TOTAL	1 126	18 000

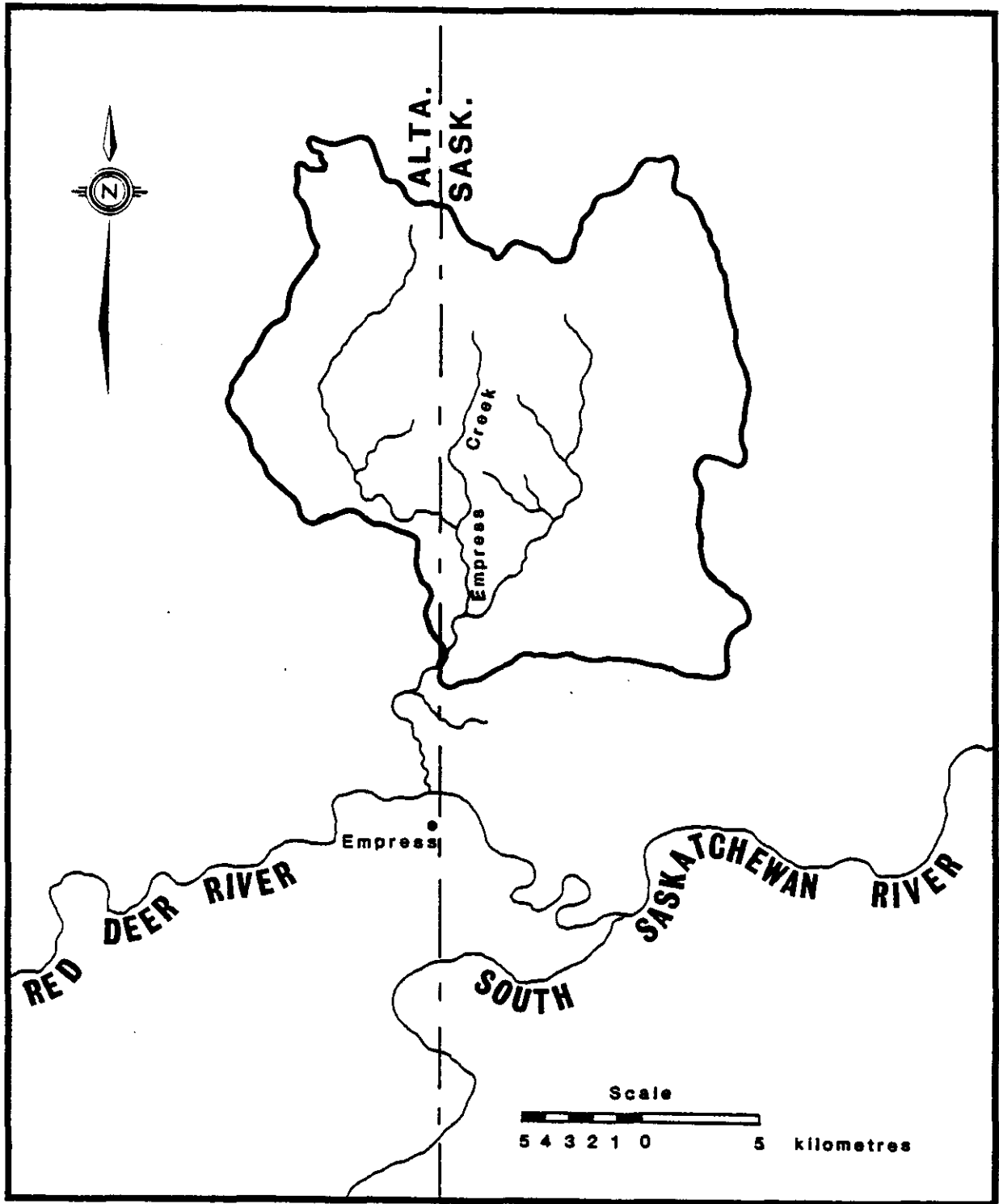


Figure A- 3 EMPRESS CREEK BASIN Tributary to the Alberta-Saskatchewan Boundary.

EMPRESS CREEK BASIN

The main stem of Empress Creek flows in a southerly direction, somewhat parallel to the Alberta-Saskatchewan Boundary, for about 15 km. The Creek then turns west, crosses the boundary, and joins the eastward flowing Red Deer River at about one km north of the Town of Empress, Alberta. The Red Deer River then crosses the Alberta-Saskatchewan Boundary and joins the South Saskatchewan River in Saskatchewan. There are two major tributaries that contribute to flow in Empress Creek. One originates in Saskatchewan and flows west to join the Creek. The other originates in Alberta and flows east crossing the boundary to join the Creek.

A nearby hydrometric gauging station, Alkali Creek near the Mouth (05CK005), has records dating back to 1962. Flow records of this station were used to estimate unit yield in the Empress Creek basin. The unit yield was estimated as follows:

Alkali Creek near the Mouth (05CK005) 1962 - 1979 = 2 750 dam³/yr

Gross Drainage Area = 590 km²

Unit Yield = 5 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Alberta portion of the basin	97	500
Saskatchewan portion of the basin	225	1 100
TOTAL	322	1 600

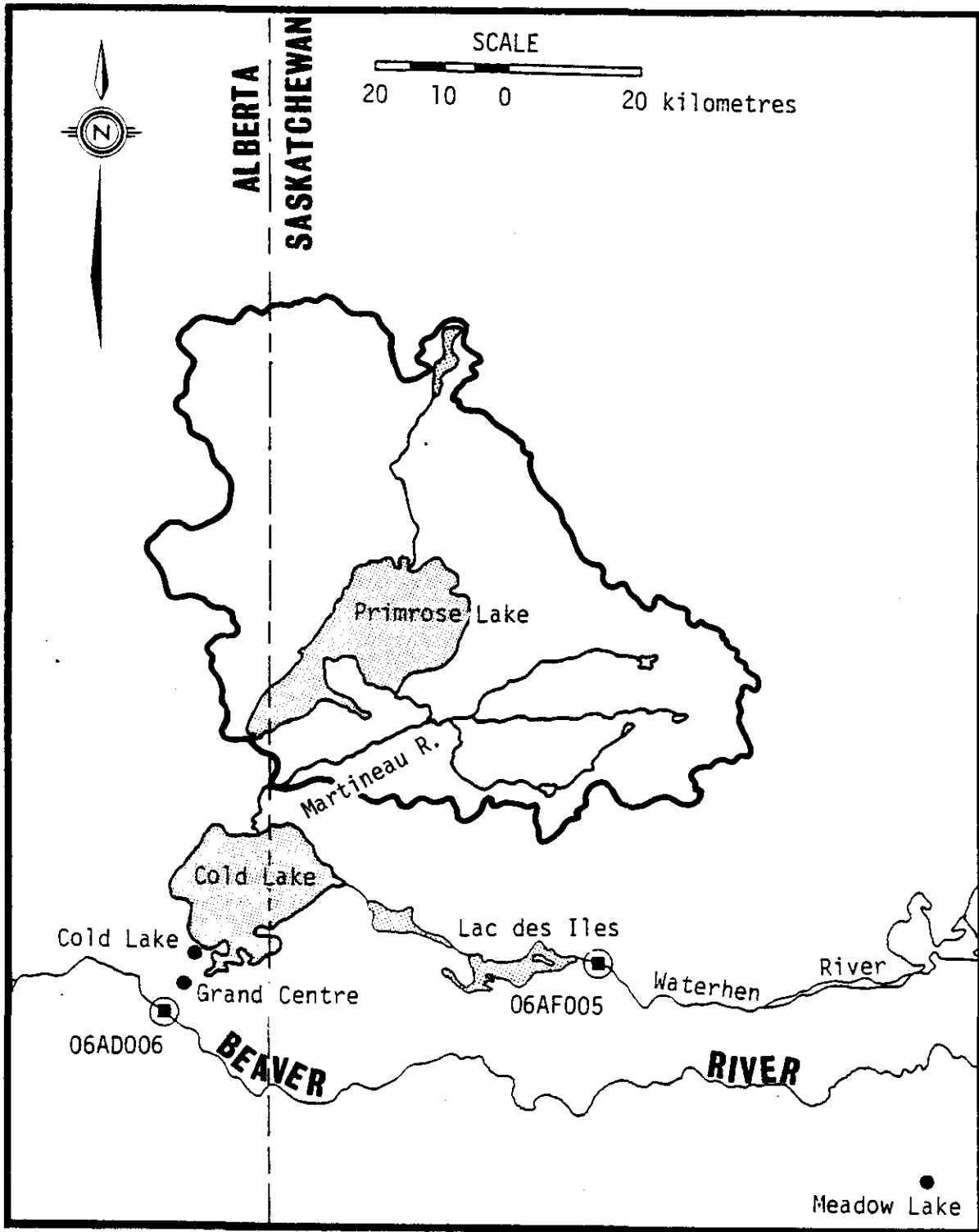


Figure A- 4 MARTINEAU RIVER BASIN Tributary to the Alberta-Saskatchewan Boundary.

MARTINEAU RIVER BASIN

The Martineau River drains Primrose Lake and flows west across the Saskatchewan-Alberta Boundary into Cold Lake. Cold Lake, which straddles the boundary, is in turn drained by the eastward flowing Waterhen River.

The westward draining portion of the Martineau River Basin forms a large part of the drainage area above the gauging station Waterhen River near Goodsoil (06AF005). This station was used to determine the yield of the westward flowing tributary area. Its records extend back to 1969 and the mean is influenced considerably by major floods in 1974 and 1975. The Beaver River at Cold Lake Reserve station (06AD006) has records dating back to 1956 and was used to offset this influence. The yields calculated for the Waterhen River above the gauging station near Goodsoil and the Beaver River at Cold Lake Reserve based on the period 1969-1979 were similar so it was felt the Beaver River station was very suitable to use in the correction procedure. Unit yield of the area was determined as follows:

Waterhen River near Goodsoil (06AF005)	1969-1979 = 670 000 dam ³ /yr
Beaver River at Cold Lake Reserve (06AD006)	1956-1979 = 860 000 dam ³ /yr
	1969-1979 = 936 000 dam ³ /yr

Waterhen River near Goodsoil corrected for length of record:

$$670\ 000 \times \frac{860\ 000}{936\ 000} = 616\ 000 \text{ dam}^3/\text{yr}$$

Gross Drainage Area = 7 772 km²

Unit Yield = 79 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Alberta portion of the basin	825	65 000
Saskatchewan portion of the basin	4 520	357 000
TOTAL	5 345	422 000

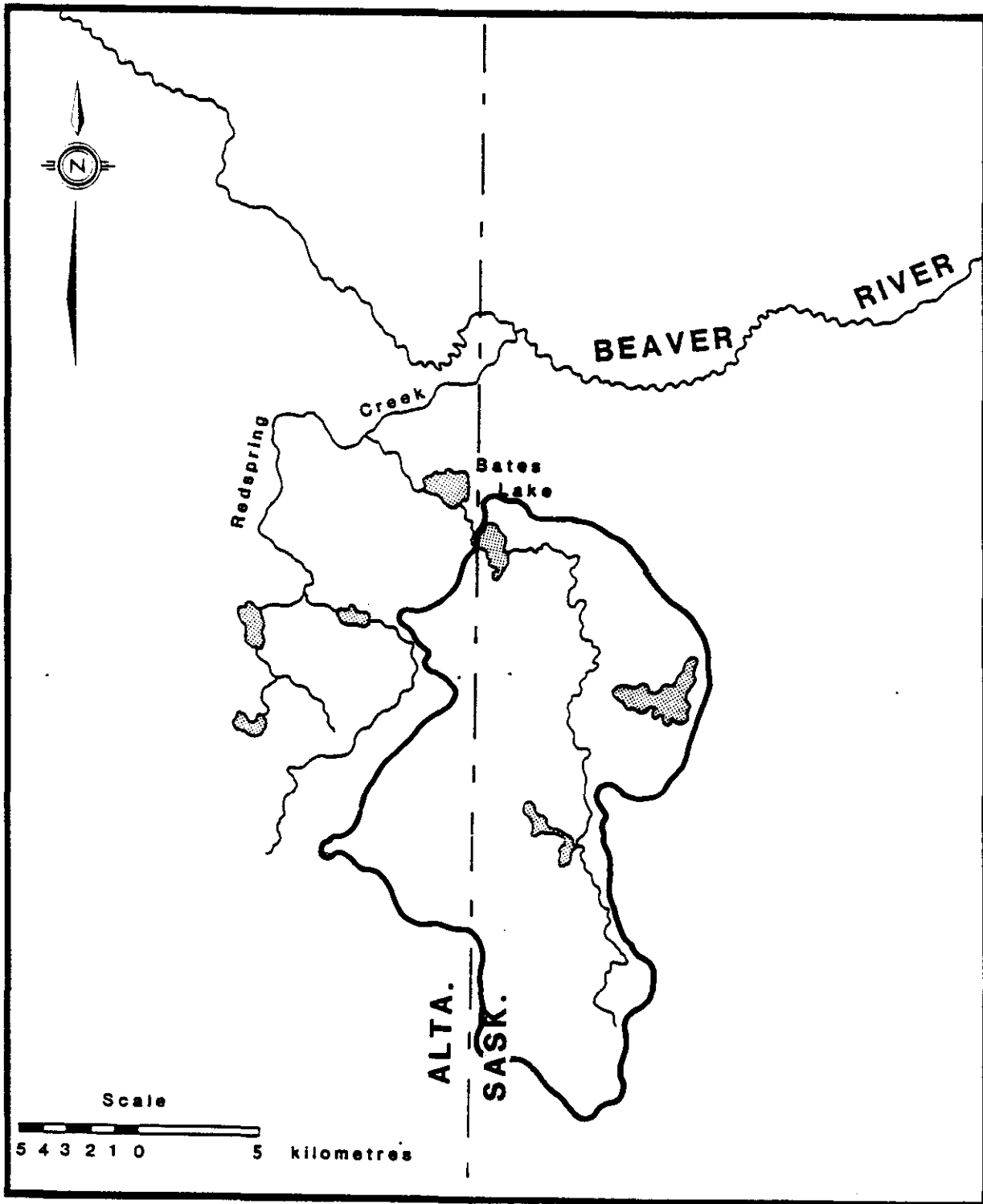


Figure A- 5 UNNAMED TRIBUTARY of Redspring Creek Tributary to the Alberta-Saskatchewan Boundary.

UNNAMED TRIBUTARY

Redspring Creek is an eastward flowing stream (watercourse) which rises in Alberta and flows northeast crossing the Alberta-Saskatchewan Boundary before entering the Beaver River. Part of the area tributary to this creek drains westward via an intermittent channel which crosses the boundary, flows into Bates Lake, and from there into Redspring Creek.

The area tributary to the gauging station on the Monnery River near Paradise Hill (05EF004) was used to determine the unit yield for the tributary area. The two basins are relatively close, lie in similar terrain, and there are no other data available for the area. Unit yield of the area was determined as follows:

Monnery River near Paradise Hill (05EF004) 1968-1979 = 15 200 dam³/yr
Gross Drainage Area = 875 km²
Unit Yield = 17 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Alberta portion of the basin	45	800
Saskatchewan portion of the basin	171	2 900
TOTAL	216	3 700

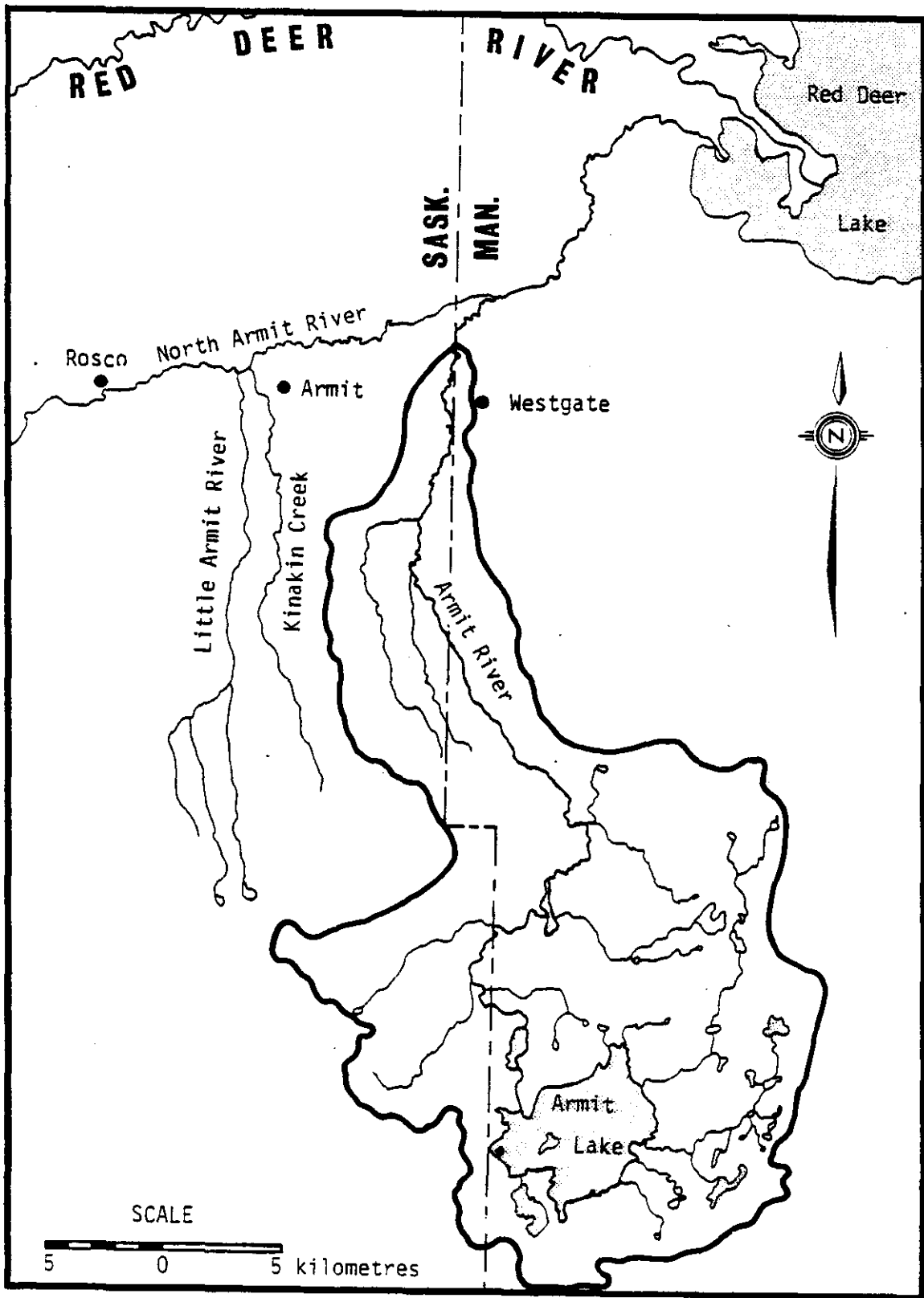


Figure A- 6 ARMIT RIVER BASIN Tributary to the Saskatchewan-Manitoba Boundary.

ARMIT RIVER BASIN

The Armit River drains a large portion of the north side of Porcupine Mountain. It starts at the outlet of Armit Lake in Manitoba, and flows in a northerly direction crossing the Manitoba-Saskatchewan Boundary several times before turning east, crossing the boundary one final time, and flowing into Red Deer Lake in Manitoba.

It may be reasonably assumed that the runoff characteristics of the north side of the mountain are somewhat similar to those of the south side. Therefore the Woody River near Bowsman (05LE004) was used to determine the unit yield of the area.

Woody River near Bowsman (05LE004) 1957-1979 = 118 000 dam³/yr
Gross Drainage Area = 2 108 km²
Unit Yield = 56 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Saskatchewan portion of the basin	132	7 400
Manitoba portion of the basin	297	16 600
TOTAL	429	24 000

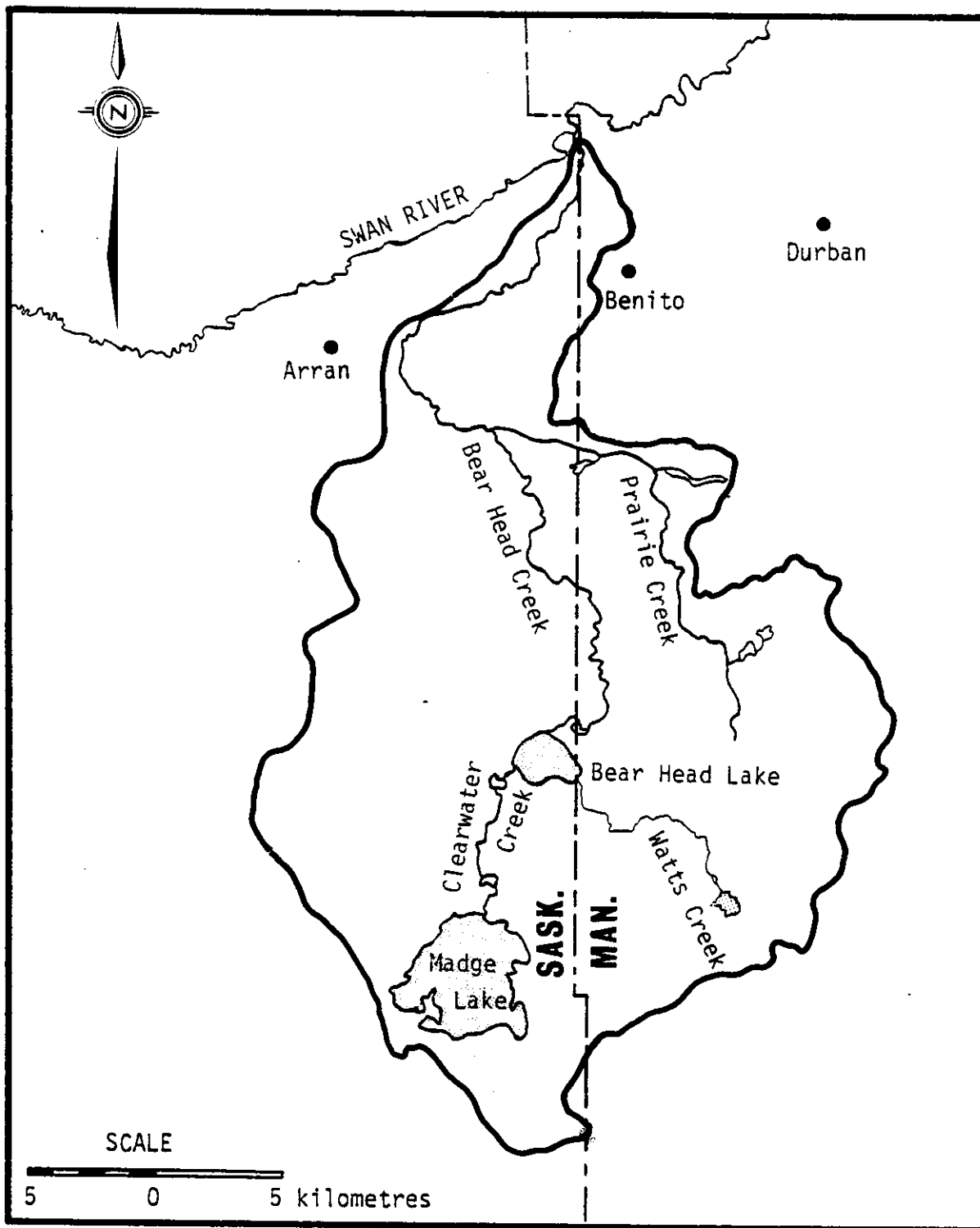


Figure A- 7 BEAR HEAD CREEK Basin Tributary to the Saskatchewan-Manitoba Boundary.

BEAR HEAD CREEK BASIN

Watts and Prairie Creeks drain the northwestern part of Duck Mountain. Watts Creek rises in Manitoba and flows into Bear Head Lake which lies across the Manitoba-Saskatchewan Boundary. Bear Head Lake is drained by Bear Head Creek. Prairie Creek also rises in Manitoba. It drains westward and joins Bear Head Creek just downstream of the boundary. Bear Head Creek in turn is tributary to the Swan River and joins this eastward flowing river just as it crosses the boundary.

The Bear Head Creek Basin is part of the drainage area tributary to the gauging station Swan River near Minitonas (05LE006). This station was used to estimate the unit yield of the area.

Swan River near Minitonas (05LE006) 1961-1979 = 195 000 dam³/yr
Gross Drainage Area = 4 232 km²
Unit Yield = 46 dam³/km²/yr

	Gross Drainage Area (km ²)	Est imated Annual Yield (dam ³)
Saskatchewan portion of the basin	325	15 000
Manitoba portion of the basin	226	10 400
TOTAL	551	25 400

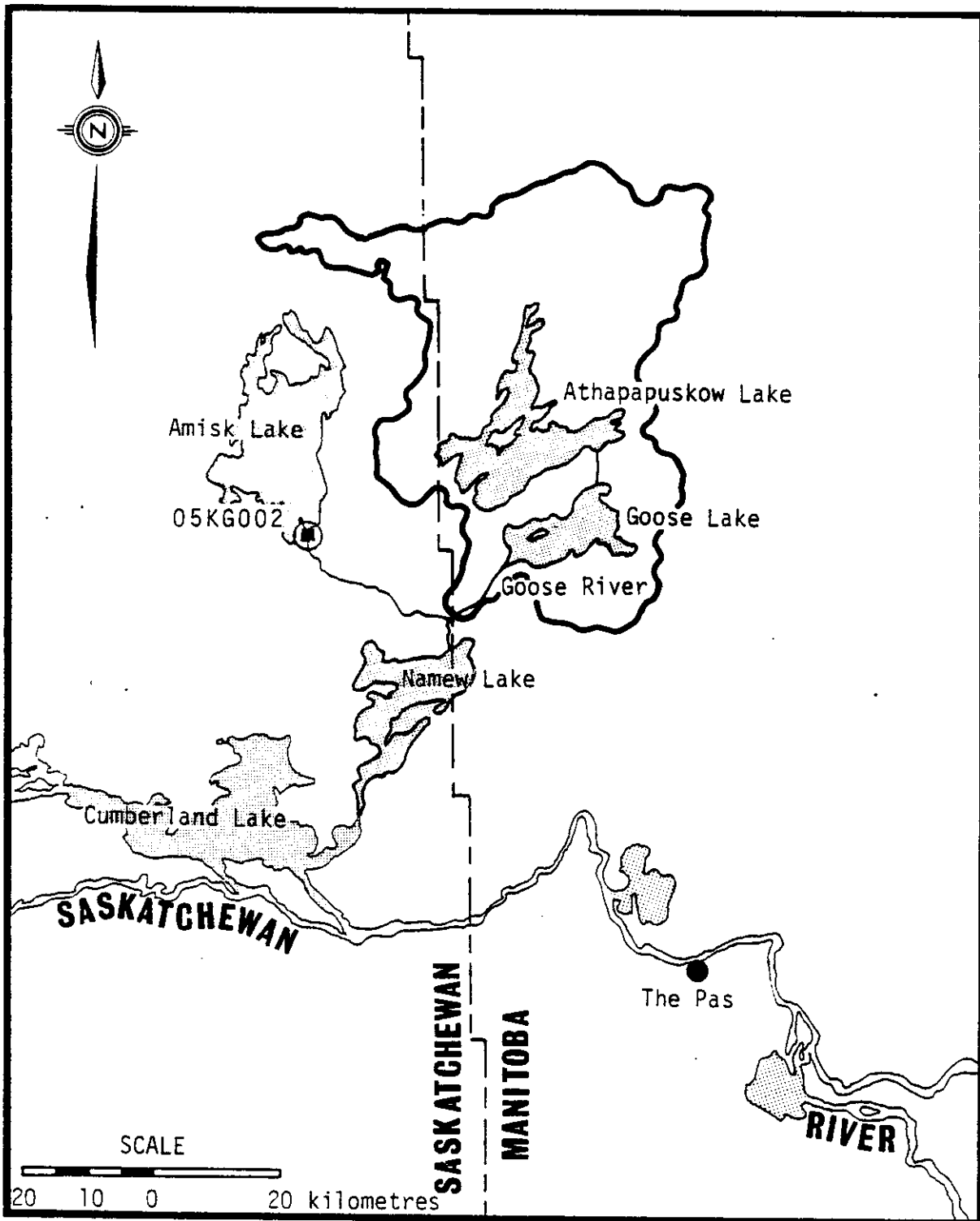


Figure A- 8 GOOSE RIVER BASIN Tributary to the Saskatchewan-Manitoba Boundary.

GOOSE RIVER BASIN

The Goose River flows in a westerly direction from Manitoba to Saskatchewan. It receives westward flowing waters from Athapapuskow and Goose Lakes and drains into Namew Lake which straddles the Manitoba-Saskatchewan boundary. The Sturgeon-weir River also drains into Namew Lake which in turn drains westward to Cumberland Lake, and enters the Saskatchewan River about 20 km upstream of the Saskatchewan-Manitoba Boundary.

The Goose River Basin tributary to the Manitoba-Saskatchewan Boundary is part of the larger Sturgeon-weir Basin above Sturgeon Landing. The area above the gauging station, Sturgeon-weir River at the Outlet of Amisk Lake (05KG002), was used to determine unit yield. The unit yield of the area was determined as follows:

Sturgeon-weir River at Outlet of Amisk Lake (05KG002) 1961-1979 = 1 640 000 dam³/yr

Gross Drainage Area = 14 630 km²

Unit Yield = 112 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Saskatchewan portion of the basin	375	42 000
Manitoba portion of the basin	2 240	251 000
TOTAL	2 615	293 000

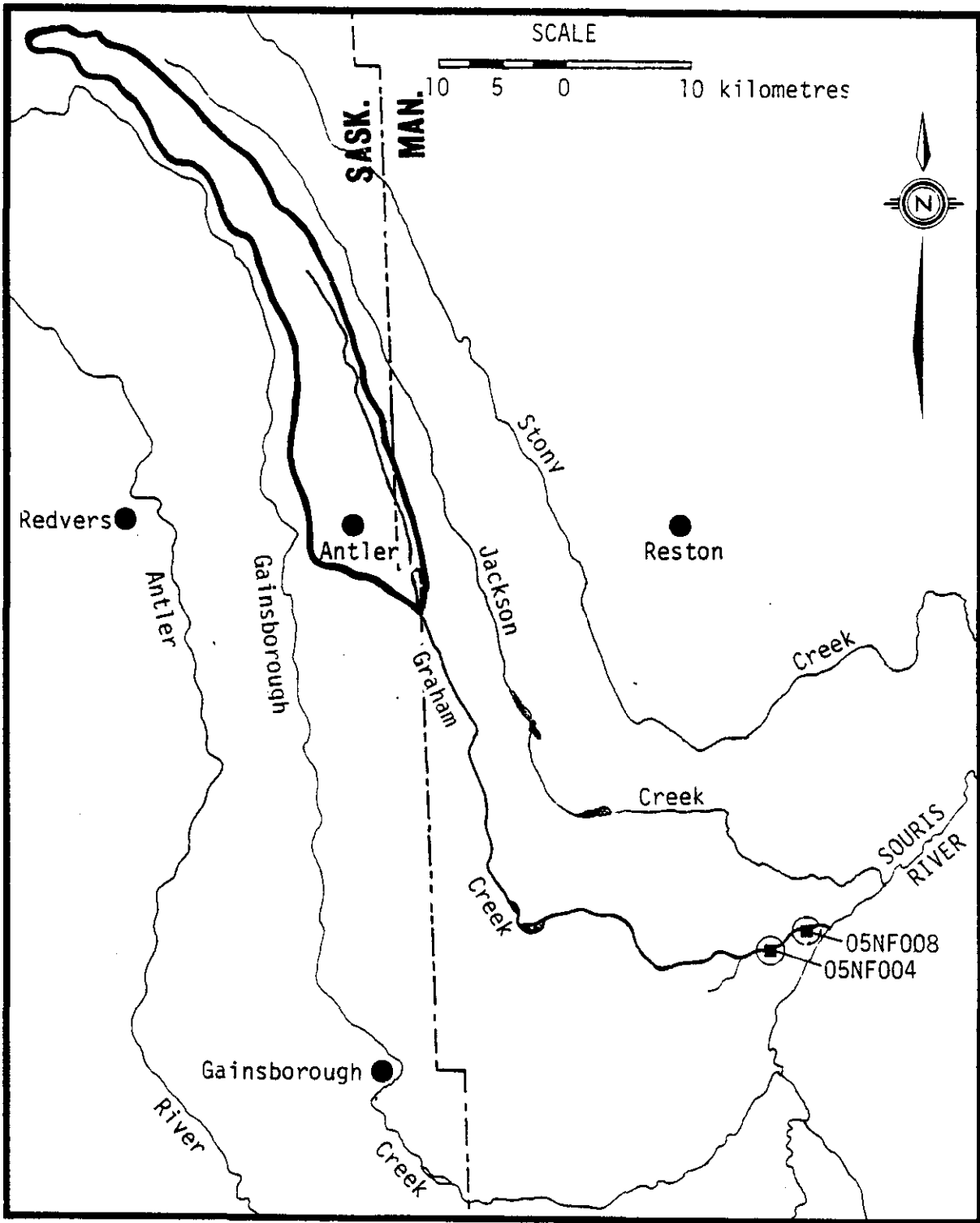


Figure A- 9 GRAHAM CREEK BASIN Tributary to the Saskatchewan-Manitoba Boundary.

GRAHAM CREEK BASIN

Graham Creek arises in the region immediately east of Moose Mountain Uplands, approximately 10 km south of the Town of Maryfield in southeastern Saskatchewan. The creek flows primarily in a southeasterly direction, somewhat parallel to the eastward flowing Stony Creek. There is a small area where the creek crosses the Saskatchewan-Manitoba Boundary three times before it permanently flows east.

The gross drainage area of Graham Creek at the Saskatchewan-Manitoba Boundary is 260 km². Natural flow at the Saskatchewan-Manitoba Boundary for the years 1912-1979 was estimated by the PFRA Hydrology Division in a report entitled "Natural Flow - Graham Creek at Saskatchewan-Manitoba Boundary". The average annual natural flow at the boundary ranged from 7 to 11 930 dam³ with an average of 813 dam³. The unit yield of the area was estimated as follows:

Gross Drainage Area at Saskatchewan-Manitoba Boundary = 263 km²
Unit Yield = 3 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Saskatchewan portion of the basin	252	760
Manitoba portion of the basin	11	30
TOTAL	263	790

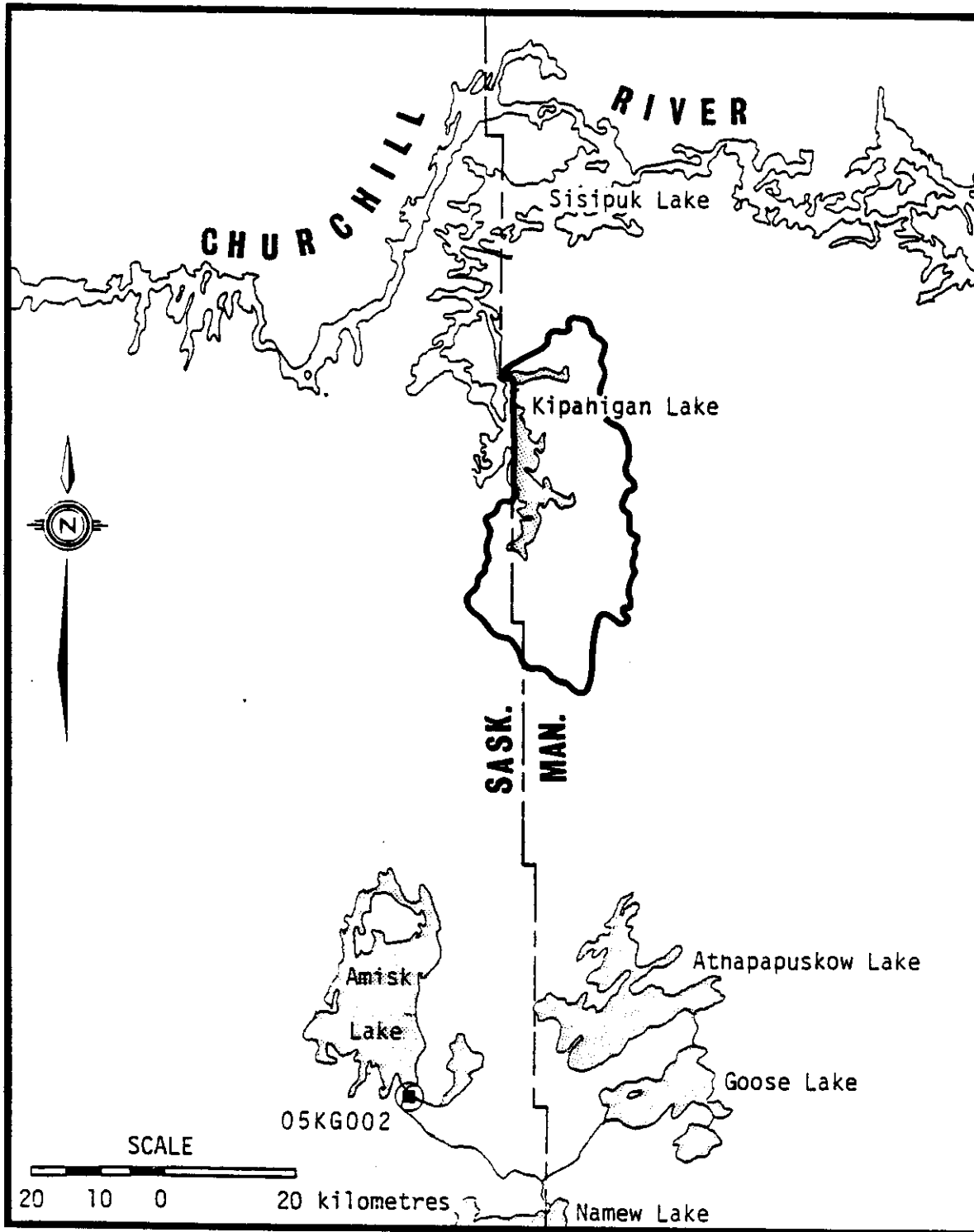


Figure A-10 KIPAHIGAN LAKE BASIN Tributary to the Saskatchewan-Manitoba Boundary.

KIPAHIGAN LAKE BASIN

Kipahigan Lake is a long and narrow lake which straddles the Saskatchewan-Manitoba Boundary. Water contributed to the lake from Saskatchewan and Manitoba flows northeasterly cross the Saskatchewan-Manitoba Boundary, and enters Sisipuk Lake which in turn flows into the eastward flowing Churchill River in Manitoba.

There are very few gauging stations in the area and the Sturgeon-weir River at the Outlet of Amisk Lake (05KG002) was chosen to determine the unit yield. The unit yield of the area was determined as shown below.

Sturgeon-weir River at Outlet of Amisk Lake (05KG002) 1961-1979 = 1 640 000 dam³/yr

Gross Drainage Area = 14 630 km²
Unit Yield = 112 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Saskatchewan portion of the basin	112	12 600
Manitoba portion of the basin	1 030	115 400
TOTAL	1 142	128 000

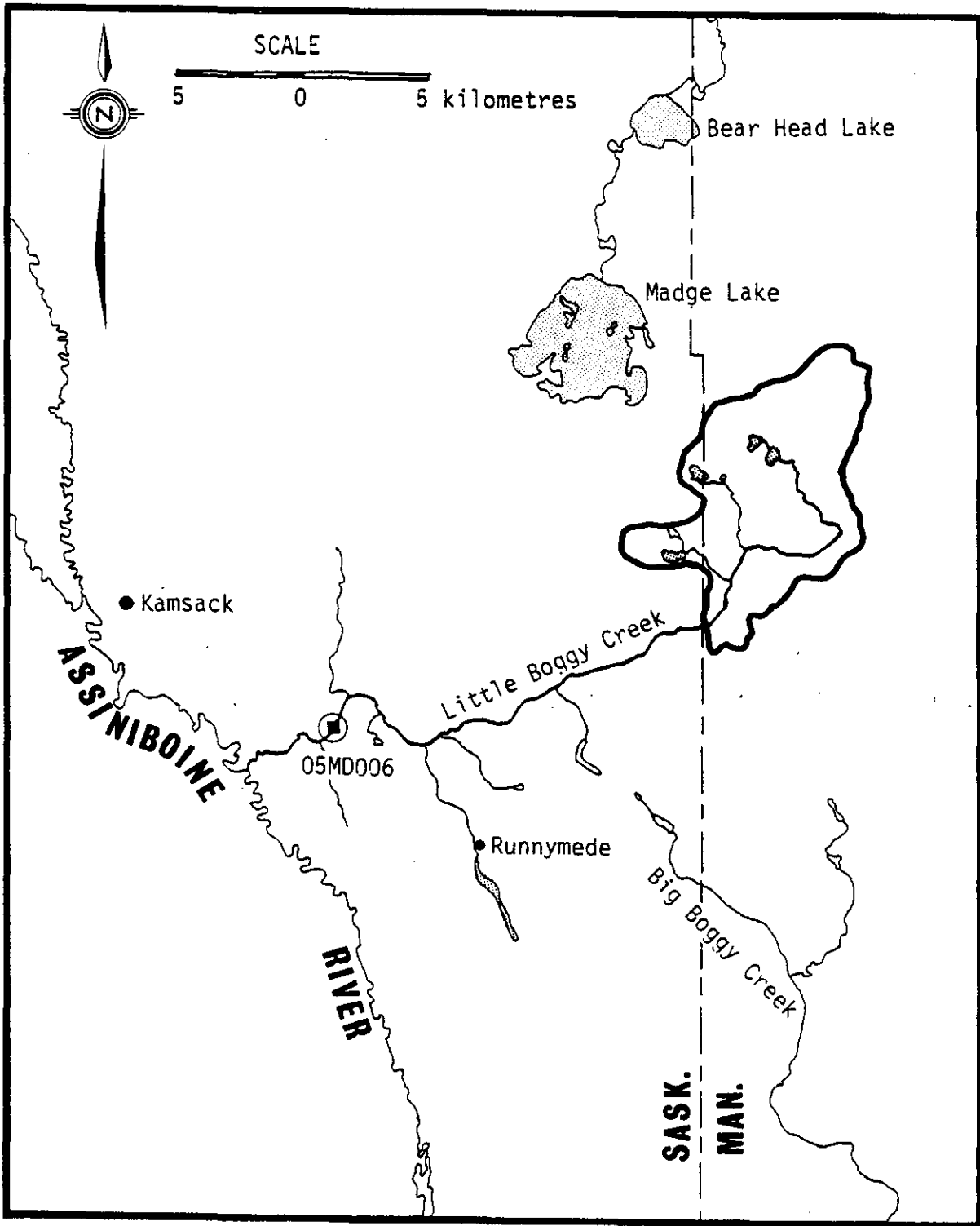


Figure A-11 LITTLE BOGGY CREEK BASIN Tributary to the Saskatchewan-Manitoba Boundary.

LITTLE BOGGY CREEK BASIN

Little Bogy Creek drains from the southwestern slopes of Duck Mountain, flows west across the Manitoba-Saskatchewan Boundary, and enters the Assiniboine River just south of Kamsack. The creek, which flows from east to west and is tributary to an eastward flowing stream, is a typical westward flowing tributary of eastward flowing stream. Records exist on this stream at a station near Cote (05MD006) for the period 1957-1973. The station was discontinued in 1974.

Unit yield of the area was derived as follows:

Little Bogy Creek near Cote (05MD006) 1957-1973 = 6 700 dam³/yr

Gross Drainage Area = 248 km²

Unit Yield = 27 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Saskatchewan portion of the basin	8	220
Manitoba portion of the basin	52	1 400
TOTAL	60	1 620

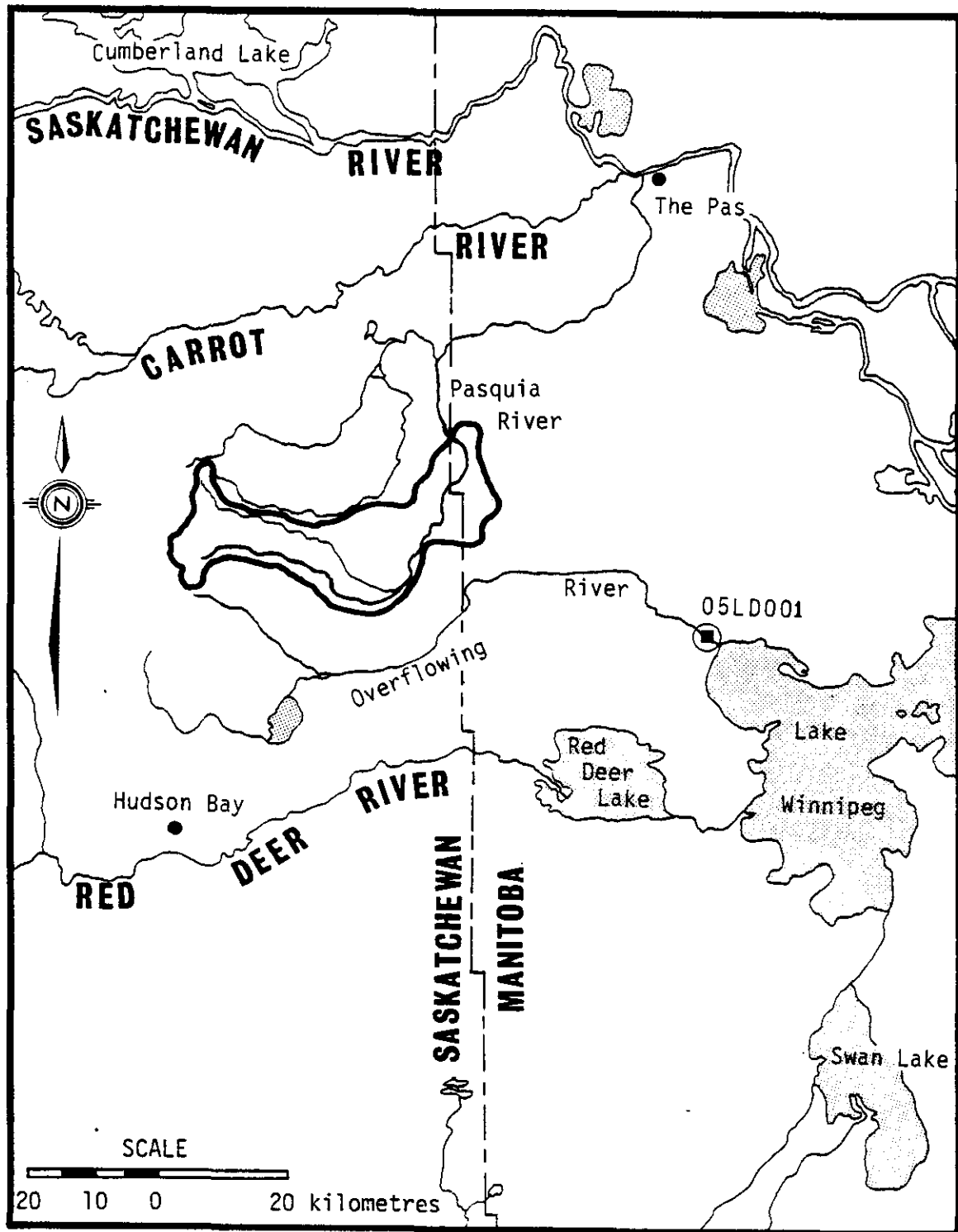


Figure A-12 PASQUIA RIVER BASIN Tributary to the Saskatchewan-Manitoba Boundary.

PASQUIA RIVER BASIN

The Pasquia River drains the east side of the Pasquia Hills and flows eastward and northeastward into Manitoba. The stream then flows back into Saskatchewan before turning east once more and flowing back into Manitoba to join the Saskatchewan River just upstream of The Pas.

The Pasquia River Basin lies adjacent to the drainage area above a gauging station on the Overflowing River (05LD001). This station, with records dating back to 1956, was used to determine the unit yield. Only a seasonal record is kept for this station so winter flows were estimated. Streams in this area, with winter records, had a characteristic recession hydrograph until January when base flow conditions were reached. These conditions usually lasted through February and March. This typical hydrograph was assumed to apply to the Overflowing River to synthesize winter flows.

Overflowing River at Overflowing River (05LD001) 1956-1979 = 267 000 dam³/yr
Gross Drainage Area = 3 550 km²
Unit Yield = 75 dam³/km²/yr

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Saskatchewan portion of the basin	567	42 500
Manitoba portion of the basin	94	7 100
TOTAL	661	49 600

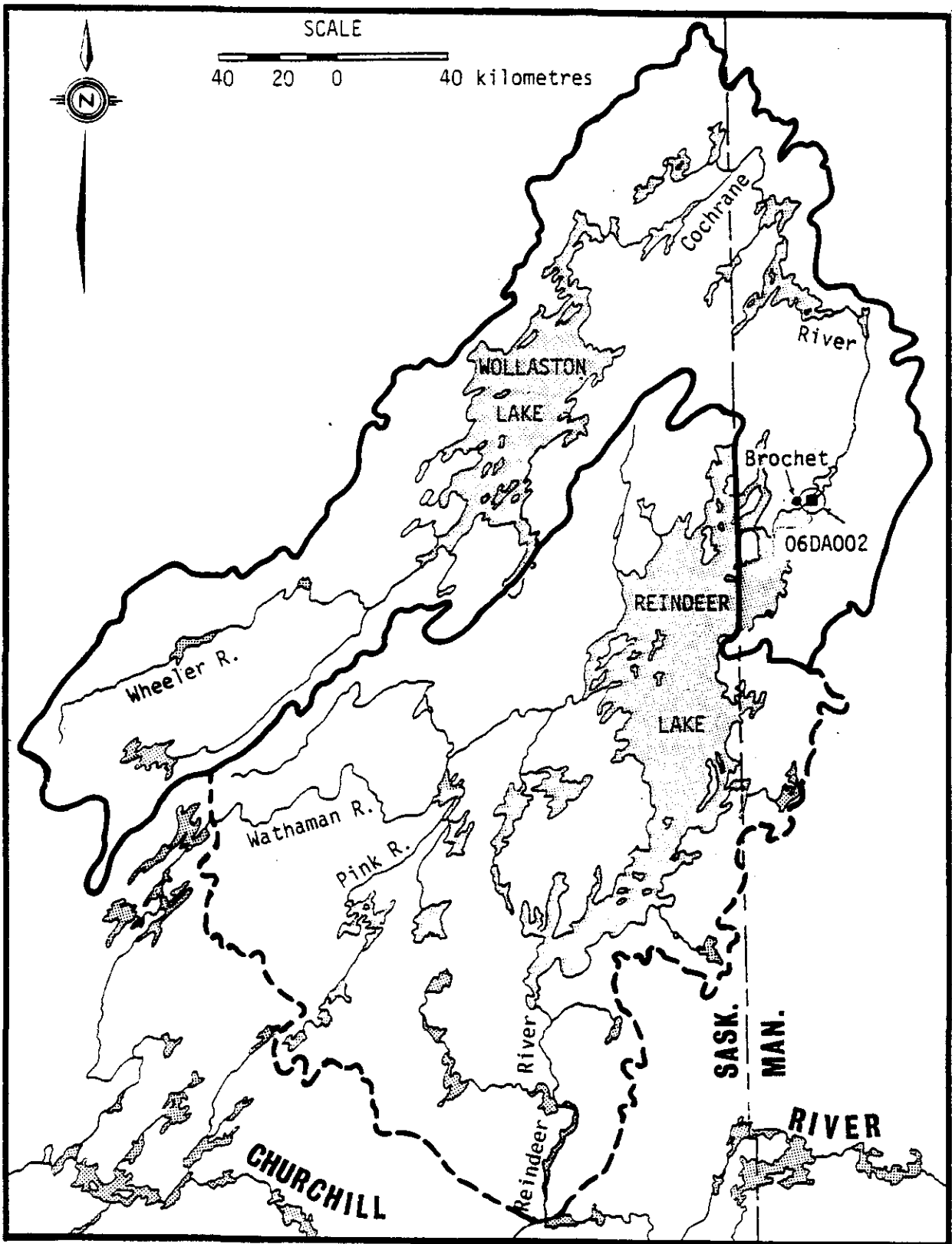


Figure A-13 REINDEER LAKE BASIN Tributary to the Saskatchewan-Manitoba Boundary.

REINDEER LAKE BASIN

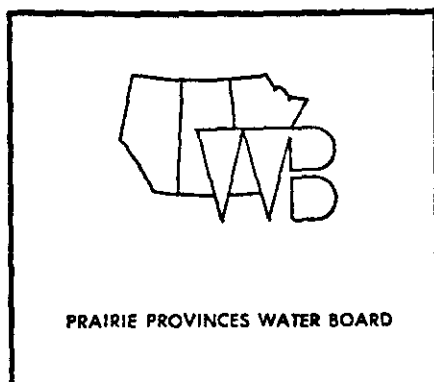
The Cochrane River drains the area around Wollaston Lake and flows eastward into Manitoba. The river then turns south and flows into Reindeer Lake, which straddles the boundary. Reindeer Lake is in turn drained by the Reindeer River which eventually joins the eastward flowing Churchill River in Saskatchewan.

The westward flowing tributary area is best described by the drainage area above the gauging station on the Cochrane River near Brochet (06DA002), since one third of the westward flowing tributary area in Manitoba contributes to the Brochet gauge. The unit yield of the area was determined as follows:

Cochrane River near Brochet (06DA002) 1972-1973, 1975-1979= 5 700 000
dam³/yr
Gross Drainage Area = 25 000 km²
Unit Yield = 228 dam³/km²/yr

There is also an area of 1 500 km² that drains directly from Manitoba into Reindeer Lake. This area has not been included in estimating the yield of Cochrane River.

	Gross Drainage Area (km ²)	Estimated Annual Yield (dam ³)
Saskatchewan portion of the basin	22 700	5 176 000
Manitoba portion of the basin	9 680	2 207 000
TOTAL	32 380	7 383 000



APPENDIX B

**ASSESSMENT OF ALTERNATIVE
APPORTIONMENT METHODS**

This appendix discusses in detail the five apportionment methods considered for the flow of westward flowing tributaries of eastward flowing streams.

Assessment of Method 1 (Mutual Agreement Method)

In Method 1, it is assumed that natural flow of westward flowing tributaries may be included in that of eastward flowing streams, and that two adjacent provinces may use the "equitable" principle in reaching an agreement to apportion their westward flowing tributary flows, so long as the terms of the 1969 Agreement are met. In the case of a westward flowing tributary spanning the Alberta-Saskatchewan Boundary, an agreement may be reached between Alberta and Saskatchewan subject to approval by Manitoba. Current water uses in westward flowing tributaries vary from basin to basin and province to province, and there is a possibility that individual arrangements would be needed to deal with the several tributary basins that have this type of apportionment problem.

From the operational point of view, the method provides a freedom of choice to determine the apportionment ratio that the two adjacent provinces wished to use in dividing this type of interprovincial flow. Depending on the agreement, an upstream province could use more than 50 percent of the westward tributary flow if the other province agreed.

The apportionment ratio of this method is not necessarily fixed at a 50:50 basis. Consequently, when a westward flowing tributary basin contributes a large portion of the total natural flow and the main stem contributes only a small portion of the total natural flow, the two provinces may have difficulties in balancing the eastward flow to meet the terms of the 1969 Apportionment Agreement. This type of situation may not occur in prairie streams but is a potential disadvantage to the practical application of this method.

Assessment of Method 2 (Straight Half Method)

In Method 2, water is apportioned each time a boundary crossing is encountered. All water flowing out of a province via the stream is subject to division. This includes water originating in the province (local inflow) and any water coming into the province as a result of apportionment of the stream at an upstream boundary crossing.

Figure B-1 illustrates the division of flow based on this approach. Case A is a tributary crossing the Alberta-Saskatchewan Boundary twice en route to an eastward flowing stream. Case B is a tributary crossing the Saskatchewan-Manitoba Boundary twice en route to an eastward flowing stream.

This method is complicated and its complexity increases rapidly as the number of boundary crossings increase. To calculate any particular provincial share on a westward flowing tributary, the local flow from each area must be determined, the appropriate percentages applied, and the results summed to give the total share.

Figure B-2 illustrates the share of flow for each province when Method 2 is applied to a westward flowing tributary which flows from Saskatchewan to Alberta and joins an eastward flowing stream in Alberta. The shares of flow for each province change depending on the percent of flow originating in Alberta or Saskatchewan. As the percent of flow originating in Alberta increases, Alberta's and Manitoba's shares increase, while Saskatchewan's share decreases. Manitoba's share of flow would always be less than that of Saskatchewan or Alberta.

Figure B-3 shows the provincial share for each province when Method 2 is applied to a westward flowing tributary that flows from Manitoba to Saskatchewan and joins an eastward flowing stream in Saskatchewan. No flow is apportioned to Alberta because the apportionment point is at the Saskatchewan-Manitoba Boundary. As the percent of flow originating in Saskatchewan increases, Saskatchewan's share of flow increases while Manitoba's share of flow decreases. Depending on the percent of flow originating in Saskatchewan, the provincial share for Manitoba would vary from 75 percent to 50 percent of flow arising in the tributary basin. Manitoba would be entitled to more water than Saskatchewan in this particular case.

Assessment of Method 3 (Conveyance Method)

In Method 3, only the province where the water originates and the ultimate destination of the water are considered. Water from any source is apportioned only once and where multiple crossings of a boundary are encountered, the stream is treated as a conveyance channel with the waters not subject to reapportionment each time a boundary is crossed. This method is much simpler than Method 2 because water is apportioned only once.

Figure B-4 illustrates the application of this approach. When flow originates in Alberta and flows to Manitoba, as shown in cases A(1) and A(3), the apportionment is 50 percent to Alberta, 25 percent to Saskatchewan, and 25 percent to Manitoba. When flow originates in Saskatchewan and flows to Manitoba, even though it may pass through Alberta as shown in A(2), the apportionment is 50 percent to Saskatchewan and 50 percent to Manitoba. Manitoba would be entitled to 100 percent of the water arising in that province.

Figure B-5 shows that one half of the flow originating in Alberta is apportioned to Alberta. Saskatchewan and Manitoba retain the same share of flow which is one quarter of the flow originating in Alberta plus one half of the flow that originates in Saskatchewan. As in Method 2 (see Figure B-6) none of the flow originating in Saskatchewan is apportioned to Alberta as the province is situated upstream of the apportionment point. Saskatchewan retains one

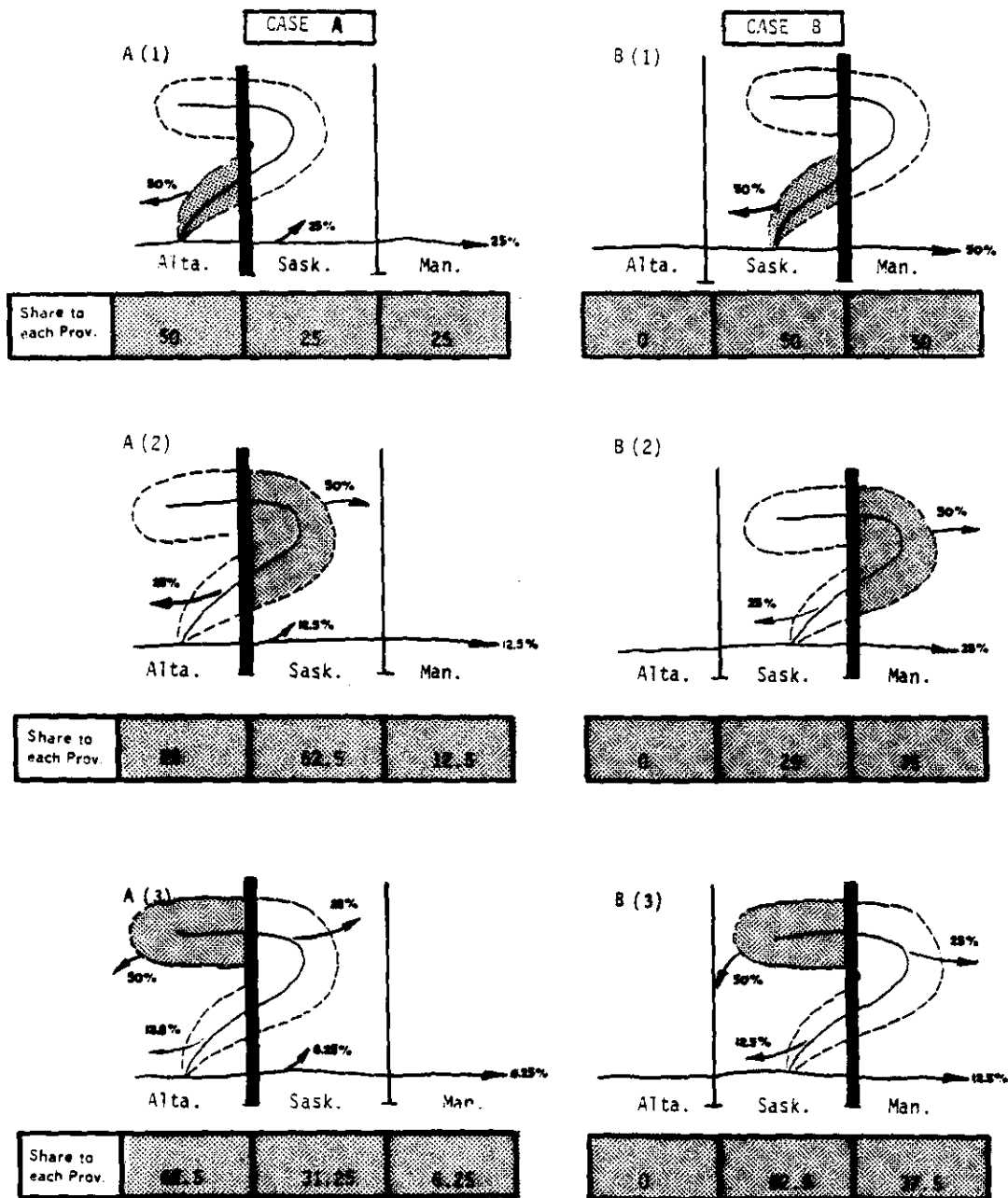
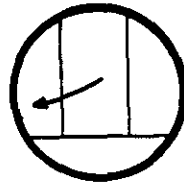


Figure B- 1 The Apportionment of Westward Flowing Tributaries. Based on Method 2.

The shaded section in each of the six sketches indicates the area for which flow apportionment is being considered. The share to each province is the percentage of water from that shaded section that belongs to each province.



Case A

Method 2
Straight Half Method

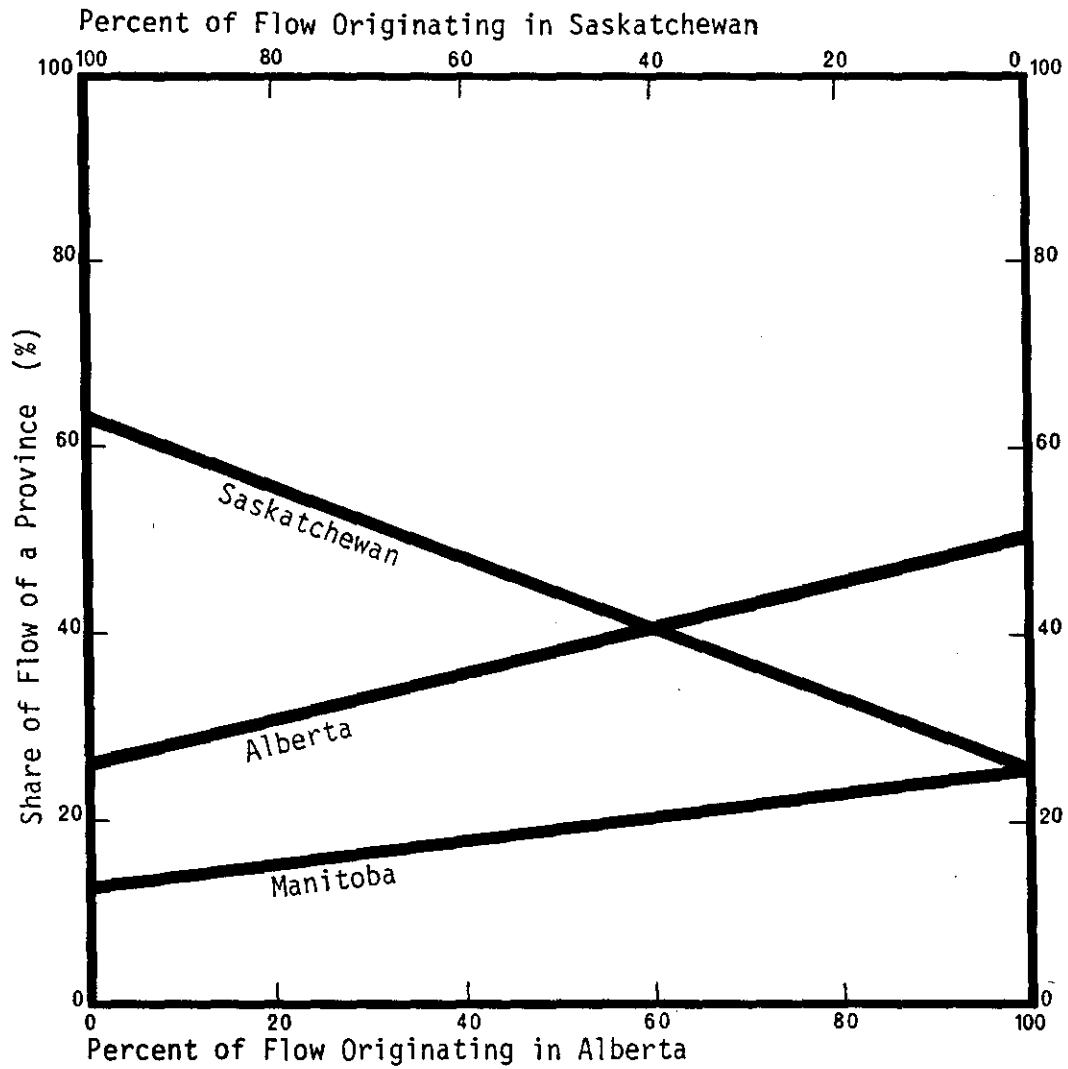
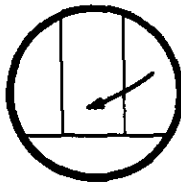


Figure B- 2 Share of Flow vs. Percent of Flow Originating in Alberta or Saskatchewan. Based on Method 2 and Assuming the Tributary Crosses the Alberta-Saskatchewan Boundary Once Only.



Case B

Method 2
Straight Half Method

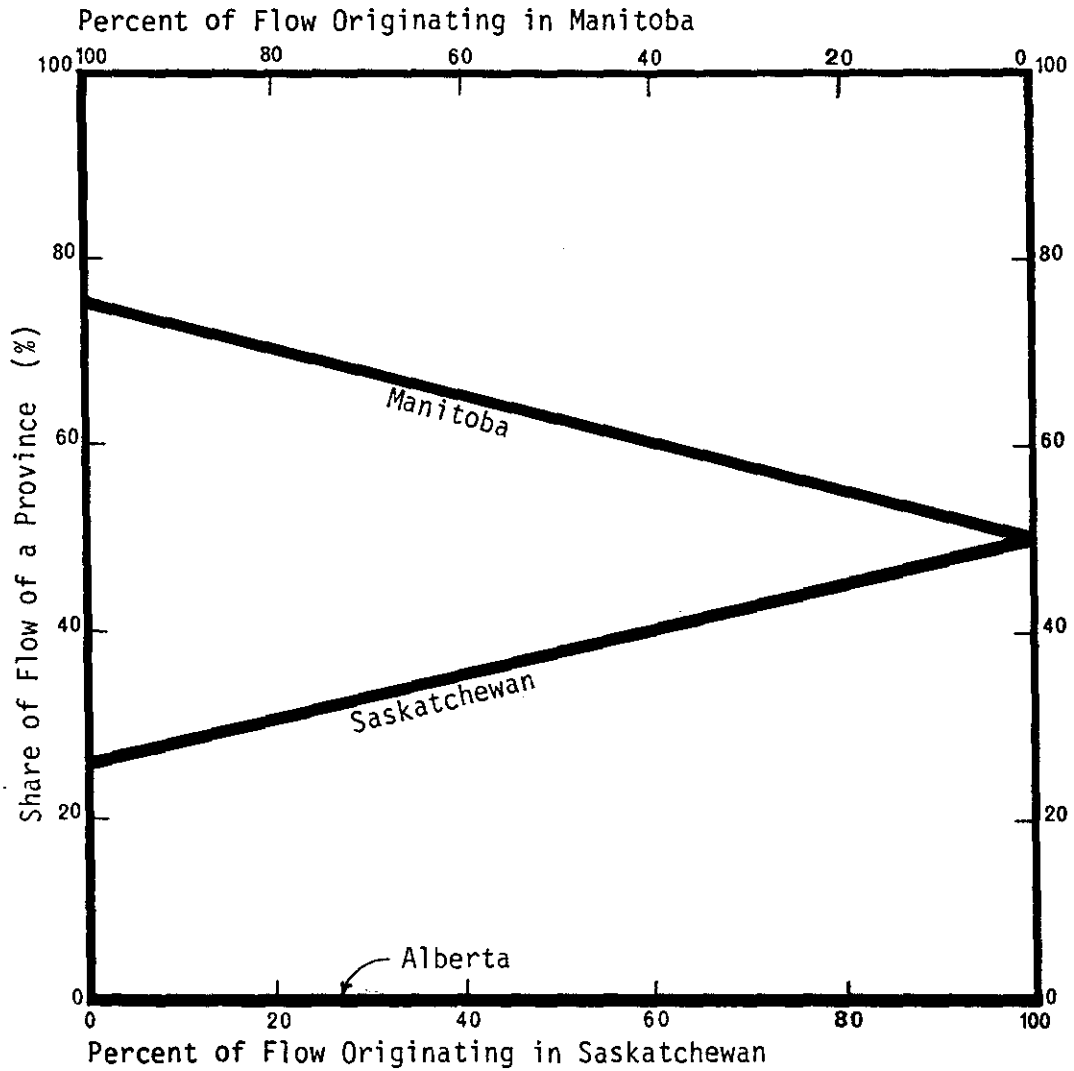


Figure B- 3 Share of Flow vs. Percent of Flow Originating in Saskatchewan or Manitoba. Based on Method 2 and Assuming the Tributary Crosses the Saskatchewan-Manitoba Boundary Once Only.

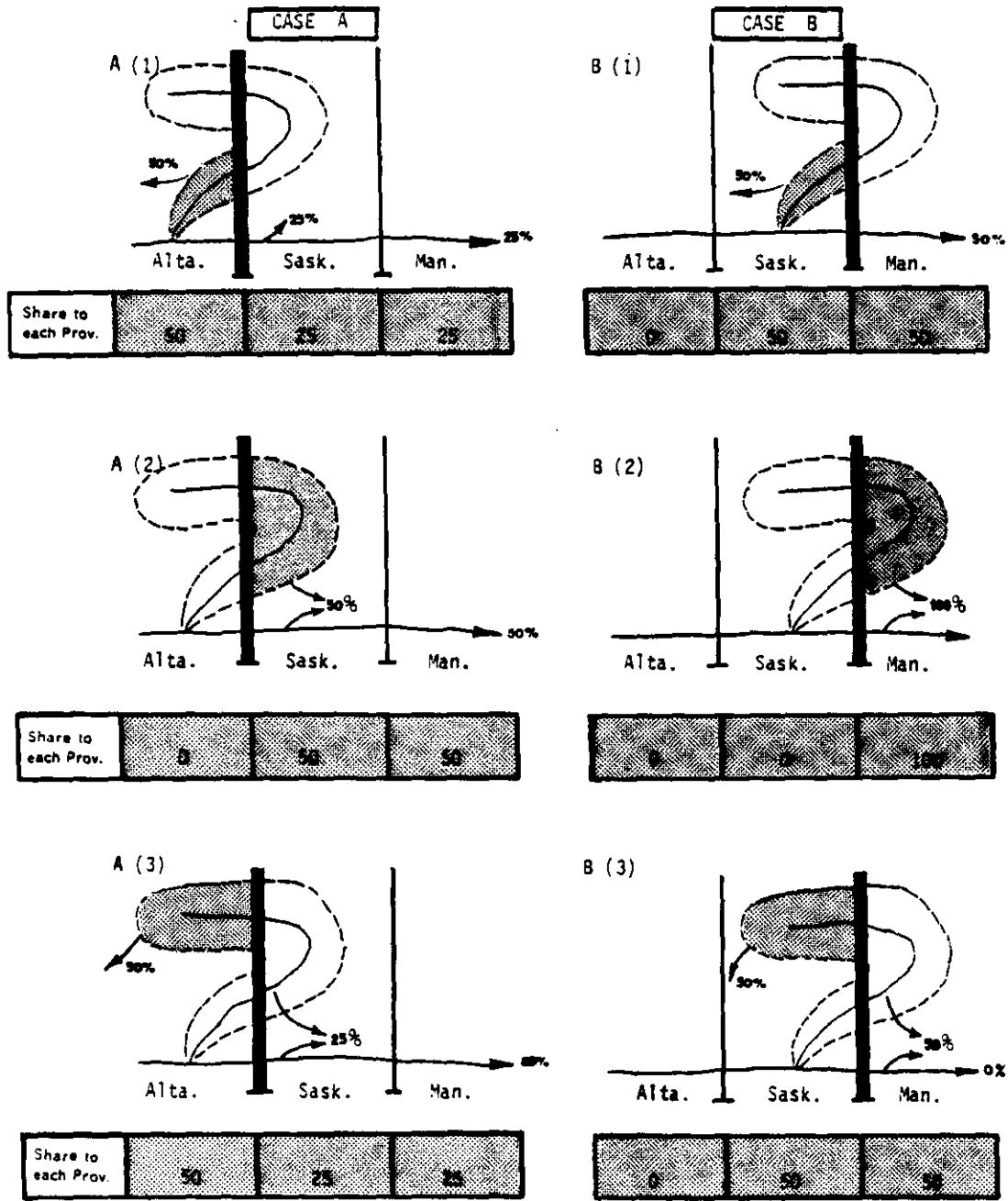
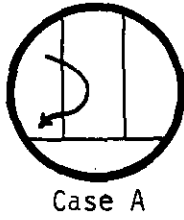


Figure B- 4 The Apportionment of Westward Flowing Tributaries. Based on Method 3.

The shaded section in each of the six sketches indicates the area for which flow apportionment is being considered. The share to each province is the percentage of water from that shaded section that belongs to each province.



Method 3
Conveyance Method

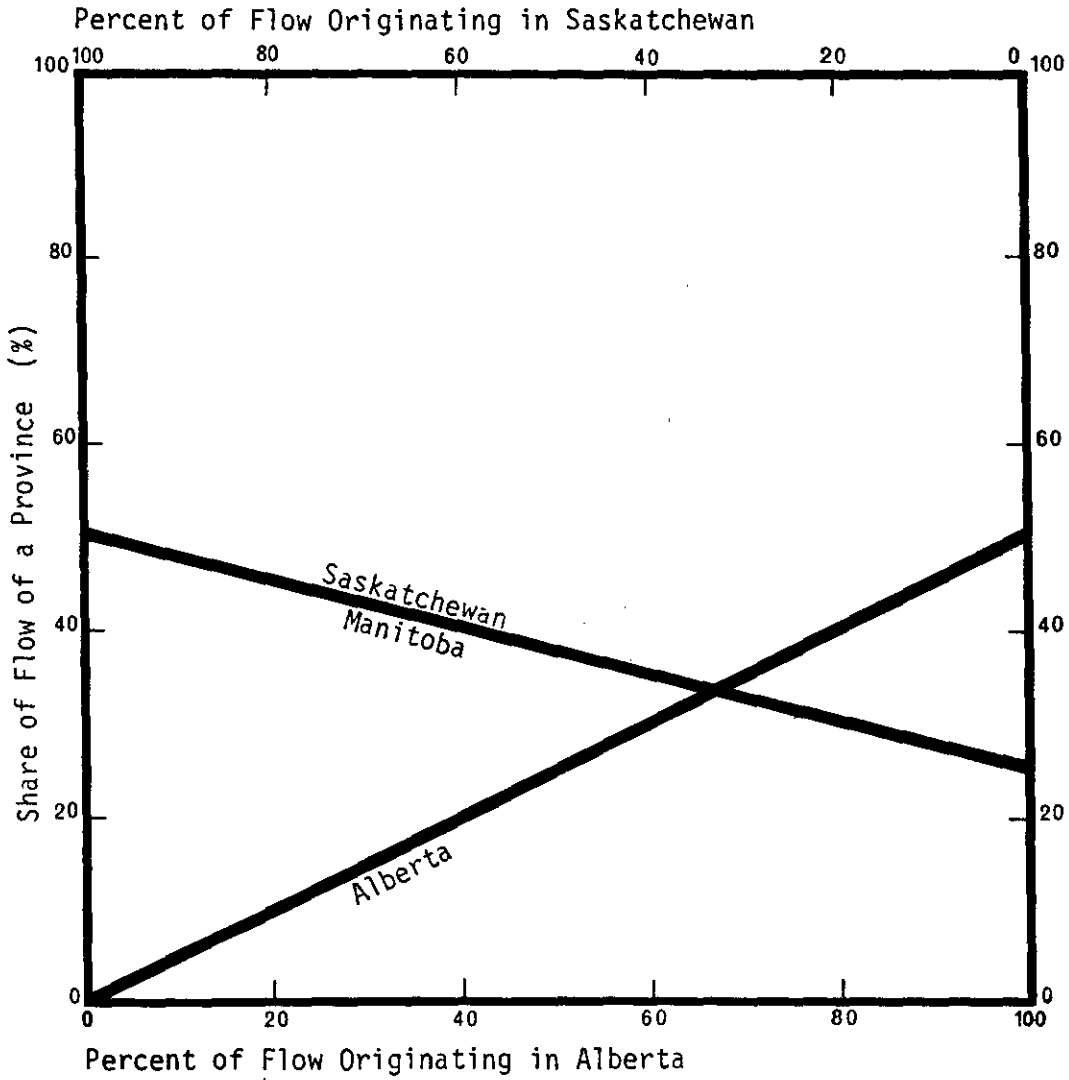
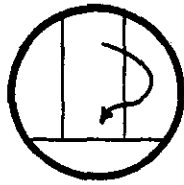


Figure B- 5 Share of Flow vs. Percent of Flow Originating in Alberta or Saskatchewan. Based on Method 3.



Case B

Method 3
Conveyance Method

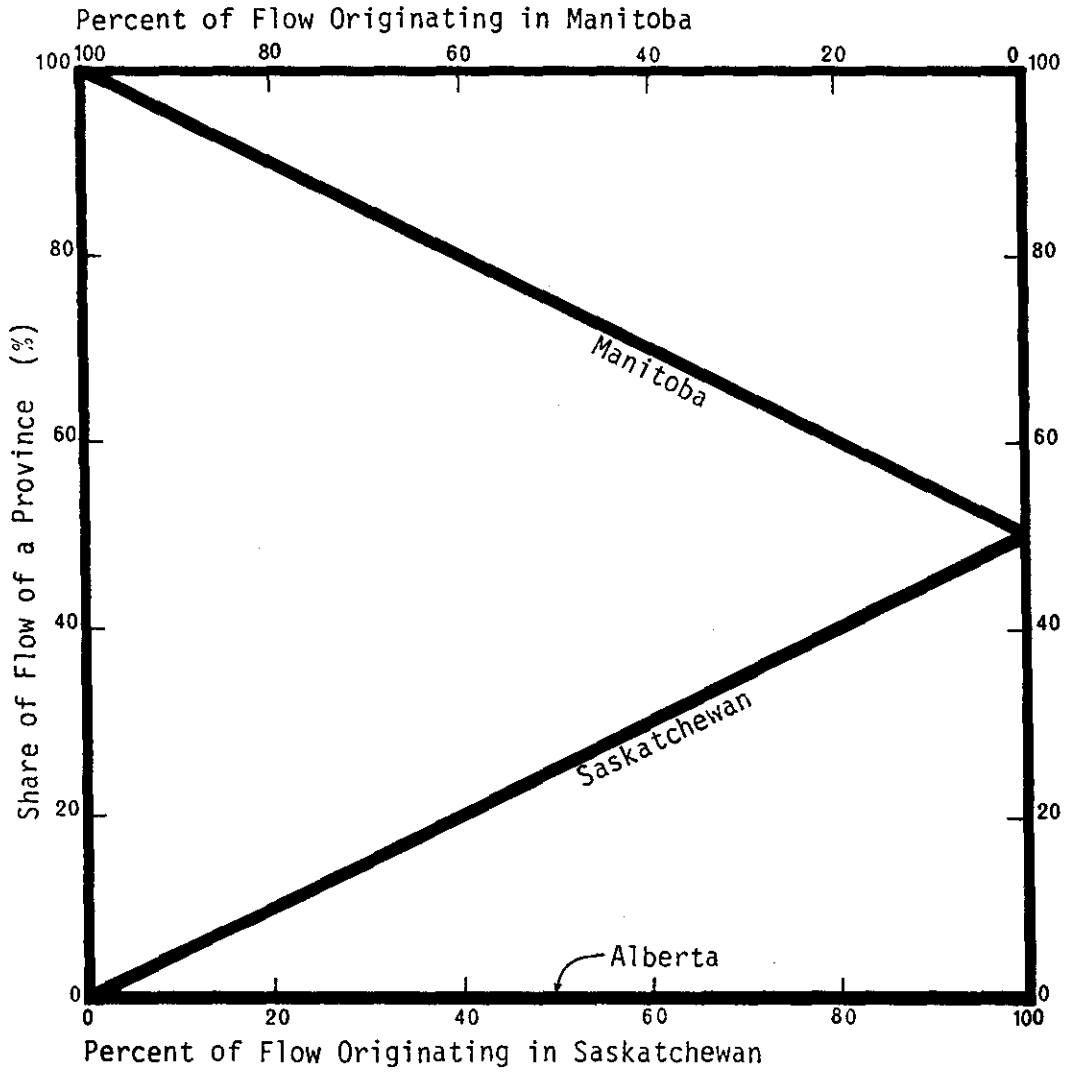


Figure B- 6 Share of Flow vs. Percent of Flow Originating in Saskatchewan or Manitoba. Based on Method 3.

half of the flow originating in Saskatchewan and the rest of the flow is Manitoba's share.

The approach is in agreement with the concept that the source province is allowed to make a net depletion of one half the natural flow arising in the province as described in the second "WHEREAS" clause in Schedules A and B.

The primary disadvantage of this method is that no consideration is given to the province through which water flows en route to its destination. For example, Alberta gets no share of any water arising in Saskatchewan (see Case A(2) of Figure B-4). Alberta is treated unfairly by this method and Saskatchewan and Manitoba appear to benefit.

Assessment of Method 4 (Exclusion Method)

Method 4 is similar to Method 3 (Conveyance Method) but water that arises in a westward draining area is excluded from the necessity of being apportioned. The province in which the westward flowing water originates may retain 100 percent of the westward flowing water.

Figure B-7 illustrates how the flow of a westward flowing tributary is apportioned in Method 4. As shown in A(2) and B(2) of Figure B-7, Saskatchewan and Manitoba may both retain 100 percent of westward flowing waters arising in their province without sharing it with the downstream province.

For a typical westward flowing tributary spanning the Alberta-Saskatchewan Boundary (see Figure B-8) the apportionment of flow that arises in the Alberta portion of the basin is 50 percent to Alberta, 25 percent to Saskatchewan, and 25 percent to Manitoba. For flow that arises in the Saskatchewan portion of the basin the apportionment is 0 percent to Alberta, 100 percent to Saskatchewan, and 0 percent to Manitoba. Alberta and Manitoba are both treated unfairly in this particular case.

When the same approach is applied to a westward flowing tributary spanning the Saskatchewan-Manitoba Boundary (see Figure B-9) Saskatchewan is entitled to retain one half of the flow arising in the Saskatchewan portion of the basin. The remaining one half of the flow arising in Saskatchewan and 100 percent of the flow arising in the Manitoba portion of the basin are Manitoba's share. In this particular case, Manitoba is entitled to have a larger share than Saskatchewan, and Saskatchewan is treated unfairly.

This method does not recognize that the flow of a westward draining area is part of interprovincial flow, which should be apportioned equitably among the provinces.

Assessment of Method 5 (Rational Method)

Method 5 is based on the concept that the province in which the water originates is entitled to 50 percent of that water and the rest of the water is divided equally between the downstream provinces.

Figure B-10 shows how flow is apportioned based on this method. As illustrated in Case A, 50 percent of the flow is apportioned to the province of origin, regardless of where the flow was withdrawn, and the remainder is

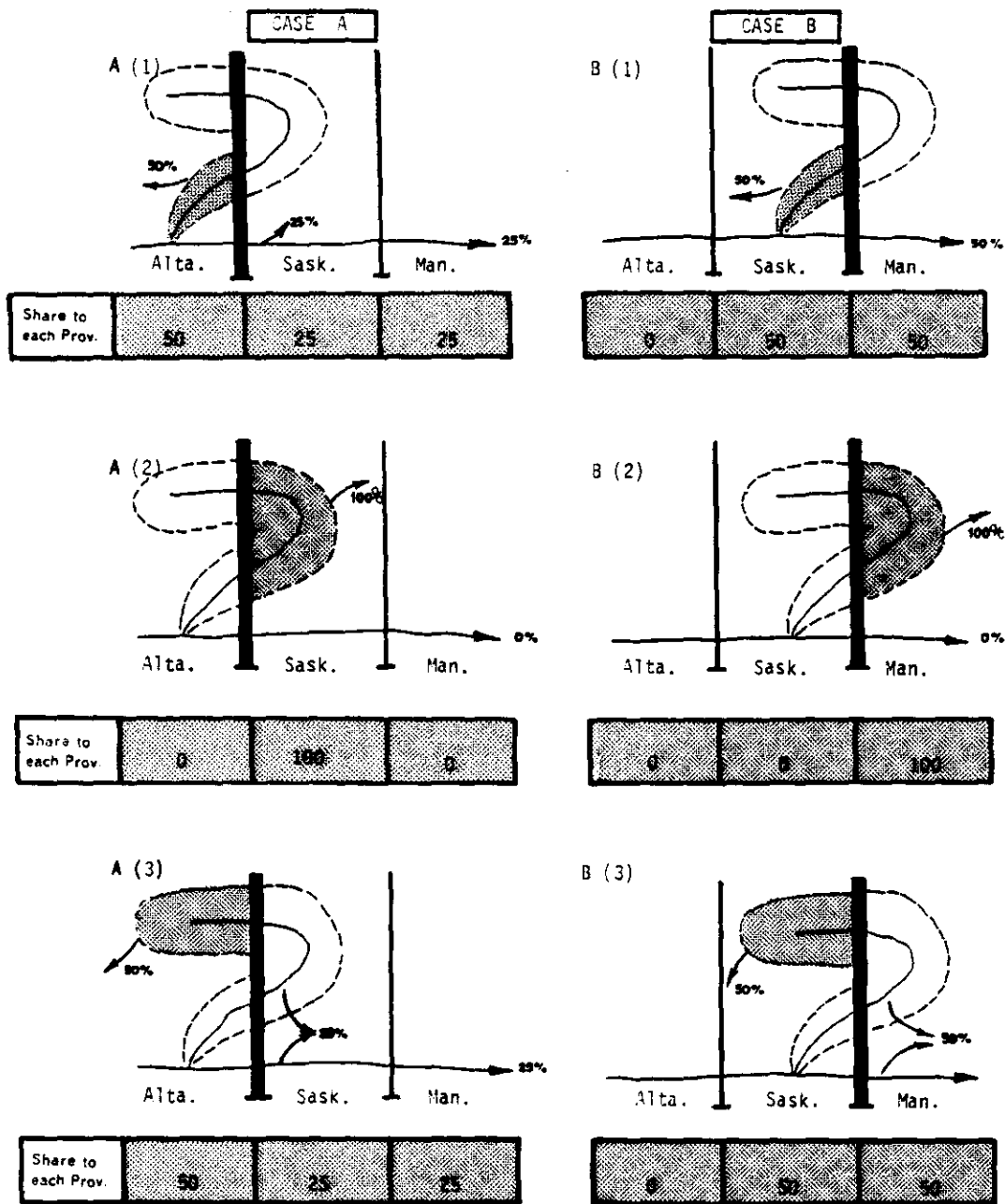
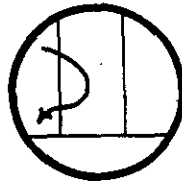


Figure B- 7 The Apportionment of Westward Flowing Tributaries. Based on Method 4.

The shaded section in each of the six sketches indicates the area for which flow apportionment is being considered. The share to each province is the percentage of water from that shaded section that belongs to each province.



Case A

Method 4
Exclusion Method

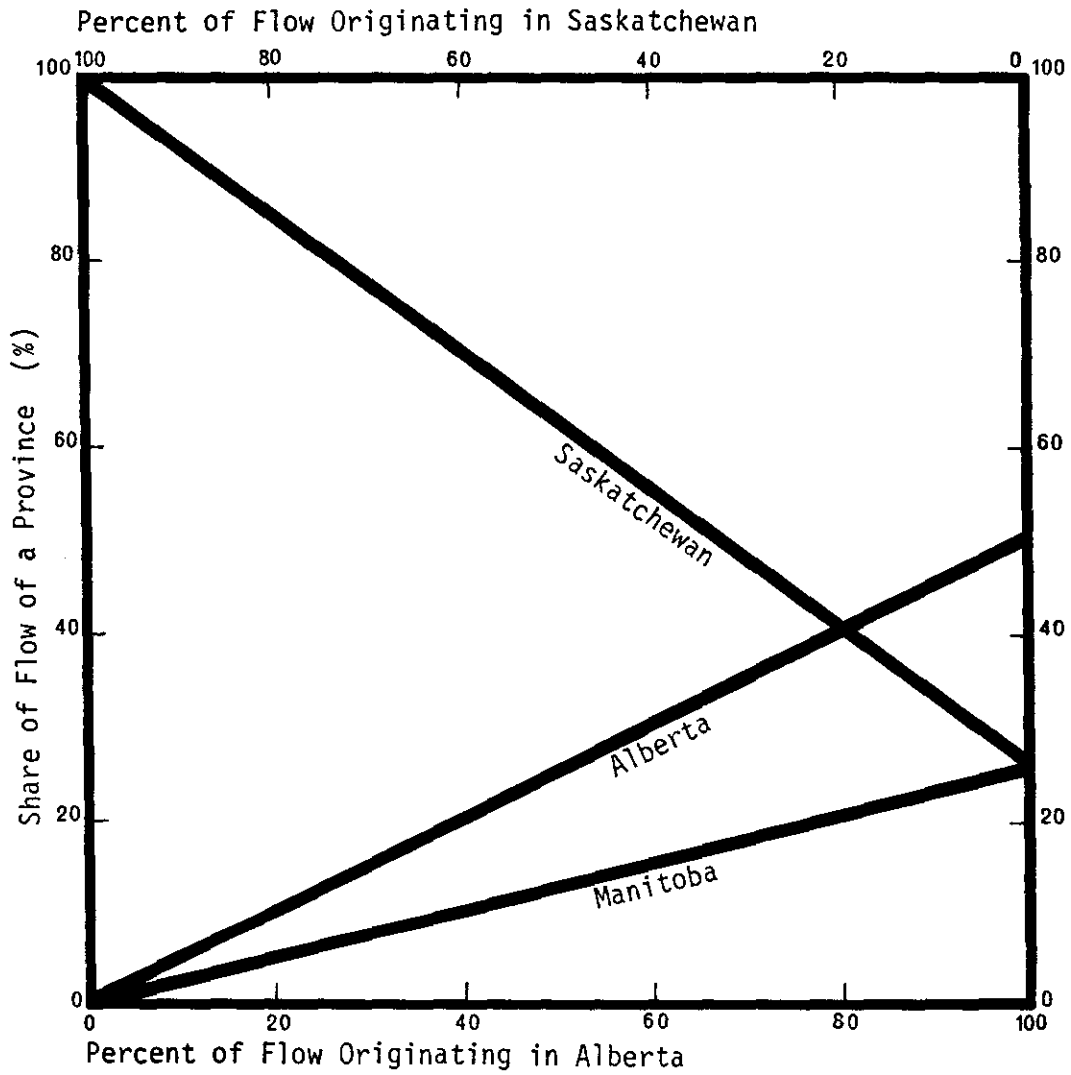
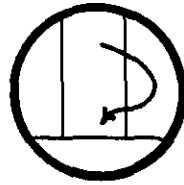


Figure B- 8 Share of Flow vs. Percent of Flow Originating in Alberta or Saskatchewan. Based on Method 4.



Case B

Method 4
Exclusion Method

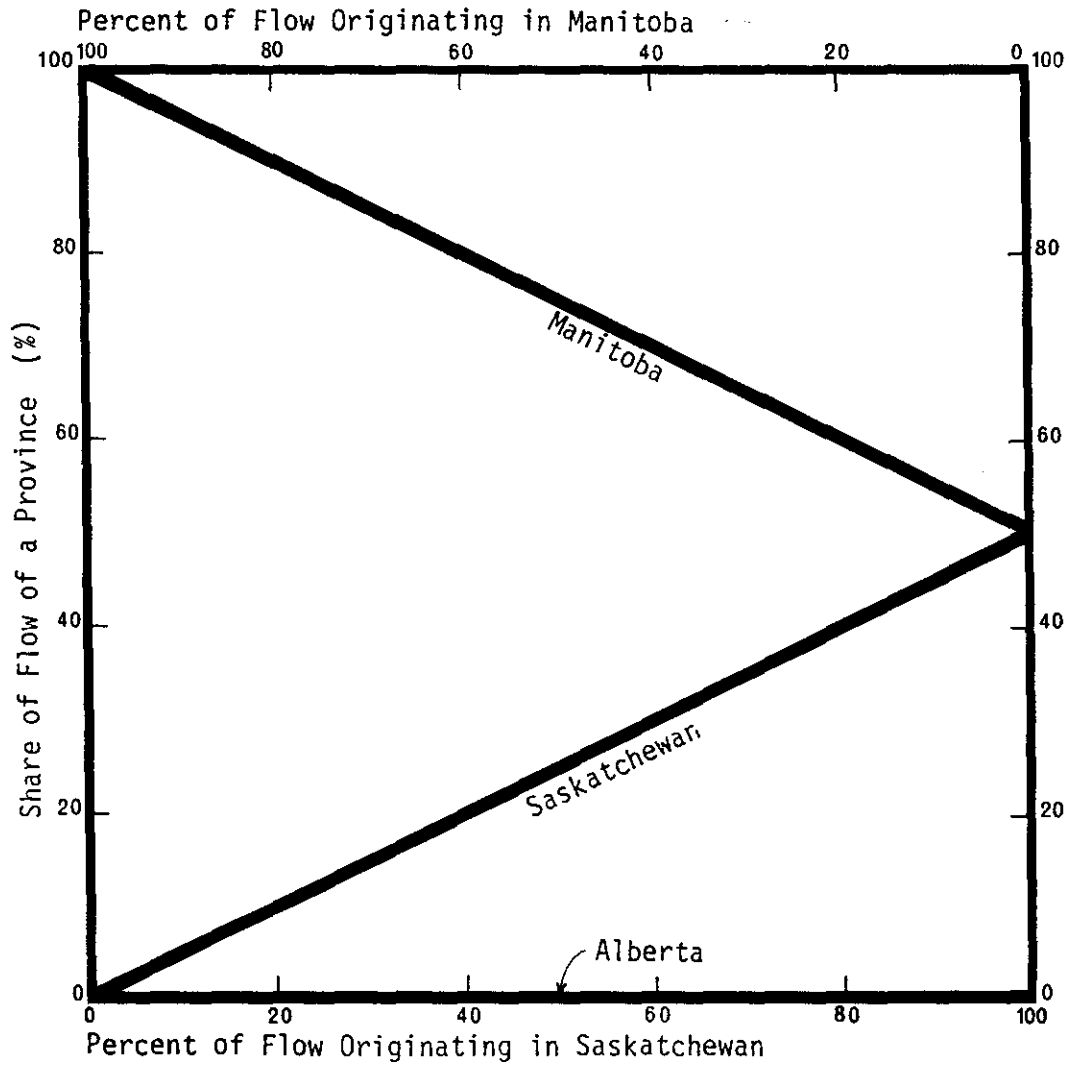


Figure B- 9 Share of Flow vs. Percent of Flow Originating in Saskatchewan or Manitoba. Based on Method 4.

equally divided between the two downstream provinces. Case B shows that any flows originating in Saskatchewan or Manitoba are apportioned on a 50:50 basis between the two provinces.

Figure B-11 shows a westward flowing tributary spanning the Alberta-Saskatchewan Boundary. The Alberta share and the Saskatchewan share vary with the percentage of flow that originates in the respective province. Manitoba is apportioned at a constant 25 percent no matter what percentage of flow originates in Alberta or Saskatchewan. The percentage share for each of the two source provinces, Alberta and Saskatchewan, varies from a high of 50 percent to a low of 25 percent. When Alberta and Saskatchewan contribute an equal amount of natural flow in the tributary basin, Alberta and Saskatchewan are each apportioned 37.5 percent of the flow and the remaining 25 percent of the flow is Manitoba's share.

Figure B-12 shows a westward flowing tributary spanning the Saskatchewan-Manitoba Boundary. In any circumstance, both Saskatchewan and Manitoba are entitled to an equal share of the flow originating in this type of westward flowing tributary.

Method 5 (Rational Method) is different from Method 1 (Mutual Agreement Method) in that water is divided on a 50:50 basis rather than on some other basis as determined by the provinces. It is simpler than Method 2 (Straight-Half Method) because water is apportioned only once. Method 5 is similar to Method 3 (Conveyance Method) in that the provinces of origin and destination receive immediate recognition in the apportionment calculations, provided that any province through which water flows en route to its destination is considered.

In Method 5 each of the three provinces receives an equitable share of the water as illustrated in Figures B-11 and B-12. Furthermore, the method is usable and is simple enough to be operationally attractive. All provinces may participate in the yield-share relationships with the shares being independent of the number of boundary crossings. Finally, Method 5 reflects the spirit of sharing that is part of the 1969 Apportionment Agreement.

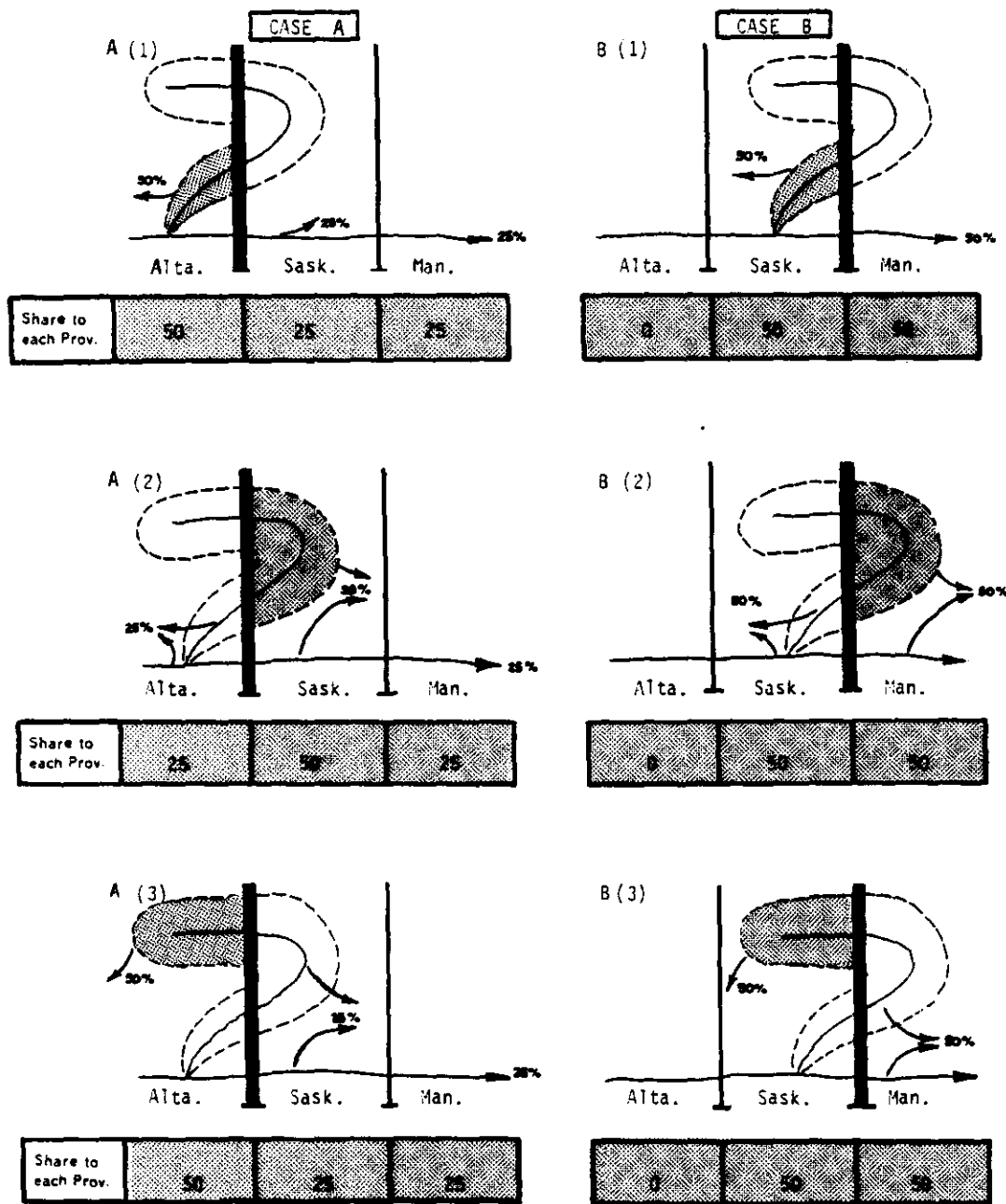
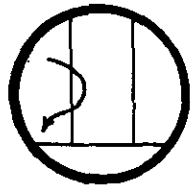


Figure B-10 The Apportionment of Westward Flowing Tributaries. Based on Method 5.

The shaded section in each of the six sketches indicates the area for which flow apportionment is being considered. The share to each province is the percentage of water from that shaded section that belongs to each province.



Case A

Method 5
Rational Method

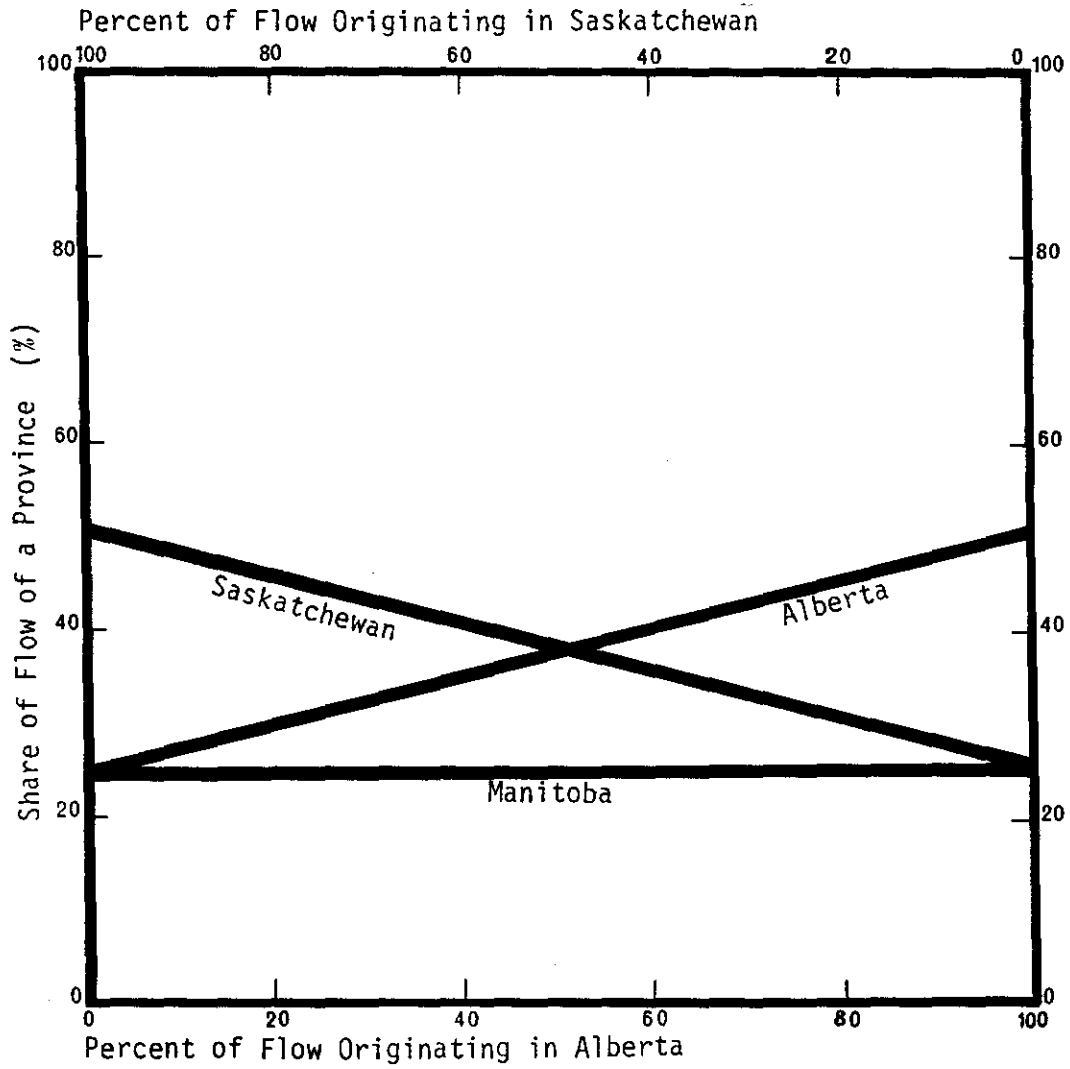
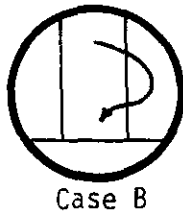


Figure B-11 Share of Flow vs. Percent of Flow Originating in Alberta or Saskatchewan. Based on Method 5.



Method 5
Rational Method

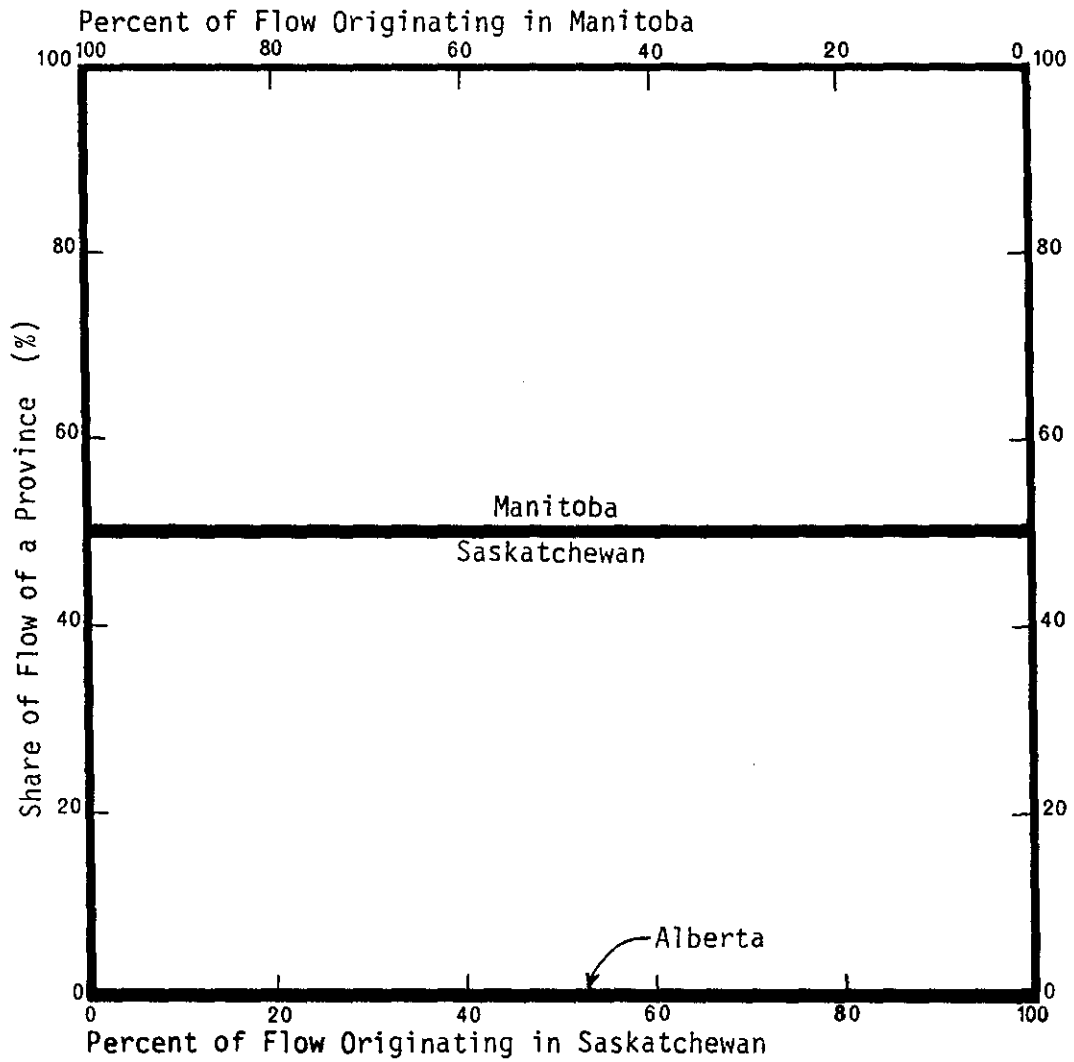
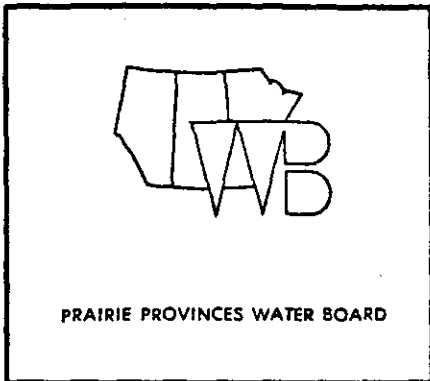


Figure B-12 Share of Flow vs. Percent of Flow Originating in Saskatchewan or Manitoba. Based on Method 5.



APPENDIX C

**MASTER AGREEMENT
ON APPORTIONMENT**

**THIS APPENDIX
INCLUDES COPIES OF:**

- THE MASTER AGREEMENT ON APPORTIONMENT
- SCHEDULE A
- SCHEDULE B and
- SCHEDULE C

MASTER AGREEMENT ON APPORTIONMENT

THIS AGREEMENT is made in quadruplicate this THIRTIETH day of OCTOBER, 1969, A.D.

BETWEEN:

HER Majesty, the Queen, in right of Canada, represented herein by the Minister of Energy, Mines and Resources

(Hereinafter called "Canada")

- and -

HER Majesty, the Queen, in right of Alberta, represented herein by the Minister in charge of Water Resources for Alberta

(Hereinafter called "Alberta")

- and -

HER Majesty, the Queen, in right of Saskatchewan, represented herein by the Minister in charge of The Water Resources Commission Act of the said Province

(Hereinafter called "Saskatchewan")

- and -

HER Majesty, the Queen, in right of Manitoba, represented herein by the Minister in charge of The Water Control and Conservation Branch Act of the said Province

(Hereinafter called "Manitoba")

WHEREAS under natural conditions the waters of the watercourses hereinafter referred to arising in or flowing through the Province of Alberta would flow into the Province of Saskatchewan and under the said conditions the waters of some of the said watercourses arising in or flowing through the Province of Saskatchewan would flow into the Province of Manitoba;

AND WHEREAS the Governor-in-Council has authorized Canada to enter into this agreement by Order-in-Council P.C. 1969-8/2051 dated October 29, 1969, and the Lieutenant Governors-in-Council for Alberta, Manitoba and Saskatchewan, respectively, have authorized them to enter into this agreement by the following Orders-in-Council:

Alberta - O.C. 2053/69
Manitoba - O.C. 1359/69
Saskatchewan - O.C. 1612/69

AND WHEREAS the parties hereto deem it to be in their mutual interest that an agreement be reached among the four parties as to the apportionment as described in the schedules attached hereto of such interprovincial waters among the three Provinces;

AND WHEREAS Alberta and Saskatchewan have entered into an agreement, which agreement is attached to this agreement as Schedule A, that permits the Province of Alberta to make a net depletion of one-half the natural flow of water arising in or flowing through the Province of Alberta and that permits the remaining one-half of the natural flow of each such watercourse to flow into the Province of Saskatchewan, subject to certain exceptions as are set forth in the said agreement;

AND WHEREAS Saskatchewan and Manitoba have entered into an agreement, which agreement is attached to this agreement as Schedule B, that permits the Province of Saskatchewan to make a net depletion of one-half the natural flow of water arising in, and one-half of the water flowing into the Province of Saskatchewan, and that permits the remaining one-half of the flow of each such watercourse to flow into the Province of Manitoba, subject to such conditions and agreements as therein contained;

AND WHEREAS the parties are desirous that the Prairie Provinces Water Board (referred to herein as the Board), reconstituted by this agreement will be responsible for the administration of this agreement;

AND WHEREAS the parties hereto recognize the continuing need for consultation and co-operation as between themselves with respect to the matters herein referred to so that the interests of all the parties are best served;

NOW THEREFORE, THIS AGREEMENT (hereinafter known as the Master Agreement) witnesseth that each party agrees as follows:

Interprovincial Agreements

1. Alberta and Saskatchewan agree that the agreement between them (hereinafter called the First Agreement), a copy of which is set out in Schedule A to the Master Agreement, will become binding upon them upon the date that the Master Agreement is executed.
2. Saskatchewan and Manitoba agree that the agreement between them (hereinafter called the Second Agreement), a copy of which is set out in Schedule B to the Master Agreement, will become binding upon them upon the date that the Master Agreement is executed.
3. The parties agree to the apportionment of water between Alberta and Saskatchewan and Manitoba as provided in the First and Second Agreements and each party agrees to be bound by the said agreements as they relate to apportionment as if it were a party thereto.
4. The parties agree that the First or Second Agreement, or both, may be altered by an agreement in writing among the four parties to the Master Agreement, but not otherwise.
5. The parties agree that the First and Second Agreements will continue in force and effect until cancelled by an agreement in writing among the four parties to the Master Agreement.

Water Quality

6. The parties mutually agree to consider water quality problems; to refer such problems to the Board; and to consider recommendations of the Board thereon.

Monitoring

7. The parties agree that the monitoring of the quantity and quality of waters as specified in the First and Second Agreements, the collection, compilation and publication of water quantity and quality data required for the implementation and maintenance of the provisions of this agreement shall be conducted by Canada, subject to provision of funds being voted by the Parliament of Canada.

Administration

8. The parties agree, subject to Clause 9 of this agreement that if at any time, any dispute, difference or question arises between the parties with respect to this agreement or the construction, meaning and effect thereof, or anything therein, or the rights and liabilities of the parties thereunder or otherwise in respect thereto, then every such dispute, difference or question will be referred for determination to the Exchequer Court under the provisions of the Exchequer Court Act of Canada and each of the parties hereto agrees to maintain or enact the necessary legislation to provide the Exchequer Court with jurisdiction to determine any such dispute, difference, or question in the manner provided under the Exchequer Court Act.
9. The parties also agree that the Board, with the consent of the parties in dispute, may cause to be prepared, a factual report of the dispute for consideration by the parties hereto prior to the referral of the dispute to the Exchequer Court.
10. The parties agree that the Prairie Provinces Water Board shall monitor and report on the apportionment of waters as set out in the provisions of the First and Second Agreements and ratified by this Master Agreement.
11. The parties agree to revoke the agreement dated July 28, 1948, establishing the Prairie Provinces Water Board and to reconstitute the

Prairie Provinces Water Board in the form of Schedule C hereto and the said Schedule shall form and become part of this Master Agreement.

12. Because the Orders-in-Council referred to in Schedule D hereto will become redundant upon the execution of this Master Agreement, the parties agree to take steps to have them revoked.

13. The parties agree for the future application of the provisions of the Master Agreement (and the First and Second Agreements thereunder), to work together and to cooperate to the fullest extent each with the other for the integrated development and use of water and related resources to support economic growth according to selected social goals and priorities and to participate in the formulation and implementation of comprehensive planning and development programs according to their national, regional and provincial interest and importance.

14. No Member of the Parliament of Canada or Member of the Legislative Assemblies of the Provinces party to this agreement shall hold, enjoy, or be admitted to any share or part of any contract, agreement, commission or benefit arising out of this agreement.

IN WITNESS HEREOF Canada has caused its presents to be executed by its Minister of Energy, Mines and Resources, and Alberta has caused its presents to be executed by its Minister in charge of Water Resources, and Saskatchewan has caused its presents to be executed by its Minister in charge of The Water Resources Commission Act, and Manitoba has caused its presents to be executed by its Minister in charge of The Water Control and Conservation Branch Act on the day and year first mentioned above.

"A. Davidson"

Witness to the signature of the Minister
(Energy, Mines and Resources) for Canada

"J.J. Greene"

Minister (Energy, Mines and Resources) for
Canada

October 30, 1969

Date

"R. E. Bailey"

Witness to the signature of the Minister in
charge of Water Resources for Alberta

"Henry A. Ruste"

Minister in charge of Water Resources for
Alberta

October 30, 1969

Date

"Harold W. Pope"

Witness to the signature of the Minister in
charge of The Water Resources Commission
Act for Saskatchewan

"Allan R. Guy"

Minister in charge of The Water Resources
Commission Act for Saskatchewan

October 30, 1969

Date

"Thomas E. Weber"

Witness to the signature of the Minister in
charge of The Water Control and Conserva-
tion Branch Act for Manitoba

"Lenard S. Evans"

Minister in charge of The Water Control
and Conservation Branch Act for Manitoba

October 30, 1969

Date

4th Recital Clause amended on July 5, 1984

SCHEDULE A

THIS AGREEMENT is made in quadruplicate this THIRTIETH day of OCTOBER, 1969, A.D.

BETWEEN:

HER Majesty, the Queen, in right of Alberta, represented herein by the Minister in charge of Water Resources for Alberta

(Hereinafter called "Alberta")

- and -

HER Majesty, the Queen, in right of Saskatchewan, represented herein by the Minister in charge of The Water Resources Commission Act of the said Province

(Hereinafter called "Saskatchewan")

WHEREAS under natural conditions the waters of the watercourses hereinafter referred to arising in or flowing through the Province of Alberta would flow into the Province of Saskatchewan and under the said conditions the waters of some of the said watercourses arising in or flowing through the Province of Saskatchewan would flow into the Province of Manitoba;

AND WHEREAS the parties hereto deem it to be in their mutual interest and in the interest of Manitoba that an agreement in principle be reached among the said three Provinces as to the apportionment of such interprovincial waters among them;

AND WHEREAS the parties hereto are of the opinion that an equitable apportionment of such waters as between the adjoining Provinces of Alberta and Saskatchewan would be to permit the Province of Alberta to make a net depletion of one-half the natural flow of water arising in or flowing through the Province of Alberta and to permit the remaining one-half of the natural flow of water of each such watercourse to flow into the Province of Saskatchewan, subject to certain

prior rights as are hereinafter set forth or may hereafter be mutually agreed upon in writing;

AND WHEREAS on the basis of the foregoing apportionment as between the Provinces of Alberta and Saskatchewan the parties hereto are of the opinion that in a similar manner, an equitable apportionment of the remainder of the natural flow of the said watercourses that flow into the Province of Manitoba after permitting the Province of Alberta to make its depletion of one-half thereof would be to permit the Province of Saskatchewan to make a net depletion of one-half of the said remainder and to permit the other one-half thereof to flow into the Province of Manitoba; and that the natural flow of any tributaries to the said watercourses which tributaries join the said watercourses in the Province of Saskatchewan without arising in or first flowing through the Province of Alberta could be apportioned one-half to the Province of Saskatchewan and one-half to the Province of Manitoba in a manner similar to the apportionment of waters as between the Provinces of Alberta and Saskatchewan, in all cases subject to such prior rights as may be mutually acknowledged by the said Provinces of Manitoba and Saskatchewan;

AND WHEREAS the parties hereto recognize the continuing need for consultation and cooperation as between themselves and with Manitoba with respect to the matters herein referred to so that the best and most beneficial use of the said waters may be made and the interests of all said provinces best served:

NOW THIS AGREEMENT witnesseth as follows:

1. IN THIS AGREEMENT:

- (a) "Natural flow" means the quantity of water which would naturally flow in any watercourse had the flow not been affected by human interference or human intervention, excluding any water which is part of the natural flow in Alberta but is not available for the use of Alberta because of the provisions of any international treaty which is binding on Alberta.

- (b) "Watercourse" means any river, stream, creek, or other natural channel which from time to time carries a flowing body of water from the Province of Alberta to the Province of Saskatchewan and includes all tributaries of each such river, stream, creek or natural channel which do not themselves cross the common boundary between the Provinces of Alberta and Saskatchewan. Such tributaries as do themselves cross the said common boundary between the Provinces of Alberta and Saskatchewan shall be deemed to be "watercourses" for the purpose of this agreement.
2. (a) The parties hereto shall mutually establish a method by which to determine the natural flow of each watercourse flowing across their said common boundary.
- (b) For the purpose of this agreement, the said natural flow shall be determined at a point as near as reasonably may be to their said common boundary.
- (c) Notwithstanding sub-paragraph (b) the point at which the natural flow of the watercourses known as the South Saskatchewan and Red Deer Rivers is to be determined may be, at the option of Alberta, a point at or as near as reasonably may be below the confluence of the said two rivers.
3. Alberta shall permit a quantity of water equal to one-half the natural flow of each watercourse to flow into the Province of Saskatchewan, and the actual flow shall be adjusted from time to time on an equitable basis during each calendar year, but this shall not restrict or prohibit Alberta from diverting or consuming any quantity of water from any watercourse provided that Alberta diverts water to which it is entitled of comparable quality from other streams or rivers into such watercourse to meet its commitments to Saskatchewan with respect to each watercourse.
4. Notwithstanding paragraph 3 hereof, the following special provisions shall apply as between the parties hereto with respect to the watercourse known as the South Saskatchewan River.
- (a) Alberta shall be entitled in each year to consume, or to divert or store for its consumptive use a minimum of 2,100,000 acre-feet net depletion out of the flow of the watercourse known as the South Saskatchewan River even though its share for the said year, as calculated under paragraph 3 hereof, would be less than 2,100,000 acre-feet net depletion, provided however Alberta shall not be entitled to so consume or divert, or store for its consumptive use, more than one-half the natural flow of the said South Saskatchewan watercourse if the effect thereof at any time would be to reduce the actual flow of the said watercourse at the common boundary of the said Provinces of Saskatchewan and Alberta to less than 1,500 cubic feet per second.
- (b) The consumption or diversion by Alberta provided for under the preceding sub-paragraph shall be made equitably during each year, depending on the actual flow of water in the said watercourse and the requirements of each Province, from time to time.
5. The parties hereto shall work together and co-operate to the fullest extent, each with the other, for the most effective, economical and beneficial use of waters flowing from the Province of Alberta into the Province of Saskatchewan, including the construction and operation of approved projects of mutual advantage to our Provinces on a cost-share basis proportionate to the benefits derived therefrom by each Province, (the approval of which projects shall not be unreasonably withheld by either of the parties hereto) and shall enter into such other arrangements, agreements or accords with each other, and with the Governments of Canada and other Provinces to best achieve the principles herein agreed upon.

6. Notwithstanding paragraph 3 hereof, with respect to each of the three watercourses known as Battle Creek, Lodge Creek, and Middle Creek, the annual flow shall be apportioned such that, in each of the said watercourses, Alberta permits a quantity of water equal to 75 percent of the natural flow to pass the interprovincial boundary from Alberta to Saskatchewan.
7. If at any time any dispute, difference or question shall arise between the parties or their representatives touching this agreement or the construction, meaning and effect thereof, or anything therein, or the rights or liabilities, of the parties or their representatives thereunder or otherwise in respect thereto then every such dispute, difference or question shall be referred for determination to the Exchequer Court under the provisions of The Exchequer Court Act of Canada, and each of the parties hereto agrees to enact the necessary legislation to provide the Exchequer Court with jurisdiction to determine any such dispute, difference or question in the manner provided under Section 30 of The Exchequer Court Act.
8. This agreement shall become effective upon the execution of an agreement by Canada, Alberta, Manitoba and Saskatchewan relative to the apportionment of waters referred to in this agreement.

"R. E. Bailey"

Witness to the signature of the Minister
in charge of Water Resources for Alberta

"Henry A. Ruste"

Minister in charge of Water Resources
for Alberta

"Harold W. Pope"

Witness to the signature of the Minister
in charge of The Water Resources Com-
mission Act

IN WITNESS WHEREOF Alberta has caused these presents to be executed on its behalf by its Minister in charge of Water Resources, and Saskatchewan has caused these presents to be executed by its Minister in charge of The Water Resources Commission Act, both on the day and year first above mentioned.

"Allan R. Guy"

Minister in charge of The Water Re-
sources Commission Act

Section 6 amended on July 5, 1984.

SCHEDULE B

THIS AGREEMENT is made in quadruplicate this THIRTIETH day of OCTOBER, 1969, A.D.

BETWEEN:

HER Majesty, the Queen, in right of Saskatchewan, represented herein by the Minister in charge of The Water Resources Commission Act of the said Province

(Hereinafter called "Saskatchewan")

- and -

HER Majesty, the Queen, in right of Manitoba, represented herein by the Minister in charge of The Water Control and Conservation Branch Act of the said Province

(Hereinafter called "Manitoba")

WHEREAS under natural conditions the waters of the watercourses hereinafter referred to arising in or flowing through the Province of Saskatchewan would flow into the Province of Manitoba;

AND WHEREAS the parties hereto deem it to be in their mutual interest and in the interest of Alberta that an agreement in principle be reached among the said three Provinces as to the apportionment of interprovincial waters among them;

AND WHEREAS the parties hereto are of the opinion that an equitable apportionment of such waters as between the adjoining Provinces of Saskatchewan and Manitoba would be to permit the Province of Saskatchewan to make a net depletion of one-half the natural flow of water arising in, and one-half the flow of water flowing into, the Province of Saskatchewan, and to permit the remaining one-half of the flow of water of each such watercourse to flow into the Province of Manitoba, subject to certain rights as may hereafter be mutually agreed upon in writing;

AND WHEREAS on the basis of the foregoing apportionment as between the Provinces of Saskatchewan and Manitoba, the parties hereto are of the opinion that in a similar manner, an equitable apportionment of the natural flow of the said watercourses arising in or flowing through the Province of Alberta would be to permit the Province of Alberta to make a net depletion of one-half thereof, subject to such prior rights as may be mutually acknowledged by the said Provinces of Alberta, Saskatchewan and Manitoba;

AND WHEREAS the parties hereto recognize the continuing need for consultation and co-operation as between themselves and with Alberta with respect to the matters herein referred to so that the interests of all said Provinces are best served;

NOW THIS AGREEMENT witnesseth as follows:

1. IN THIS AGREEMENT:

- (a) "Natural flow" means the quantity of water which would naturally flow in any watercourse had the flow not been affected by human interference or human intervention.
- (b) "Watercourse" means any river, stream, creek, or other natural channel which from time to time carries a flowing body of water from the Province of Saskatchewan to the Province of Manitoba and includes all tributaries of each such river, stream, creek or natural channel which do not themselves cross the common boundary between the Provinces of Saskatchewan and Manitoba. Such tributaries as do themselves cross the said common boundary between the Provinces of Saskatchewan and Manitoba shall be deemed to be "watercourses" for the purpose of this agreement.

2. (a) The parties hereto shall mutually establish a method by which to determine the natural flow of each watercourse flowing across their said common boundary.
- (b) For the purpose of this agreement, the said natural flow shall be determined at a point as near as reasonably may be to their said common boundary.
3. Saskatchewan shall permit in each watercourse the following quantity of water to flow into Manitoba during the period from April 1 of each year to March 31 of the year following: A quantity of water equal to the natural flow for that period determined at the point referred to in paragraph 2(b) hereof, less
 - (a) one-half the water flowing into Saskatchewan in that watercourse from Alberta, and
 - (b) any water which would form part of the natural flow in that watercourse but does not flow into Saskatchewan because of the implementation of any provision of any subsisting water apportionment agreement made between Alberta and Saskatchewan and approved by Manitoba, and
 - (c) one-half the natural flow arising in Saskatchewan.
4. Saskatchewan shall be entitled during such period to consume or to divert or store for its consumptive use the water it is not required to permit to flow into Manitoba in each watercourse under paragraph 3 hereof, but such consumption or diversion shall be made equitably depending on the actual flow of water in each watercourse and the requirements of each Province from time to time, but Saskatchewan shall permit sufficient water to flow into Manitoba to meet its commitments during such period under paragraph 3 hereof.
5. The parties hereto shall work together and co-operate to the fullest extent, each with the other, for the use of waters flowing from the Province of Saskatchewan into the Province of Manitoba, including the construction and operation of approved projects of mutual advantage to the said Provinces on a cost-share basis proportionate to the benefits derived therefrom by each Province (the approval of which projects shall not be unreasonably withheld by either of the parties hereto) and shall enter into such other arrangements, agreements or accords with each other, and with the Governments of Canada and other Provinces to best achieve the principles herein agreed upon.
6. If at any time any dispute, difference or question shall arise between the parties or their representatives touching this agreement or the construction, meaning and effect thereof, or anything therein, or the rights or liabilities of the parties or their representatives thereunder or otherwise in respect thereto then every such dispute, difference or question shall be referred for determination to the Exchequer Court under the provisions of The Exchequer Court Act of Canada, and each of the parties hereto agrees to maintain or enact the necessary legislation to provide the Exchequer Court with jurisdiction to determine any such dispute, difference or question in the manner provided under The Exchequer Court Act.

The actual flow shall be adjusted from time to time by mutual agreement on an equitable basis during such period but this shall not restrict or prohibit Saskatchewan from diverting, storing or consuming any quantity of water from any watercourse provided that Saskatchewan diverts water to which it is entitled of comparable quality from other streams or rivers into such watercourse to meet its commitments to Manitoba with respect to each watercourse.

7. This agreement shall become effective upon the execution of an agreement by Canada, Alberta, Manitoba and Saskatchewan relative to the apportionment of waters referred to in this agreement.

IN WITNESS WHEREOF Saskatchewan has caused these presents to be executed by its Minister in charge of The Water Resources Commission Act, and Manitoba has caused these presents to be executed by its Minister in charge of The Water Control and Conservation Branch Act on the day and year first above mentioned.

"Harold W. Pope"

Witness to the signature of the Minister in charge of The Water Resources Commission Act

"Allan R. Guy"

Minister in charge of The Water Resources Commission Act

"Thomas E. Weber"

Witness to the signature of the Minister in charge of The Water Control and Conservation Branch Act

"Leonard S. Evans"

Minister in charge of The Water Control and Conservation Branch Act.

SCHEDULE C

PRAIRIE PROVINCES WATER BOARD AGREEMENT

THIS AGREEMENT made this THIRTIETH day of OCTOBER, 1969, A.D.

BETWEEN:

THE GOVERNMENT OF CANADA,
hereinafter called "Canada"

- and -

THE GOVERNMENT OF MANITOBA,
hereinafter called "Manitoba"

- and -

THE GOVERNMENT OF SASKATCHEWAN,
hereinafter called "Saskatchewan"

- and -

THE GOVERNMENT OF ALBERTA,
hereinafter called "Alberta"

1. Manitoba, Saskatchewan, Alberta and Canada agree to establish and there is hereby established a Board to be known as the Prairie Provinces Water Board to consist of five members to be appointed as follows:

- (a) two members to be appointed by the Governor General in Council, one of whom shall be Chairman of the Board, on the recommendation of the Minister of Energy, Mines and Resources,
- (b) one member to be appointed by the Lieutenant Governor in Council of each of the Provinces of Manitoba, Saskatchewan and Alberta.

2. Functions

The Board shall oversee and report on the Master Agreement (including the First and

Second Agreements thereunder) executed by Canada, Alberta, Manitoba and Saskatchewan for the apportionment of waters flowing from one Province into another Province; shall take under consideration, comprehensive planning, water quality management and other questions pertaining to water resource management referred to it by the parties hereto; shall recommend appropriate action to investigate such matters and shall submit recommendations for their resolution to the parties hereto.

3. Composition of Board

The members of the Board shall be chosen from those engaged in the administration of water resources or related duties for Manitoba, Saskatchewan, Alberta or Canada, as the case may be, and shall serve as members of the Board in addition to their other duties.

4. Duties of the Board

In accordance with its functions, the duties of the Board shall be as follows:

- (a) to review, collate, and analyze stream-flow data and prepare reports and recommendations on the apportionment of water,
- (b) to review water quality problems, particularly such problems located at the interprovincial boundaries, and to recommend to the parties hereto, appropriate management approaches for their resolution including the establishment of new institutional arrangements,
- (c) to develop recommendations on other water matters, in addition to problems on water quality, referred to the Board by any party hereto including the review and analysis of existing information and the requesting of additional studies and assistance by appropriate governmental agencies to provide information for formulating its recommendations,

- (d) to promote through consultation and the exchange of information the integrated development of water resources of inter-provincial streams,
- (e) to cause to be prepared with the consent of the parties involved factual reports on disputes arising out of the water apportionment for consideration by the parties hereto,
- (f) to ensure the co-ordination of such technical programs as water quantity and quality monitoring and streamflow forecasting required for the effective apportionment of water.

5. Confirmation of the Board's Recommendations

A recommendation of the Board with respect to any matters referred to it under Section 2 shall, subject to the Master Agreement for the apportionment of water, become effective when adopted by Orders-in-Council passed by Canada and each of the Provinces.

6. Authority of Board

The Board shall have authority to correspond with all Governmental organizations and other sources of information in Canada or abroad concerned with the administration of water resources, and such other authority as may be conferred on the Board from time to time by agreement between the parties hereto; all agencies of the four governments having to do with the water and associated resources in the area covered by the Agreement shall be required to supply the Board with all data in their possession requested by the Board.

7. Records

The records relating to the water resources of the three provinces collected and compiled by the P.F.R.A. organization at Regina shall be made available to the Board.

8. Meetings of the Board

The Board shall meet at the call of the Chairman and meetings shall be called at least twice annually; the expenses of the members shall be borne by their respective governments.

9. Reports

The Board shall submit an annual progress report outlining work done and work contemplated in the agreed program to each of the responsible Ministers of the parties hereto and such other reports as may be requested by any one of such Ministers.

10. Operation of the Board

The Secretary for the Board and such other technical and clerical staff as may be required, with a headquarters at Regina, shall be Federal or Provincial public servants. The cost of administration, excluding the cost of monitoring as described in Section 7 of the Master Agreement, but including staff, accommodation, supplies and incidental expenses of the Board, shall be borne by the parties hereto on the basis of one-half by Canada and one-sixth by each of the Provinces. The Board shall prepare for approval of the parties hereto, work program, staff requirements, annual budgets and five-year forecasts and such other reports as may be required in the operation of the Board.

- 11. Any water development project already constructed or to be constructed by any one of the parties shall be so operated as to maintain the apportionment of water as set out in the Master Agreement (and the First and Second Agreements thereunder) for the apportionment of waters of interprovincial streams.