WILDLIFE OF MANITOBA'S SOURIS RIVER BASIN: RESOURCE BASE, PRESENT USE AND IMPACT ANALYSIS

A Practicum

Submitted to the Natural Resource Institute

University of Manitoba

In Partial Fulfillment of the

Requirements for the Degree of

Master of Natural Resource Management

by

Gregory M. Goodwin

1977

WILDLIFE OF MANITOBA'S SOURIS RIVER BASIN: RESOURCE BASE, PRESENT USE AND IMPACT ANALYSIS

by

GREGORY M. GOODWIN

A practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF NATURAL RESOURCE MANAGEMENT

ABSTRACT

The Souris River Basin in Canada is characterized by poor water quality, substantial and widespread spring flooding and undependable water supplies. The need for a comprehensive study of the Canadian portion of the Souris River Basin is defined by problems and opportunities presented for water resource management and development in this region.

To adequately assess how these water supply, flooding and water quality problems should be dealt with, information regarding the resource base and present use must be made readily available.

The primary objectives of this particular study were to describe and estimate populations and habitat characteristics of wildlife adjacent to the major watercourses in Manitoba's Souris Basin and to determine the present utilization of the wildlife resource in the Basin. In addition, as a secondary objective, two water development projects were chosen as case studies to estimate the impact on wildlife of project implementation.

It was concluded that:

1. While populations of upland game birds, migratory game birds, white-tailed deer and various fur species may be abundant at times, population levels of most species are inextricably linked to the availability and quality of habitat. Since most of the Souris River Basin in Manitoba

is utilized for agricultural purposes, maintenance or enhancement of the Basin's wildlife resource is dependent on the sound management of habitat types which are primarily riparian in nature.

2. Manitoba's portion of the Souris River Basin represents approximately 1.5% of the province's total area. Utilization of the Basin's wildlife resource is greater than expected, considering its area in relation to the remainder of the province. This productivity and utilization occurs despite the fact that most of the Souris River Basin is intensively developed for agriculture.

3. The total lost value (in perpetuity) of the potentially harvestable fur resource may be in the order of $7,400 (1976$) if Patterson Dam is implemented. In addition, the total value (in perpetuity) of potentially huntable animal populations lost due to Patterson Dam reservoir may approximate $100,000-130,000 in 1976$.

4. The total lost value (in perpetuity) of the potentially harvestable fur resource may be in the order of $30,000 (1976$) if High Souris Dam is implemented. In addition, the total value of potentially huntable animal populations lost due to High Souris Dam reservoir may approximate $560,000-740,000 in 1976$.

ACKNOWLEDGMENTS

In recognition of the assistance provided in the preparation of this practicum, I would like to thank the people and the various organizations, without whose help, completion of this report would have been impossible.

I wish to express my gratitude to my committee advisors, Dr. R. Riewe of the Biology Teaching Unit and Dr. R. Capel, Professor of Agricultural Economics, both at the University of Manitoba.

I would especially like to thank Mr. W. Koonz (Chairman), Wildlife Research Specialist, Department of Renewable Resources and Transportation Services, whose advice, assistance and time were invaluable to me in the completion of this practicum.

I am further indebted to the many people who assisted me in acquiring, analyzing or interpreting the vast amount of data accumulated. Some of these people include: Mr. M. Shoesmith, Mr. R. Stardom, Mr. D. Caswell, Mr. L. Bidlake, Mr. H. Goulden, Mr. I. Millikan, Mr. W. Sawka, Mr. D. Wardley and Mr. J. Peterson of the Department of Renewable Resources and Transportation Services; Mr. M. Austford, Mr. M. Samp and Mr. B. Harrison of the Department of Mines, Resources and Environmental Management; Dr. W. Cowan, Dr. A. Macaulay and Mr. M. Mattson of Ducks Unlimited; Dr. D. Rusch of the University of Wisconsin; Mr. G. Forsyth of P.F.R.A. and Mr.

J. Neilson, Mr. G. Latonas and Mr. R. Baydack of the Natural Resource Institute.

Special thanks are due to the people of the Souris River Basin Study who provided assistance in obtaining data pertinent to the Souris River Basin in Manitoba.

Financial assistance, travelling and publication expenses were provided by Research Branch of the Department of Renewable Resources and Transportation Services, and are gratefully acknowledged by the author.

TABLE OF CONTENTS

Page

Table of Contents (Cont'd)

LIST OF FIGURES

LIST OF TABLES

Page

Page

Page

CHAPTER 1

INTRODUCTION

1.1 The Problem

In the past, residents of the Souris River Basin in Saskatchewan, North Dakota and Manitoba have been plagued by problems associated with the widely fluctuating flows of the Souris River. Farmers, ranchers and businessmen have had to tolerate the tempermental characteristics of this river. The Souris often transforms from a rampaging torrent in spring to a relative trickle by fall of the same year. Social well-being and general welfare of residents near the river is directly affected by the peculiarities of this unique water-course. The river is often at one of two extremes and as the river goes, so go the fortunes and misfortunes of people directly affected by its actions.

The people of the Souris River Basin are weary of having their lives so cruelly dictated by potentially manageable problems. In an attempt to deal with some of the water supply, flooding and water quality problems, the Souris River Basin Study was established in 1974.

1.2 The Souris River Basin Study

This Study is a result of a joint agreement by the Saskatchewan, Manitoba and Federal governments under The Canada Water Act, to research and report on problems in the Canadian

portion of the Souris River Basin. Recommendations which may solve some of the problems are scheduled to be forthcoming from the Study Board by the end of 1977.

The objective and purpose of the Souris River Basin Study as stated in the original agreement is:

> "to carry out an assessment of the water and related resources of the Souris River Basin and of the demands being made upon them, to set objectives relative to the management of these resources in Canada and to develop an appropriate plan to meet these objectives." (Thomson, 1975)

The objective of the Study as interpreted by the Study Board is:

> "to determine the extent to which water and water-related resources in the Souris Basin (together with water which may be imported into the Basin) can be managed and developed to meet the social and economic aspirations of the people in the Basin." (Thomson, 1975)

Toward this end, the Souris River Basin Study has been divided into its component sectors. These include: Water Supply, Flood Reduction, Water Quality, Agriculture, Fisheries, Wildlife, and Recreation. Each sector is required to research and report on specific aspects inherent to it as they relate to the Souris Basin. These reports are forwarded to the Souris River Basin Study Office in Regina.

1.3 The Study Area

1.3.1 Description

The entire Souris River Basin encompasses approximately 25,500 square miles of North America's Great Plains and includes portions of Saskatchewan, Manitoba, North Dakota, and Montana (Lombard North Planning, Ltd., 1972).

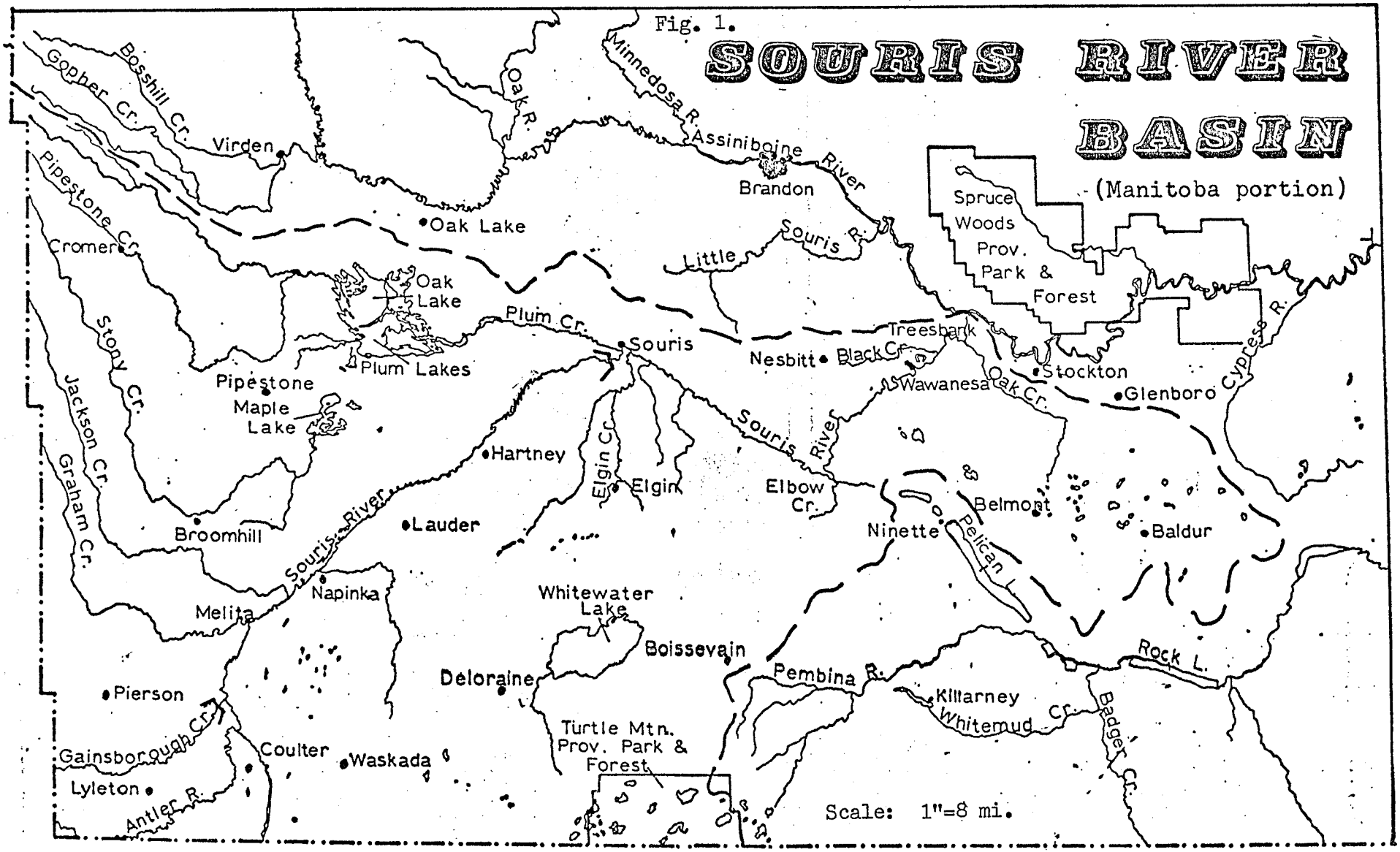
The Souris River originates in Saskatchewan and flows generally south-east into North Dakota where it gradually loops north-east into Manitoba, eventually discharging into the Assiniboine River. Manitoba's portion of the Souris River Basin (Figure 1) is approximately 3780 square miles in area (Lombard North Planning, Ltd., 1972).

In 1971, the population of Manitoba's portion of the Souris River Basin was estimated to be 18,720 (Manitoba Evaluation Task Force, 1976). The two major urban centers in the Basin are Melita and Souris with 1971 populations of 1,132 and 1,674 respectively (Manitoba Evaluation Task Force, 1976).

1.3.2 Climate

The climate of the Souris River Basin is classified as continental. This indicates that summer temperatures are higher, winter temperatures are lower and mean annual range is greater than the world average, at that latitude (Lombard North Planning, Ltd., 1972). July mean temperatures range from 17°C to 20°C while the January mean ranges between -17°C and -14°C (Hale, 1975).

Fig. 1.



Source: Dept. of Mines, Resources and Environmental Management, Surveys, Mapping and Lands Branch

The Souris Basin receives approximately 46 cm. of precipitation annually (Lombard North Planning, Ltd., 1972).

1.3.3 Physical Characteristics

Hale (1975) divides Manitoba's portion of the Souris River Basin into seven physiographic regions. These are the Waskada Till Plain, Turtle Mountain, Tiger Hills, Upper Assiniboine Delta, Oxbow Till Plain, Souris Plain and Newdale Till Plain. These regions describe lands ranging from gently undulating, water-worked terrain of the Waskada Till Plain to morainic deposits forming Tiger Hills.

Hale (1975) also divides the Basin into three major soil types. The majority of the Basin is composed of Black Chernozenic soils (dark colored grassland soils). In the north-west and south-east regions of the Basin, a combination of Black Cherozenic and Solonetzic soils (hard and poorly structured soils) is found. The extreme south-east corner of the Basin contains predominantly Gray Wooded Podzolic soils (light colored forest soils).

1.3.4 Land Use

Agricultural production predominates as the major land use in the Basin. Where arable land is plentiful, wheat production dominates, while in areas where arable land is scarce, the trend is toward grain-livestock farms.

In the Manitoba portion of the Basin, wheat constitutes approximately 30% of the annual total acreage of improved land under crops. Wheat is followed by barley, flaxseed, oats, hay,

rapeseed, rye, and mixed grain in order of importance, i.e. by acreage (Toews and Partridge, 1976).

1.3.5 Hydrologic Characteristics

The principle watercourse of the Souris River Basin is the Souris River. As mentioned before, it is characterized by widely fluctuating flows both in the course of one year and over the period of the river's recorded history (Appendix I). The flow of the Souris River in Manitoba varies from 0 cubic feet per second (cfs) during most winters at Melita to discharges near 25,000 cfs at Wawanesa (Harrison, pers. comm.).

Many tributaries contribute to the flow of the Souris River. Some of the more permanent watercourses flowing into the Souris River in Manitoba are Antler River and Gainsborough, Graham, Jackson, Plum, Elgin, Elbow, Black, and Oak Creeks. Stony Creek is a small watercourse originating in Saskatchewan and terminating in the Maple-Hunter Marsh complex. This system is hydrologically connected to the Souris River via the Maple Lake Drain.

Major lakes contained within the Basin's boundaries include the Maple-Hunter Marsh Complex, the Oak-Plum Lakes Complex, and Whitewater Lake. Whitewater Lake is, in itself, a separate drainage basin and does not hydrologically contribute to the Souris River. However, it is contained within the Basin's boundaries for the purpose of this report.

CHAPTER 2

METHODOLOGY AND OBJECTIVES

2.1 Report Methodology

As mentioned previously, the Souris River Basin Study was divided into component sectors. During 1976, the Wildlife Sector of the Study compiled reports on different aspects of the wildlife resource in the Basin. Specifically, these reports, entitled, "Wildlife Populations and Habitat in the Souris River Basin: Manitoba" (Goodwin and Koonz, 1976), "Present Use of the Wildlife Resource in the Souris River Basin: Manitoba" (Koonz and Goodwin, 1976a) and "Management Options for Wildlife Enhancement" (Koonz and Goodwin, 1976b) were prepared and submitted for the Study Board's perusal and ultimate use in the Souris River Basin Final Report. Information collected for completion of the previously mentioned reports is also utilized in this practicum.

2.2 Research Objectives

1. To describe and estimate the present populations and habitat characteristics of wildlife which may be found along the Manitoba portion of the Souris River and its major tributaries,

2. To determine the present use of the wildlife resource in Manitoba's portion of the Souris Basin,

3. To determine and quantify, in economic terms, the potential impact of two proposed water management schemes on the wildlife resource and associated habitats in the Manitoba portion of the Souris River Basin.

2.3 Delimitations

This project concerns itself only with the Manitoba portion of the Souris River Basin. The Study does not consider the potential impacts of the Garrison Diversion Unit on Manitoba nor any other water related projects unless put forward for evaluation by the Souris River Study Board.

2.4 Definition of Terms

1. impact - any beneficial or detrimental change which accrues to a resource as a result of any human oriented activity.

2. wildlife -undomesticated animals and birds not including fishes or invertebrates.

3. drainage basin - the entire tract of land drained by a river and its tributaries as delineated by topography.

4. habitat - the region where a plant or animal naturally grows or lives; native environment.

2.5 Assumptions

1. The water regime of the Souris River and its tributaries will remain relatively consistent with occurrences in the past providing no water management options are implemented.

2. The wildlife populations and habitats of the Souris River Basin will remain relatively consistent in the future as extrapolated from the past if no water management options are implemented.

3. The field data collected during 1976 will not differ substantially from any other year.

CHAPTER 3

WILDLIFE POPULATIONS AND HABITAT ALONG THE SOURIS RIVER AND MAJOR TRIBUTARIES AND LAKES

3.1 Introduction

Estimating populations of certain wildlife species along the riparian corridors of major watercourses in the Souris River Basin has been attempted and is described in this chapter.

This estimation was accomplished by applying average densities of certain wildlife species to specific habitat types determined through air photo analysis.

Detailed aerial photo interpretation of the riparian vegetation types has been completed along the Souris River and its major tributaries ($\frac{1}{2}$ mile on either side). The tributaries examined include the Manitoba portions of Antler River and Gainsborough, Jackson and Pipestone Creeks. Watercourses analyzed which are completely contained within Manitoba's portion of the Basin include Plum, Elgin, Black and Oak Creeks. Also, identification and measurement of habitat types adjacent to the Oak-Plum Lakes Complex, the Maple-Hunter Marsh Complex and Whitewater Lake have been completed and are included. Wildlife population estimates are included only for those areas in which air photo analysis was undertaken.

3.2 Methods and Materials

Aerial photos from July 1968 (scale: 1" = 1320') were used for analysis as this was the most recent year available. However, aerial photos, by township, for a portion of the Souris River, had to be enlarged and analyzed since no aerial photos were taken east of Heaslip Station in 1968. Black and Oak Creeks were enlarged and analyzed in a similar fashion. Photos from the 1970 LIFT (Lower Inventory For Tomorrow) series were of a scale (1" = 6666') in which detailed interpretation was impossible.

The vegetative analysis consisted of dividing major riparian vegetation types into six categories:

1. Timber - areas with tree coverage greater than 80%.

2. Bush - areas with shrub coverage greater than 80% with the remainder consisting of grassland or timber.

3. Grassland - areas of pasture or abandoned farmland which are predominantly grasses and herbs with less than 5% woody coverage.

4. Cropland - areas which have been cultivated and sown for crops or lie in summerfallow.

5. Marsh - seasonally flooded areas which are often dry by autumn or permanently flooded areas consisting of emergent and floating vegetation.

6. Bush and grassland - areas consisting of less than 80% but more than 25% bush with the remainder consisting of grasses and herbs with less than 5% woody coverage.

Urban areas and open water are two other classifications used in the analysis.

3.3 Wildlife Population Density Estimates

It was assumed that average known densities of animal species applied to habitat types were winter densities, since summer habitat is rarely a limiting factor. In the case of cyclic species such as snowshoe hare, (Lepus americanus), and lynx (Felis lynx), peak densities are used since habitat size is not likely a limiting factor at lower population levels. In addition, it is assumed that waterfowl densities are those which could be expected as the resident spring breeding population.

To facilitate analysis of impact on wildlife of proposed water-resource developments and to quantify this impact in economic terms, species chosen had to have some direct economic value to people, either as a fur resource or as a potential hunting resourse. Thus, a value (albeit, a minimum one) may be placed on any potential population decrease or increase of these species due to implementation of any proposed projects. In addition, populations of snowshoe hare and meadow vole were estimated in order to show possible changes or shifts in habitat, since they are species which indicate changes in specific habitat types. Most of the species listed may be used as indicators for habitat quality.

Stardom (personal communication) indicates that an average of three American beaver (Castor canadensis) per

river mile could be expected along the Souris River and most major tributaries. This estimate is substantiated by field observations in July 1976 when 55 beaver lodges were observed along 149 miles of the Souris River (Appendix II). Assuming 2 adults and 4 young per lodge (Banfield, 1974) an estimate of 2.2 beaver/river mile is obtained. However, because not all beaver build lodges and some merely have a hole in the river bank, this may serve to inflate the 2.2 beaver/river mile estimate upwards. Novakowski (1965) found 0.7 active beaver lodges per mile of stream in his study in northern Alberta. At 6 beaver/lodge, an average of 4.2 beaver/river mile is obtained.

Stardom (personal communication) considers 2 muskrat (Ondatra zibethicus) per river mile to be an average along the Souris River from the United States border to the Town of Souris. Because the river's velocity increases downstream from Souris to the Assiniboine confluence, he estimates that an average of 1 muskrat/river mile would be expected. Stardom (personal communication) further indicates that 2 muskrat/river mile would be found along the listed tributaries of the Souris River and that 0.1 muskrat/acre or 64 muskrats/square mile could be expected in a marsh habitat. Olson (1955) states that a spring muskrat population of 1.5 to 2.0 pairs/acre of marsh habitat is necessary for a productive breeding population. Many marshes along the Souris River are seasonal, usually dry by autumn and consequently

are not able to sustain a substantial winter population of muskrat. For the Oak-Plum Lakes Complex, Maple-Hunter Marsh Complex and Whitewater Lake, it may be useful to use Banfield's (1974) estimates of a variation from three animals per acre of open pond to thirty-five per acre of cattail marsh. He indicates that Manitoba marshes may carry as many as twenty-three to twenty-six animals per acre (14,720 - 14,640/square mile).

American mink (Mustela vison) are semi-aquatic predators which favour deciduous woodlands and marshes surrounding banks of rivers, ponds, lakes and streams. Stardom (personal communication) estimates that 0.5 mink could be found per square mile of all habitats in the study area except urban areas and open water. Banfield (1974) states that prior to the trapping season, populations may be in the order of 8.5 to 22 per square mile of good habitat. However, in less favourable agricultural areas, after the trapping season, the population may be as low as three or four per square mile (Banfield, 1974).

Of the upland game birds found in the Basin, sharp-tailed grouse(Pedioecetes phasianellus) are the most abundant (Lombard North Planning, Ltd., 1972). Rusch (personal communication) indicates that 75 sharp-tailed grouse may be found per square mile of grassland/bush habitat. Ruffed grouse (Bonasa umbellus), which are fewer in number prefer the Aspen parkland found in the northeast portion of the Basin (Lombard North Planning, Ltd., 1972). Rusch (personal

communication) estimates that 25 ruffed grouse may be found per square mile of timber/bush habitats. They have been known to occur along the wooded sections of creeks and rivers although they have never been abundant in the Basin. Hungarian partridge (Perdix perdix) are commonly seen in and around farm shelterbelts. From information presented by Hunt (1974), it is assumed that 20 partridge are found per square mile of bush habitat.

Rusch (personal communication) estimates that 16 white-tailed jack rabbits (Lepus townsendii) may be found per square mile in the Basin's cropland/grassland habitat and that 300 snowshoe hare may be found per square mile of timber/bush habitat.

In a survey done in southern Manitoba, 4 red fox (Vulpes vulpes) dens per township were observed (Latonas, personal communication). Assuming 2 adults and 5 pups/den as an average, 0.78 fox/square mile of all habitat types except urban areas and open water could be found. Latonas (personal communication) suggests using a range of 0.75 - 1.00 red fox/ square mile for population estimates. Banfield (1974) indicates that average fox densities in agricultural land have been estimated to be 0.63 fox/square mile.

Banfield (1974) states that little information is available on home ranges and population densities of coyotes (Canis latrans). Rusch (personal communication) estimates that 0.75 coyotes may be expected per square mile of timber/

bush habitat in the Souris Basin.

Wrigley (1974) in a two hectare (4.94 acre) plot in the Souris River Bend Wildlife Management Area (W.M.A.) found 3 red squirrels (Tamiasciurus hudsonicus) in what he describes as savanna habitat. This converts to 389 red squirrels per square mile of savanna. Wrigley describes savanna near Carberry as dominated by white spruce (Picea glauca), bur oak (Quercus macrocarpa) and trembling aspen (Populus tremuloides). This description coincides closest with the classification of timber used in this report. Stardom (personal communication) indicates that 10 red squirrels might be expected per river mile along wooded portions of the Souris River and its tributaries.

Banfield (1974) states that striped skunk (Mephitis mephitis) populations average 13.5 per square mile of agricultural land and although skunks reach their greatest densities in agricultural areas, they are also found in forests and along river valleys.

Stardom (personal communication) indicates that a 10% trapper utilization of American badger (Taxidea taxus) is expected in the Souris Basin. Using information presented in Koonz and Goodwin (1976a) and extrapolating, it is estimated that 0.5 badger may be found/square mile of any habitat with the exception of urban areas and open water.

All habitat types, except urban areas and water, may support a population of 1.4 ermine (Mustela erminea) per square mile in the Souris Basin (Stardom, pers. comm.).

In northern Alberta, Nellis et al. (1972) found winter density figures of lynx (Felis lynx) ranging from 0.05 to 0.19 per square mile, paralleling the decline and rise of snowshoe hare populations. Lynx are found in the Basin only during peaks in their population cycles and even then are rare.

Lynch (1972) estimated minimum densities of raccoons (Procyon lotor) in three of his subareas in Delta Marsh to be 2.6, 5.5 and 2.8/square mile; the mean raccoon density was 3.3/square mile. Unfortunately, he did not indicate the areas of different habitat types in his study region. Cowan (personal communication) estimates winter populations of raccoons may be 5 - 10 raccoons per river mile along the Souris River and its major tributaries. Banfield (1974) states the population density for raccoons has been estimated at two families (10 individuals) per square mile of good habitat.

Wrigley (1974) found in his two-hectare plot (4.94 acres) in the Souris River Bend W.M.A. 192 meadow voles (Microtus pennsylvanicus) in marsh habitats, 46 in the prairie, 1 in the shrub, and 2 in savanna habitats. This converts to 216,876.8, 5958.4, 128.0, and 256.0 per square mile of habitat mentioned previously. Banfield (1974) states that meadow voles have been observed at densities of 15 to 45 animals per acre of old field habitat and 45 to 150 animals per acre of marsh habitat. During population peaks,

Banfield indicates densities may go as high as 400 per acre (256,000 animals per square mile). Estimating the vole populations serves to indicate the food potential for raptors and organisms higher up in food chains. Any vole population shift, increase or decrease resulting from the implementation of a water-resource project will affect these predators.

Documentation of white-tailed deer (Odocoileus virginianus) population estimates and range of deer densities is detailed for southwestern Manitoba. For this report the results acquired by Goulden and Goulden (1969) will be utilized.

> "The ultimate criterion for evaluating a parcel of deer habitat is its sustained carrying capacity. With this in mind, during preliminary stages of our province-wide evaluation of white-tailed deer range for the Canada Land Inventory (C.L.I.), we carefully examined all existing Manitoba deer density information and arbitrarily established a range of densities commensurate with each capability class. These density ranges were used mainly as a guide in our classification and are not to be considered infallible." (Goulden and Goulden, 1969).

Table 1 - Population Densities for Deer in each C.L.I. Capability Class. (Goulden and Goulden, 1969)

Capability Class*	Range of Deer Densities (Deer/Square Mile)
1	31 to 42
2	21 to 30
3	13 to 20
4	7 to 12
5	3 to 6
6	less than 3
7	0

*See Appendix III for detailed description of each capability class.

Vermeer (1972) indicates that an average of 37.7 breeding pairs of all duck species may be expected per square mile of Aspen parkland in his survey stratum 24 (Figure 2).

Table 2 indicates the average number of breeding pairs per square mile by species.

Table 2 - Average Numbers of Waterfowl Breeding Pairs per square mile in Vermeer's Survey Stratum 24 - 1960 to 69 (Vermeer, 1972).

Ducks	Aspen Parkland - Strata 24
Mallard	7.5
Pintail	2.9
Gadwall	2.2
American widgeon	1.9
Northern shoveler	2.6
Blue-winged teal	12.6
Green-winged teal	1.9
Redhead	1.4
Canvasback	1.6
Lesser scaup	3.1
Species combined	37.7

Waterfowl population statistics are available by Stratum (Figure 3) from the Canadian Wildlife Service (C.W.S.). Table 3 indicates relative populations of waterfowl in Stratum 39 which encompasses most of the Souris River Basin.

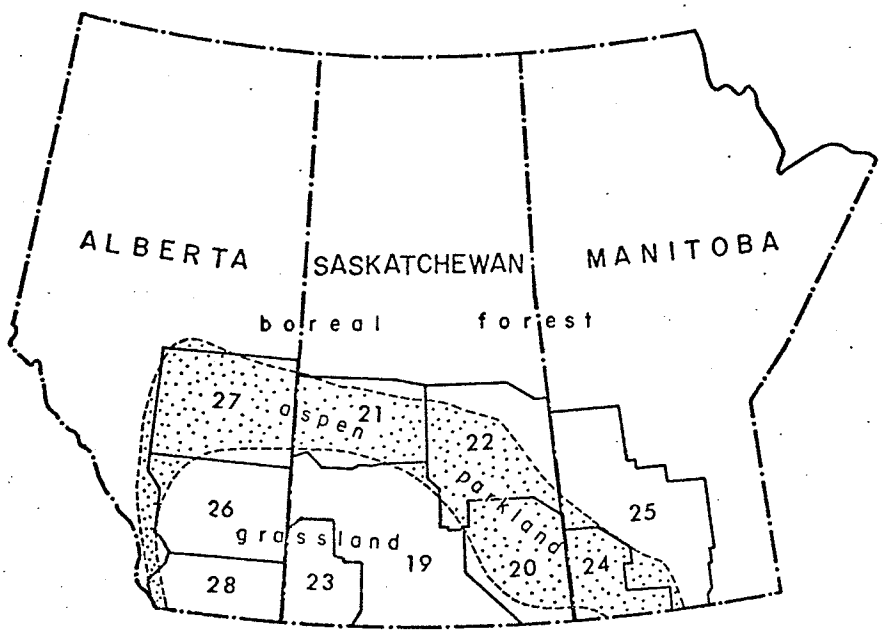


Fig. 2. Geographic locations of waterfowl survey strata in the aspen parkland and grassland.

Source: Vermeer, 1972.

Table 3 - Relative Abundance of Waterfowl Species in Stratum 39 (C.W.S.) - 1955 to 1975 and 1975 Adjusted Population Estimates (Gollop and Domitrovich, 1975).

Species	Adjusted Population Estimates (21 Year Average)	% of Total (21 Year Average)	1975	
			Adjusted Population Estimates	% of Total
Mallard	80,799	16.0	147,000	16.9
Gadwall	22,323	4.4	33,700	3.8
American widgeon	20,593	4.1	12,600	1.5
Green-winged Teal	21,009	4.2	30,000	3.5
Blue-winged Teal	214,962	42.8	354,000	40.8
Northern shoveler	30,156	6.0	53,300	6.1
Pintail	52,727	10.5	99,600	11.5
Redhead	15,966	3.2	20,700	2.4
Canvasback	11,376	2.3	21,300	2.5
Scaups	31,976	6.4	75,900	8.8

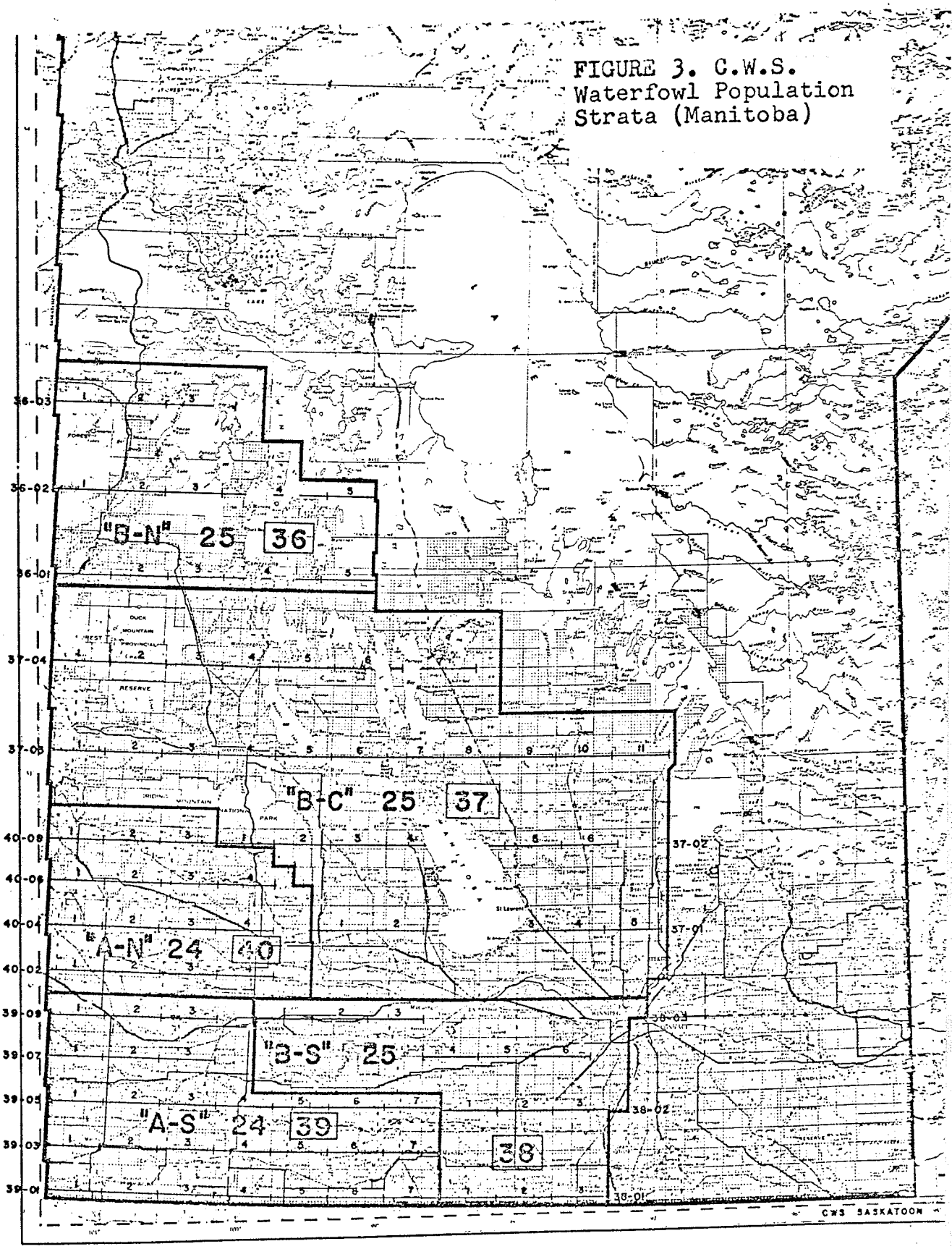


FIGURE 3. C.W.S. Waterfowl Population Strata (Manitoba)

Table 4 presents a summary of the population densities which are used in this report along with associated habitat types. Wildlife species not included in the following table, but which are found in the Souris Basin may be observed in Appendices IV-VI.

3.4 Wildlife of the Analyzed Areas

3.4.1 The Souris River

The Manitoba portion of the Souris River has been arbitrarily divided into five reaches to facilitate analysis of the wildlife resource. These five sections are:

1. Manitoba - U.S. Border to Melita	29.3 river miles
2. Melita to Hartney	44.2 river miles
3. Hartney to Souris	28.1 river miles
4. Souris to past the Elbow	29.8 river miles
5. Past the Elbow to Assiniboine River Confluence	38.0 river miles
	169.4 river miles

For each section of the river, the areas of all 8 habitat types are totalled and wildlife densities from Table 4 are applied to them. In this way an estimation of wildlife population numbers is acquired. In addition, since there is detailed information available regarding white-tailed deer and waterfowl habitat types from the Canada Land Inventory (C.L.I.), a brief description of the habitat as it pertains to deer (Goulden et al, 1970 and Imrie et al, 1974) and waterfowl (Adams and Hutchinson, 1968 and Hutchinson and and Adams, 1970).

Table 4 - Species' Densities and Associated Habitat Types Used to Determine Wildlife Populations in the Souris Basin.

Species	Habitat Type	Densities per Square Mile+
American beaver	River	3[a]
Muskrat	River	2[a*] 1[a**]
	Marsh	64
Mink	All except urban & water	0.5
Sharp-tailed grouse	Grassland/Bush	75
Ruffed grouse	Timber/Bush	25
Hungarian partridge	Bush	20
White-tailed jack rabbit	Cropland/Grassland	16
Snowshoe hare	Timber/Bush	300
Red fox	All except urban & water	0.75-1.00
Coyote	Timber/Bush	0.75
Striped skunk	Cropland	13.5
Red squirrel	Timber	389
American badger	All except urban & water	0.5
Ermine	All except urban & water	1.4
Lynx	All except urban & water	0.05=0.19
Raccoon	Timber/Bush	10
Meadow vole	Timber	256.0
	Bush	128.0
	Grassland	5958.4
	Marsh	216876.8
	Grassland/Bush	3043.2
White-tailed deer	Timber/Bush-CLI Class 1	31-42
	CLI Class 2	21-30
	CLI Class 3	13-20
	CLI Class 4	7-12
	CLI Class 5	3-6
	CLI Class 6	Less than 3
	CLI Class 7	0
Waterfowl	All except urban & water	37.7

a. Densities expressed per river mile.
* Density of muskrat upstream of Souris
** Density of muskrat downstream of Souris
\+ The number of significant figures may be different because of the varied sources of information.

3.4.1.1 Manitoba-U.S. Border to Melita (29.3 miles)

This reach of the river traverses gently rolling or flat terrain. The Souris Valley is generally U-shaped, often reaching one half mile in width. From the U.S. border to the confluence with the Antler River, the valley is treeless and utilized primarily for stock grazing. Antler River, Gainsborough and Graham Creeks discharge into the Souris River in this section.

In 1937, the Prairie Farm Rehabilitation Administration (P.F.R.A.) constructed Melita Dam #1 (Project #96) for stock-watering and domestic purposes. The dam is temporary in nature, i.e. it is only put into operation when low water levels warrant such action. It is situated downstream of the Antler-Souris River confluence.

Table 5 indicates areas of habitat types occurring within approximately one half mile on either side of the river.

Table 5 - Areas of Habitat Types - Souris River Reach 1

Habitat Type	Area (Sq. miles)	% of Total Analyzed Area
Timber	0.98	4.7
Bush	2.56	12.2
Grassland	0.27	1.3
Cropland	10.64	50.7
Marsh	3.67	17.5
Bush/Grassland	2.86	13.6
Urban	0.01	less than 1
Water	0.00	0.0
Total	20.99	100.0

Table 6 estimates populations of certain species which may be found within one half mile on either side of the river.

The potential for deer productivity appears to be fair to good in this region (Goulden et al., 1970). Most of the area is C.L.I. Class 3 (8.4 square miles) while the remainder is Class 5 or 6.

Examining the C.L.I. Land Capability maps for Waterfowl, it is clearly evident that production of waterfowl is not high in this area (Adams and Hutchinson, 1968). Sixteen point six square miles of the analyzed area is Class 3 while the remainder is Class 5. However, field observations along the river from Coulter to Antler River have indicated higher densities of waterfowl, than would be expected from examination of C.L.I. maps (Appendix II).

From the U.S. border to the Antler River confluence, there is minimal potential to support beaver, muskrat or mink populations, primarily because this reach is devoid of good habitat necessary for these species to propogate and exist.

3.4.1.2 Melita to Hartney (44.2 miles)

The riparian tree growth along banks of the Souris River in this reach consists primarily of American elm (Ulmus americana), green ash (Fraxinus pennsylvanica), box elder (Acer negundo) and bur oak. The river has left a number of permanent and semi-permanent cut-off oxbows in this area during its meandering over the years. Jackson Creek enters the river downstream of Melita and the Maple Lake Drain discharges into the Souris River near Lauder.

Table 6 - Wildlife Population Estimates - Souris River Reach 1

Species	Habitat Types	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	29.3[b]	88
Muskrat	River Marsh	2[a] 64	29.3[b]) 3.67)	281
Mink	All except urban & water	0.5	20.98	10
Sharp-tailed grouse	Grassland/Bush	75	5.69	427
Ruffed grouse	Timber/Bush	25	3.54	89
Hungarian partridge	Bush	20	2.56	51
White-tailed jack rabbit	Cropland/Grassland	16	10.91	175
Snowshoe hare	Timber/Bush	300	3.54	1062
Red fox	All except urban & water	0.75 - 1.00	20.98	16 - 21
Coyote	Timber/Bush	0.75	3.54	3
Striped Skunk	Cropland	13.5	10.64	144
Red squirrel	Timber	389	0.98	381
American badger	All except urban & water	0.5	20.98	10
Ermine	All except urban & water	1.4	20.98	29
Lynx	All except urban & water	0.05 - 0.19	20.98	1 - 4
Raccoon	Timber/Bush	10	3.54	35
Meadow vole	All except urban, cropland, & water	128-216,876.8	10.34	806,830
White-tailed deer	Timber/Bush	0 - 42	CLI Class 3-8.40 CLI Class 5-4.20 CLI Class 6-8.40	122-218
Waterfowl	All except urban & open water	37.7	20.98	791

a. Densities expressed per river mile

b. River miles

The river flows through the Lauder Sandhills in this section. The abrupt changes in soil and vegetation types are easily observable.

There are three stop-log dams in Reach 2. One is downstream of Melita (Melita Dam #2 built by P.F.R.A. - also Project #96). Melita Dams #1 and #2 were built for stock-watering and domestic purposes and their reservoirs cover a combined area of 250 acres with a storage capacity of 1200 acre-feet (Hale, 1975).

The Napinka dam is a concrete structure built in 1938 primarily for stock-watering. This dam has the largest storage capacity of the five situated along the Manitoba portion of the Souris River. The reservoir has an area of 120 acres and a storage capacity of 1000 acre-feet (Hale, 1975).

In addition, the dam at Hartney (P.F.R.A. project #152) was built in 1941 for stock watering. This reservoir has an area of 100 acres and a storage capacity of 220 acre-feet. These dams are not put into operation until the level of the Souris River decreases to a certain point at each dam site (Hale, 1975).

Table 7 indicates the areas of habitat types which may be observed within one half mile of the river on either side in this section.

Table 7 - Areas of Habitat Types - Souris River Reach 2

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	3.95	14.3
Bush..	1.97	7.1
Grassland	2.06	7.5
Cropland	18.40	66.5
Marsh	0.67	2.4
Bush/Grassland	0.54	1.9
Urban	0.04	0.2
Water	0.03	0.1
Total	27.66	100.0

Table 8, by extracting the relevant information from the previous table estimates populations of wildlife species found along the river.

The potential for deer production here is excellent. Eight square miles of the analyzed area have a C.L.I. classification of 2, and 15.73 square miles are rates as Class 3. The remainder is Class 6. In addition, there are substantial blocks of wintering habit (Class 3W) close to the river, in the Lauder Sandhills W.M.A. (Goulden et al., 1970).

Waterfowl production is similar to Reach 1: 22.95 square miles of the analyzed area in Class 3; the remainder is Class 5, 6, or 7 (Adams and Hutchinson, 1968).

3.4.1.3 Hartney to Souris (28.1 miles)

This section of the river could be called a transitional zone. The Souris changes from a relatively slow velocity river with a minimal rate of drop before Hartney,

Table 8 - Wildlife Population Estimates - Souris River Reach 2

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	44.2[b]	133
Muskrat	River Marsh	2[a] 64	44.2[b] 0.67	131
Mink	All except urban & water	0.5	27.59	14
Sharp-tailed grouse	Grassland/Bush	75	4.57	343
Ruffed grouse	Timber/Bush	25	7.78	195
Hungarian partridge	Bush	20	1.97	39
White-tailed jack rabbit	Cropland/Grassland	16	20.46	327
Snowshoe hare	Timber/Bush	300	7.78	2334
Red fox	All except urban & water	0.75 - 1.00	27.59	21 - 28
Coyote	Timber/Bush	9.75	7.78	6
Striped Skunk	Cropland	13.5	18.40	248
Red squirrel	Timber	389	3.95	1537
American badger	All except urban & water	0.5	27.59	14
Ermine	All except urban & water	1.4	27.59	39
Lynx	All except urban & water	0.05 - 0.19	27.59	1 - 5
Raccoon	Timber/Bush	10	7.78	78
Meadow vole	All except urban, cropland, & water	128-216,876.8	9.19	160,487
White-tailed deer	Timber/Bush	0 - 42	CLI Class 2-8.00 CLI Class 3-15.73 CLI Class 6-3.86	372-567
Waterfowl	All except urban & water	37.7	27.59	1040

a. Densities expressed per river mile.

b. River miles

to a river with a rate of drop approaching 4 to 5 times that found upstream of Hartney.

Plum Creek is the only major watercourse discharging into the Souris River between Hartney and Souris. The Souris Dam at the Town of Souris is a permanent structure originally built in 1911 for stock-watering and domestic purposes. It was rebuilt in 1952 with a storage capacity of 410 acre-feet. The reservoir has a total area of 95 acres (Forsyth, personal communication).

Table 9 indicates habitat types and areas found within one half mile on either side of the river in this reach.

Table 9 - Areas of Habitat Types - Souris River Reach 3

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	2.72	13.2
Bush	0.40	2.0
Grassland	0.90	4.4
Cropland	16.24	79.1
Marsh	0.10	0.5
Bush/Grassland	0.00	0.0
Urban	0.17	0.8
Water	0.00	0.0
Total	20.53	100.0

Extrapolations from Table 9 may be made regarding estimated populations of certain wildlife species (Table 10).

With respect to deer production, 5.29 square miles near Hartney have a C.L.I. Land Capability rating of 2 while near Souris, 8.96 square miles are rated at Class 3 (Goulden et al.,

Table 10 - Wildlife Population Estimates - Souris River Reach 3

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	28.1[b]	84
Muskrat	River Marsh	2[a] 64	28.1[b]) 0.10)	63
Mink	All except urban & water	0.5	20.36	10
Sharp-tailed grouse	Grassland/Bush	75	1.30	98
Ruffed grouse	Timber/Bush	25	3.12	78
Hungarian partridge	Bush	20	0.40	8
White-tailed jack rabbit	Cropland/Grassland	16	17.14	274
Snowshoe hare	Timber/Bush	300	3.12	936
Red fox	All except urban & water	0.75 - 1.00	20.36	15 - 20
Coyote	Timber/Bush	0.75	3.12	2
Striped Skunk	Cropland	13.5	16.24	219
Red squirrel	Timber	389	2.72	1058
American badger	All except urban & water	0.5	20.36	10
Ermine	All except urban & water	1.4	20.36	29
Lynx	All except urban & water	0.05 - 0.19	20.36	1 - 4
Raccoon	Timber/Bush	10	3.12	31
Meadow vole	All except urban, cropland, & water	128-216,876.8	4.12	27,798
White-tailed deer	Timber/Bush	0 - 42	CLI Class 2-5.29 CLI Class 3-8.96 CLI Class 6-6.11	227-356
Waterfowl	All except urban & water	37.7	20.36	768

a. Densities expressed per river mile

b. River miles

1970). The remainder of the analyzed area is Class 6.

As mentioned previously, the current in this section of the Souris River increases steadily as one progresses downstream, therefore, potential for the production of waterfowl also decreases. The analyzed area is rated as Class 3 from Hartney to a point approximately half way to Souris. From this point to Souris the area is Class 4 (Adams and Hutchinson, 1968).

3.4.1.4 Souris to past Elbow (29.8 miles)

The river flows through a unique area which is typified by heavily wooded steep riverbanks and cliffs up to 200 feet high near the elbow. It starts to drop rather dramatically in this section, in places approaching 10 feet per mile.

Elgin and Elbow Creeks are two of the more continuous watercourses entering the Souris River in this reach. Elgin Creek enters from the south, just past the Town of Souris and Elbow Creek joins the Souris River where it abruptly turns north-east from its previous direction of south-east.

Table 11 indicates the areas of different habitat types found between Souris and the Elbow.

Table 11 - Areas of Habitat Types - Souris River Reach 4

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	5.51	21.7
Bush	3.63	14.3
Grassland	1.03	4.1
Cropland	12.37	48.8
Marsh	0.02	0.1
Bush/Grassland	2.78	11.0
Urban	0.00	0.0
Water	0.00	0.0
Total	25.34	100.0

Table 12 estimates populations of certain wildlife species, from data presented in the previous table.

This reach of the river has good potential for deer production (Goulden et al., 1970). It can also maintain a substantial deer population because of large areas of excellent wintering habitat found along the river. The Souris River Bend W.M.A. was established with maintenance of white-tailed deer populations as its primary function (Manitoba Department of Mines, Resources and Environmental Management, 1974). Table 13 indicates the classifications and their areas as rated by the C.L.I. Land Capability of Ungulates (Deer) for lands in Reach 4 of the Souris River.

Because of the river's high velocity in this reach, waterfowl production has very little potential. Fifteen point nine-six square miles of the analyzed area have a C.L.I. Land Capability for Waterfowl of only 4. This is the area immediately adjacent to the river. The remainder of the

Table 12 - Wildlife Population Estimates - Souris River Reach 4

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	29.8[b]	89
Muskrat	River Marsh	1[a] 64	29.8[b]) 0.02)	31
Mink	All except urban & water	0.5	25.34	13
Sharp-tailed grouse	Grassland/Bush	75	7.44	558
Ruffed grouse	Timber/Bush	25	9.14	229
Hungarian partridge	Bush	20	3.63	73
White-tailed jack rabbit	Cropland/Grassland	16	13.40	214
Snowshoe hare	Timber/Bush	300	9.14	2742
Red fox	All except urban & water	0.75 - 1.00	24.35	19 - 25
Coyote	Timber/Bush	0.75	9.14	7
Striped skunk	Cropland	13.5	12.37	167
Red squirrel	Timber	389	5.51	2143
American badger	All except urban & water	0.5	25.34	13
Ermine	All except urban & water	1.4	25.34	35
Lynx	All except urban & water	0.05 - 0.19	25.34	1 - 5
Raccoon	Timber/Bush	10	9.14	91
Meadow vole	All except urban, cropland, & water	128-216,876.8	12.97	20,811
White-tailed deer	Timber/Bush	0 - 42	CLI Class 1 or 1W - 5.82 CLI Class 2-1.52 CLI Class 3-15.21 CLI Class 4, 5 & 6 - 2.79	419 - 613
Waterfowl	All except urban & water	37.7	25.34	955

a. Densities expressed per river mile

b. River miles

analyzed area is evenly divided between Class 5 and 7 (Adams and Hutchinson, 1968, and Hutchinson and Adams, 1970).

Table 13 - C.L.I. Land Capability of Ungulates (Deer) - Souris River Reach 4 (Goulden et al., 1970, and Imrie et al., 1974).

Capability Class	Area (Sq. Miles)	% of Total Analyzed Area
1	1.01	4.0
1W	4.81	19.0
2	1.52	6.0
3	11.92	47.0
3W	3.29	13.0
4	0.51	2.0
5	1.77	7.0
6	0.51	2.0
Total	25.34	100.0

3.4.1.5 Past Elbow to Assiniboine Confluence (38.0 miles)

This reach is characterized by 200-250 foot cliffs adjacent to a good portion of the river's length. The river drops at even a greater rate, in places, than in the previous section, thereby resulting in stronger and faster flows. Two major tributaries, Black and Oak Creeks, discharge into the Souris River downstream of Wawanesa.

There is a permanent concrete dam at Wawanesa. It was built in the 1930's primarily for stock watering and domestic purposes.

Table 14 indicates the major habitat types and their areas along this reach of the river.

Table 14 - Areas of Habitat Types - Souris River Reach 5

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	9.75	33.1
Bush	0.79	2.7
Grassland	2.33	7.9
Cropland	14.77	50.1
Marsh	0.13	0.4
Bush/Grassland	1.26	4.3
Urban	0.39	1.3
Water	0.07	0.2
Total	29.49	100.0

Extrapolations utilizing data from the previous table with respect to estimated populations of listed species are included in Table 15.

This area is extremely important to deer because there are substantial blocks of Class 1W deer wintering areas to support deer produced in Class 2 lands, according to the C.L.I. Land Capability for Ungulates (Deer) (Imrie, et al., 1974). The importance of this area with respect to deer may be observed in Table 16.

Table 16 - C.L.I. Land Capability for Ungulates (Deer) - Souris River Reach 5 (Imrie et al., 1974).

Capability Class	Area (Sq. Miles)	% of Total Analyzed Area
1	0.58	2.0
1W	2.03	7.0
2	8.42	29.0
3	6.10	21.0
5	11.90	41.0
Total	29.03	100.0

Table 15 - Wildlife Population Estimate - Souris River Reach 5

Species	Habitat Types	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	38.0[b]	114
Muskrat	River Marsh	1[a] 64	38.0[b]) 0.13)	46
Mink	All except urban & water	0.5	29.03	15
Sharp-tailed grouse	Grassland/Bush	75	4.38	329
Ruffed grouse	Timber/Bush	25	10.54	264
Hungarian partridge	Bush	20	0.79	16
White-tailed jack rabbit	Cropland/Grassland	16	17.10	274
Snowshoe hare	Timber/Bush	300	10.54	3192
Red fox	All except urban & water	0.75 - 1.00	29.03	22 - 29
Coyote	Timber/Bush	0.75	10.54	8
Striped skunk	Cropland	13.5	14.77	199
Red squirrel	Timber	389	9.75	3793
American badger	All except urban & water	0.5	29.03	15
Ermine	All except urban & water	1.4	29.03	41
Lynx	All except urban & water	0.05 - 0.19	29.03	1 - 6
Raccoon	Timber/Bush	10	10.54	105
Meadow vole	All except urban, cropland, & water	128-216,876.8	14.26	48508
White-tailed deer	Timber/Bush	0.42	CLI Class 1 or 1W - 2.61 CLI Class 2-8.42 CLI Class 3-6.10 CLI Class 5-11.90	373-556
Waterfowl	All except urban & water	37.7	29.03	1094

a. Densities expressed per river mile

b. River miles

Waterfowl production in this reach is minimal. The C.L.I. Land Capability for Waterfowl rates the analyzed area: 15.7 square miles as Class 4, with remainder Class 5, 6, and 7 (Hutchinson and Adams, 1970).

3.4.1.6 Summary

Table 17 indicates total area of different habitat types for the Souris River.

Table 17 - Areas of Habitat Types - Souris River (Manitoba portion)

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	22.91	18.5
Bush	9.35	7.5
Grassland	6.59	5.3
Cropland	72.42	58.4
Marsh	4.59	3.7
Bush/Grassland	7.44	6.0
Urban	0.61	0.5
Water	0.10	0.1
Total	124.01	100.0

Table 18 indicates estimated total populations for listed species along the Souris River within one half mile on either side.

3.4.2 Major Tributaries and Lakes

This section has been divided into eleven subsections, each one representing a major tributary of the Souris River or a large water body in the Basin. As with the Souris River, air photos were examined and major habitat types were delineated

Table 18 - Wildlife Population Estimates - Souris River (Manitoba portion)

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	169.4[b]	508
Muskrat	River	2[a*] (1[a**])	169.4[b])	565
	Marsh	64	4.59)	
Mink	All except urban & water	0.5	123.30	62
Sharp-tailed grouse	Grassland/Bush	75	15.94	1196
Ruffed grouse	Timber/Bush	25	32.26	807
Hungarian partridge	Bush	20	9.35	187
White-tailed jack rabbit	Cropland/Grassland	16	79.01	1264
Snowshoe hare	Timber/Bush	300	32.26	9678
Red fox	All except urban & water	0.75 - 1.00	123.30	92 - 123
Coyote	Timber/Bush	0.75	32.26	24
Striped skunk	Cropland	13.5	72.42	978
Red squirrel	Timber	389	22.91	8912
American badger	All except urban & water	0.5	123.30	62
Ermine	All except urban & water	1.4	123.30	173
Lynx	All except urban & water	0.05 - 0.19	123.30	6 - 23
Raccoon	Timber/Bush	10	32.26	323
Meadow vole	All except urban, cropland, & water	128-216,876.8	50.88	1064433
White-tailed deer	Timber/Bush	0 - 42	CLI Class 1 & 1W - 8.43	
			CLI Class 2 & 2W - 23.23	
			CLI Class 3 & 3W - 54.40	1513-2310
			CLI Class 4-0.51	
			CLI Class 5-17.87	
			CLI Class 6-18.88	
Waterfowl	All except urban & water	37.7	123.30	4648

a. Densities expressed per river mile
b. River miles

* Density per river mile upstream of Souris
** Density per river mile downstream of Souris

and measured. Specifically, tributaries analyzed included the Manitoba portions of Antler River, Gainsborough, Jackson, Pipestone, Plum, Elgin, Black and Oak Creeks. In addition, analysis was undertaken adjacent to the Oak-Plum Lakes Complex, Maple-Hunter Marsh Complex and Whitewater Lake. Graham and Stony Creeks were not analyzed, however, riparian vegetation types along these creeks were assumed to be similar to the Manitoba portion of Jackson Creek. The information derived from the analysis of Jackson Creek was applied to Graham and Stony Creeks.

3.4.2.1 Antler River (45.1 miles)

Antler River has its source in Saskatchewan and traverses lands of mixed prairie in Saskatchewan, North Dakota, and Manitoba. After the river enters Manitoba, it subsequently flows into North Dakota before flowing north and eventually entering the Souris River near Coulter.

Antler River usually maintains a flow throughout the year although a "no-flow" situation has occurred at various times. The mean flow of the Antler has been estimated at 17.2 cubic feet per second (c.f.s.) for the period March through October (Createplan, 1970). During the winter months, flow is considered negligible and conceivably most of the river freezes to the bottom (Appendix I). However, Neilson (personal communication) states that from his observations of the major tributaries, beaver dams prevent total freeze-up. On the average, pools occur every 100 yards along the Antler River.

Winter survival of aquatic mammals may occur because of formation of pools from natural landforms or beaver dams, thereby preventing almost certain freeze-out.

Lands immediately adjacent to Antler River are heavily treed with a bush and bush/grassland complex surrounding forested areas. The remainder of the analyzed area is under heavy agricultural use (Table 19).

Table 19 - Areas of Habitat Types - Antler River

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	2.01	11.7
Bush	0.59	3.5
Grassland	0.09	0.5
Cropland	12.73	74.6
Marsh	0.00	0.0
Bush/Grassland	1.66	9.7
Urban	0.00	0.0
Water	0.00	0.0
Total	17.08	100.0

Table 20 indicates wildlife population estimates for certain species assuming, as before, an average density for prime habitat.

Situated along the Antler River are substantial areas of good white-tailed deer winter habitat (Table 21).

Bidlake (personal communication) states that 100-200 deer overwinter near the Antler River.

As the river enters Manitoba from Saskatchewan, the C.L.I. Land Capability for Waterfowl rates large areas as Class 3. However, as the river re-enters Manitoba from North Dakota, adjacent areas have a Land Capability for Waterfowl of only Class 4 or 5 (Adams and Hutchinson, 1968).

Table 20 - Wildlife Population Estimates - Antler River

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	45.1[b]	135
Muskrat	River Marsh	2[a] 64	45.1[b]) 0.00)	90
Mink	All except urban & water	0.5	17.08	9
Sharp-tailed grouse	Grassland/Bush	75	2.34	176
Ruffed grouse	Timber/Bush	25	2.60	65
Hungarian partridge	Bush	20	0.59	12
White-tailed jack rabbit	Cropland/Grassland	16	12.82	205
Snowshoe hare	Timber/Bush	300	2.60	780
Red fox	All except urban & water	0.75-1.00	17.08	13-17
Coyote	Timber/Bush	0.75	2.60	2
Striped skunk	Cropland	13.5	12.73	172
Red squirrel	Timber	389	2.01	782
American badger	All except urban & water	0.5	17.08	9
Ermine	All except urban & water	1.4	17.08	24
Lynx	All except urban & water	0.05-0.19	17.08	1-3
Raccoon	Timber/Bush	10	2.60	26
Meadow vole	All except urban, cropland, & water	128-216,876.8	4.35	6177
White-tailed deer	Timber/Bush	0-42	CLI Class 2W-7.69 CLI Class 3W-5.98 CLI Class 6-3.42	239-361
Waterfowl	All except urban & water	37.7	17.08	644

a. Densities expressed per river mile
b. River miles

Table 21 - C.L.I. Land Capability for Ungulates (Deer) - Antler River (Goulden et al., 1970).

Capability Class	Area (Sq. Miles)	% of Total Analyzed Area
2W	7.69	45.0
3W	5.98	35.0
6	3.41	20.0
Total	17.08	100.0

3.4.2.2 Gainsborough Creek (31.3 miles)

Gainsborough Creek has its source in Saskatchewan and traverses lands similar to those adjacent to Antler River. The creek is not as heavily wooded as Antler River and the analyzed portion is primarily bush and grassland near the Saskatchewan-Manitoba border. The valley of Gainsborough Creek is a relatively deep erosion channel. As with the Antler River and most of the tributaries of the Souris River, Gainsborough Creek is in a "no-flow" situation for most winter months. From March through October the mean flow of the creek is 6.5 c.f.s. (Createplan, 1970).

Table 22 indicates different vegetative habitat types and their areas adjacent to Gainsborough Creek.

Table 22 - Areas of Habitat Types - Gainsborough Creek.

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	0.56	4.4
Bush	1.51	11.7
Grassland	2.04	15.8
Cropland	5.25	40.7
Marsh	0.00	0.0
Bush/Grassland	3.55	27.4
Urban	0.00	0.0
Water	0.00	0.0
Total	12.91	100.0

Table 23 indicates the estimated population of certain wildlife species within one half mile from either side of the creek, again, assuming average densities per square mile or per river mile.

Gainsborough Creek is an important deer wintering area (Table 24).

Table 24 - C.L.I. Land Capability for Ungulates (Deer) - Gainsborough Creek (Goulden et al., 1970).

Capability Class	Area (Sq. Miles)	% of Total Analyzed Area
3W	2.32	18.0
4	6.46	50.0
5	2.32	18.0
6	1.81	14.0
Total	12.91	100.0

Because the creek probably freezes to the bottom in most years, aquatic animals are forced to spend winters in the Souris River, natural ponds or in ponds formed by beaver dams.

Where Gainsborough Creek enters Manitoba from Saskatchewan, the C.L.I. Land Capability for Waterfowl is rated as Class 3 (Adams and Hutchinson, 1968). This classification represents only 1.02 square miles of the analyzed area. Class 4 (4.42 square miles), Class 5 (1.70 square miles), and Class 6 (5.77 square miles) represent the remainder of the analyzed area adjacent to Gainsborough Creek. It is evident therefore, that this creek is not a

Table 23 - Wildlife Population Estimates - Gainsborough Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	31.3[b]	94
Muskrat	River Marsh	2[a] 64	31.3[b]) 0.00)	63
Mink	All except urban & water	0.5	12.91	6
Sharp-tailed grouse	Grassland/Bush	75	7.10	533
Ruffed grouse	Timber/Bush	25	2.07	52
Hungarian partridge	Bush	20	1.51	30
White-tailed jack rabbit	Cropland/Grassland	16	7.29	117
Snowshoe hare	Timber/Bush	300	2.07	621
Red fox	All except urban & water	0.75-1.00	12.91	10-13
Coyote	Timber/Bush	0.75	2.07	2
Striped skunk	Cropland	13.5	5.25	71
Red squirrel	Timber	389	0.56	218
American badger	All except urban & water	0.5	12.91	6
Ermine	All except urban & water	1.4	12.91	18
Lynx	All except urban & water	0.05-0.19	12.91	1-2
Raccoon	Timber/Bush	10	2.07	21
Meadow vole	All except urban, cropland, & water	128-216,876.8	8.66	23,294
White-tailed deer	Timber/Bush	0-42	CLI Class 3-2.32 CLI Class 4-6.46 CLI Class 5-2.32 CLI Class 6-1.81	82-167
Waterfowl	All except urban & water	37.7	12.91	487

a. Densities expressed per river mile

b. River miles

major waterfowl production area nor is it a primary or even secondary waterfowl staging area.

3.4.2.3 Graham Creek (47.4 miles), Jackson Creek (37.3 miles) and Stony Creek (34.9 miles)

These creeks are combined because of the technique used in analyzing their adjacent areas. Jackson Creek was arbitrarily chosen as typical and information acquired from this analytical area was applied to both Graham and Stony Creeks. These creeks originate in Saskatchewan and flow south-east. Graham Creek eventually joins the Souris River where the Town of Melita is now situated and Jackson Creek joins the Souris a few miles to the north of Graham Creek. Stony Creek terminates in the Maple-Hunter Marsh complex. This series of lakes and marshes is hydrologically connected to the Souris River by way of the Maple Lake Drain. Jackson Creek's analyzed area is primarily cropland with substantial areas of bush adjacent to the creek; especially near the Saskatchewan-Manitoba border. Table 25 indicates areas of different habitat types in the analyzed region adjacent to Jackson Creek. Percentages were taken and applied directly to an area one half mile on either side of both Graham and Stony Creeks.

Tables 26, 27, and 28 indicate estimated populations of wildlife species which may be found within one half mile on either side of the three creeks.

These creeks probably freeze to the bottom during winter and in dry years may completely cease flow in

Table 25 - Areas of Habitat Types - Graham, Jackson and Stony Creeks

Habitat Type	Graham Creek Area (Sq. Miles)	Jackson Creek Area (Sq. Miles)	Stony Creek Area (Sq. Miles)	% of Analyzed Area
Timber	1.34	1.51	1.93	4.2
Bush	10.50	11.98	15.09	32.8
Grassland	3.33	3.81	4.78	10.4
Cropland	16.25	18.56	23.37	50.8
Marsh	0.00	0.00	0.00	0.0
Bush/Grassland	0.58	0.66	0.83	1.8
Urban	0.00	0.00	0.00	0.0
Water	0.00	0.00	0.00	0.0
Total	32.00	36.52	46.00	100.0

Table 26 - Wildlife Population Estimates - Graham Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	47.4[b]	142
Muskrat	River Marsh	2[a] 64	47.4[b] 0.00	95
Mink	All except urban & water	0.5	32.00	16
Sharp-tailed grouse	Grassland/Bush	75	14.41	1081
Ruffed grouse	Timber/Bush	25	11.84	296
Hungarian partridge	Bush	20	10.50	210
White-tailed jack rabbit	Cropland/Grassland	16	19.58	313
Snowshoe hare	Timber/Bush	300	11.84	3552
Red fox	All except urban & water	0.75-1.00	32.00	24-32
Coyote	Timber/Bush	0.75	11.84	9
Striped skunk	Cropland	13.5	16.25	219
Red squirrel	Timber	389	1.34	521
American badger	All except urban & water	0.5	32.00	16
Ermine	All except urban & water	1.4	32.00	45
Lynx	All except urban & water	0.05-0.19	32.00	2-6
Raccoon	Timber/Bush	10	11.84	118
Meadow vole	All except urban, cropland, & water	128-216,876.8	15.75	23,293
White-tailed deer	Timber/Bush	0-42	CLI Class 3-3.20 CLI Class 5-20.16 CLI Class 6-8.64	102-211
Waterfowl	All except urban & water	37.7	32.00	1206

a. Densities expressed per river mile
b. River miles

Table 27 - Wildlife Population Estimates - Jackson Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	37.3[b]	112
Muskrat	River Marsh	2[a] 64	37.3[b]) 0.00)	75
Mink	All except urban & water	0.5	36.52	18
Sharp-tailed grouse	Grassland/Bush	75	16.45	1234
Ruffed grouse	Timber/Bush	25	13.49	337
Hungarian partridge	Bush	20	11.98	240
White-tailed jack rabbit	Cropland/Grassland	16	22.37	447
Snowshoe hare	Timber/Bush	300	13.49	4047
Red fox	All except urban & water	0.75-1.00	36.52	27-37
Coyote	Timber/Bush	0.75	13.49	10
Striped skunk	Cropland	13.5	18.56	251
Red squirrel	Timber	389	1.51	587
American badger	All except urban & water	0.5	36.52	18
Ermine	All except urban & water	1.4	36.52	51
Lynx	All except urban & water	0.05-0.19	36.52	2-7
Raccoon	Timber/Bush	10	13.49	135
Meadow vole	All except urban, cropland, and water	128-216,876.8	17.96	26,631
White-tailed deer	Timber/Bush	0-42	CLI Class 3-4.02 CLI Class 5-28.12 CLI Class 6-4.75	136-263
Waterfowl	All except urban & water	37.7	36.52	1377

a. Densities expressed per river mile
b. River miles

Table 28 - Wildlife Population Estimates - Stony Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	34.9[b]	105
Muskrat	River Marsh	2[a] 64	34.9[b]) 0.00)	70
Mink	All except urban & water	0.5	46.00	23
Sharp-tailed grouse	Grassland/Bush	75	20.70	1553
Ruffed grouse	Timber/Bush	25	17.02	426
Hungarian partridge	Bush	20	15.09	302
White-tailed jack rabbit	Cropland/Grassland	16	28.15	450
Snowshoe hare	Timber/Bush	300	17.02	5106
Red fox	All except urban & water	0.75-1.00	46.00	35-46
Coyote	Timber/Bush	0.75	17.02	13
Striped skunk	Cropland	13.5	23.37	315
Red squirrel	Timber	389	1.93	751
American badger	All except urban & water	0.5	46.00	23
Ermine	All except urban & water	1.4	46.00	64
Lynx	All except urban & water	0.05-0.19	46.00	2-9
Raccoon	Timber/Bush	10	17.02	170
Meadow vole	All except urban, cropland, and water	128-216,876.8	22.63	93,293
White-tailed deer	Timber/Bush	0-42	CLI Class 3-11.04 CLI Class 5-27.60 CLI Class 6-7.36	227-409
Waterfowl	All except urban & water	37.7	46.00	1734

a. Densities expressed per river mile
b. River miles

the late summer. It is possible that estimated populations of certain aquatic species may be somewhat optimistic. In any event, it is probable that most water-oriented wildlife species inhabit creeks after spring break-up.

The C.L.I. Land Capability for Ungulates (Deer) along these three creeks indicate a relatively poor potential as a deer production area or as an area to maintain or overwinter existing deer populations (Goulden et al., 1970).

Regions which have a Land Capability for deer of Class 3 are found on the outer periphery of the analyzed areas along the creeks. Table 29 indicates classifications and their areas for deer production.

Table 29 - C.L.I. Land Capability for Ungulates (Deer) - Graham, Jackson and Stony Creeks (Goulden et al., 1970).

Capability Class	Graham Creek		Jackson Creek		Stony Creek	
	Area (Sq.mi.)	% of Total Analyzed Area	Area (Sq.Mi.)	% of Total Analyzed Area	Area (Sq.Mi.)	% of Total Analyzed Area
3	3.20	10.0	4.02	11.0	11.00	24.0
5	20.16	63.0	28.12	77.0	27.60	60.0
6	8.64	27.0	4.38	12.0	7.40	16.0
Total	32.00	100.0	36.52	100.0	46.00	100.0

C.L.I. Land Capability for Waterfowl in the Graham, Jackson and Stony Creek uplands show excellent productivity potential (Adams and Hutchinson, 1968). However, potential is low in valleys of these creeks. Table 30 indicates different

capability classifications for waterfowl within one half mile on either side of these creeks.

Table 30 - C.L.I. Land Capability for Waterfowl - Graham, Jackson and Stony Creeks (Adams and Hutchinson, 1968).

Capability Class	Graham Creek		Jackson Creek		Stony Creek	
	Area (Sq.mi.)	% of Total Analyzed Area	Area (Sq.mi.)	% of Total Analyzed Area	Area (Sq.mi.)	% of Total Analyzed Area
1	6.72	21.0	7.67	21.0	5.06	11.0
2	0.96	3.0	1.09	3.0	11.96	26.0
4	9.28	29.0	9.50	26.0	1.38	3.0
5	10.56	33.0	13.88	38.0	23.46	51.0
6	4.48	14.0	4.38	12.0	4.14	9.0
Total	32.00	100.0	36.52	100.0	46.00	100.0

Areas of Class 1 occur on uplands between the creeks. These lands are the most productive areas for waterfowl in the Basin. The main stems of these creeks are not considered productive waterfowl areas, since Classes 4, 5 and 6 predominate.

3.4.2.4 Maple-Hunter Marsh Complex

Stony Creek discharges into Maple Lake, which itself has no definite natural outlet. Since topography in the Maple Lake area is relatively flat, extensive flooding occurred when water levels were high. Between 1962 and 1966, very high water levels on Maple Lake caused flooding of up to 6000 acres of hayland around the lake (Water Control and Conservation Branch, 1967).

Maple Lake has no natural above ground outlet therefore

water levels were a function of the flow in Stony Creek.

A report (Water Control and Conservation Branch, 1967) described four proposals, any of which if implemented, would alleviate problems associated with flooding. One of these, the Maple Lake Drain, has subsequently been implemented. This drain hydrologically connects the Maple-Hunter Marsh Complex to the Souris River and serves to regulate the water level in the Complex for the benefit of farmers desirous of producing hay in the area.

The Maple Lake Drain will not be analyzed with respect to estimated wildlife populations along it. Table 31 indicates areas of different habitat types in the analyzed region around and including the Maple-Hunter Marsh Complex.

Table 31 - Areas of Habitat Types - Maple-Hunter Marsh Complex

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	4.43	16.0
Bush	0.86	3.1
Grassland	13.76	49.7
Cropland	2.53	9.1
Marsh	4.80	17.4
Bush/Grassland	0.00	0.0
Urban	0.00	0.0
Water	1.30	4.7
Total	27.68	100.0

Table 32 indicates the estimated abundance of listed species which may be found in the analyzed area around the Maple-Hunter Marsh Complex.

Table 32 - Wildlife Population Estimates - Maple-Hunter Marsh Complex

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	-	-	negligible[a]
Muskrat	River Marsh	14,720-16,640[b]	4.80	70,656- 79,872
Mink	All except urban & water	0.5	26.38	13
Sharp-tailed grouse	Grassland/Bush	75	14.62	1097
Ruffed grouse	Timber/Bush	25	5.29	132
Hungarian partridge	Bush	20	0.86	17
White-tailed jack rabbit	Cropland/Grassland	16	16.29	261
Snowshoe hare	Timber/Bush	300	5.29	1587
Red fox	All except urban & water	0.75-1.00	26.38	20-26
Coyote	Timber/Bush	0.75	5.29	4
Striped skunk	Cropland	13.5	2.53	34
Red squirrel	Timber	389	4.43	1723
American badger	All except urban & water	0.5	26.38	13
Ermine	All except urban & water	1.4	26.38	37
Lynx	All except urban & water	0.05-0.19	26.38	1-5
Raccoon	Timber/Bush	10	5.29	53
Meadow vole	All except urban, cropland, & water	128-216,876.8	25.15	1,124,241
White-tailed deer	Timber/Bush	0-42	CLI Class 4-3.32 CLI Class 6-24.36	23-113
Waterfowl	All except urban & water	37.7	26.38	995

a. H. Goulden & I. Millikan (Personal communication)
b. Banfield (1974)

This area does not have a high deer production nor overwintering potential (Goulden et al., 1970). There are small blocks of Class 3W lands, although these are merely extensions of wintering areas associated with Lauder Sandhills.

The C.L.I. Land Capability for Waterfowl in and around Maple Lake indicates a very high waterfowl production potential (Adams and Hutchinson, 1968). Eighteen point two seven square miles is classified as 2S.

Robertson (1967) estimated a minimum population of 2500 ducks and 290 coots utilizing the Maple Lake area before any substantial migration occurred. He also estimated a minimum population of 6000 ducks and 1785 coots utilizing the Hunter Marsh Complex.

3.4.2.5 Pipestone Creek (51.8 miles)

This creek has its source in Saskatchewan and meanders across a good portion of the Basin's Aspen parkland before discharging into Oak Lake. As the creek enters from Saskatchewan, riparian vegetation consists primarily of bush and grassland. Gradually, timber starts to predominate the riparian zone. There are two major stretches of forested areas along Pipestone Creek interspersed with bush and grassland. As the creek turns north, dykes and a diversion direct the flow into Oak Lake along a shorter route. The actual river channel flows further north before meandering eventually into Oak Lake. A good portion of the old channel is now marsh during years when water levels are high.

This creek is larger than most of the creeks previously examined and probably does not freeze to the bottom throughout its length each winter. However, when freeze-out occurs there would be a die-off of the aquatic oriented mammals. Muskrat and beaver would probably re-inhabit the watercourse from Oak Lake in the spring.

Table 33 indicates areas of habitat types occurring within approximately one half mile of either side of the creek.

Table 33 - Areas of Habitat Types - Pipestone Creek

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	3.35	7.2
Bush	6.83	14.8
Grassland	3.58	7.7
Cropland	29.56	64.0
Marsh	0.33	0.7
Bush/Grassland	2.33	5.1
Urban	0.14	0.3
Water	0.10	0.2
Total	46.22	100.0

From the information illustrated in the previous table, Table 34 estimates populations of certain species which may be found along the creek.

The potential for deer production and overwintering is excellent in this area (Table 35). This region is crucial for maintenance of deer populations because it is the only wintering area of significance in this portion of the Basin.

Table 34 - Wildlife Population Estimates - Pipestone Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	51.8[b]	155
Muskrat	River	2[a]	51.8[b]	125
	Marsh	64	0.33	
Mink	All except urban & water	0.5	45.98	23
Sharp-tailed grouse	Grassland/Bush	75	12.74	956
Ruffed grouse	Timber/Bush	25	10.18	255
Hungarian partridge	Bush	20	6.83	137
White-tailed jack rabbit	Cropland/Grassland	16	33.14	530
Snowshoe hare	Timber/Bush	300	10.18	3054
Red fox	All except urban & water	0.75-1.00	45.98	34-46
Coyote	Timber/Bush	0.75	10.18	8
Striped skunk	Cropland	13.5	29.56	399
Red squirrel	Timber	389	3.35	1303
American badger	All except urban & water	0.5	45.98	23
Ermine	All except urban & water	1.4	45.98	64
Lynx	All except urban & water	0.05-0.19	45.98	2-9
Raccoon	Timber/Bush	10	10.18	102
Meadow vole	All except urban, cropland, & water	128-216,876.8	16.42	101,723
White-tailed deer	Timber/Bush	0-42	CLI Class 1W-11.56 CLI Class 2-1.39 CLI Class 3-1.39 CLI Class 4-15.70 CLI Class 5-7.86 CLI Class 6-8.32	539-816
Waterfowl	All except urban & water	37.7	45.98	1733

a. Densities expressed per river mile
b. River miles

Table 35 - C.L.I. Land Capability for Ungulates (Deer) - Pipestone Creek (Goulden et al., 1970).

Capability Class	Area (Sq. Miles)	% of Total Analyzed Area
1W	11.56	25.0
2	1.39	3.0
3	1.39	3.0
4	15.70	34.0
5	7.86	17.0
6	8.32	18.0
Total	46.22	100.0

Examining the C.L.I. Capability for Waterfowl along Pipestone Creek, it may be observed that the potential for waterfowl production is poor with areas of Class 4 (32.35 square miles), Class 5 (10.17 square miles) and Class 6 (1.39 square miles). However areas of Class 2 (2.31 square miles) occur in the uplands of the analyzed area within one half mile on either side of Pipestone Creek (Adams and Hutchinson, 1968).

3.4.2.6 Oak-Plum Lakes Complex

A substantial number of wildlife studies have been done in and around this area. Oak Lake is the second largest lake in the Canadian portion of the Souris River Basin. Pipestone Creek discharges into Oak Lake and Plum Creek drains the complex out of South Plum Lake.

In 1956, the Plum Creek Diversion was built in order to relieve the usual spring flooding situation. However, during relatively dry years the water level of the complex drops,

drying up marshes. Ducks Unlimited built a dam in 1958 where Plum Creek drains Plum Lake and the entire Oak-Plum Lakes Complex. It was built to combat this water table problem but D.U. has not operated Plum Lake Dam because of an inability to secure all required land rights (flood easements).

In 1959, approximately 65% of the surface water area of Oak-Plum Lakes dried up. This represented a decrease in water level of approximately five feet. It caused a severe winter kill of aquatic organisms and an 85% decline in waterfowl population which indicates a loss of approximately 10,000 birds (Hale, 1975).

The Oak Lake Control structure was built in 1964 in an attempt to solve the problems associated with fluctuating levels of the lake. The dam is located where Oak Lake flows into the Plum Lakes system. It is a fixed crest concrete structure with a full supply level of 1410 feet above sea level (a.s.l.) and a storage capacity of 20,000 acre-feet (Harrison, personal communication). Dykes were built in association with this dam to maintain the water in Oak Lake at the full supply level.

Plum Lake is presently classes as a "semi-permanent" water body since there is a continum of water throughout the year during most, but not all years. Water levels decrease after spring run-off and marshes dry up during periods of drought (Bossenmaier, 1971).

Table 36 indicates sizes of habitat types in and around

the Oak-Plum Lakes Complex.

Table 36 - Areas of Habitat Types - Oak-Plum Lakes Complex

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	2.51	4.8
Bush	0.31	0.6
Grassland	17.45	33.3
Cropland	2.28	4.3
Marsh	13.15	25.1
Bush/Grassland	0.13	0.2
Urban	0.00	0.0
Water	16.64	31.7
Total	52.47	100.0

Table 37 indicates estimated abundance of wildlife species in the analyzed area around the Oak-Plum Lakes complex.

Most of the analyzed area has poor potential for deer production, although there are small areas of fairly good wintering habitat. Adjacent to the north-east edge of Oak Lake is an area of Class 2 (1.07 square miles) (C.L.I. Land Capability for Ungulates (Deer)), and two small areas of Class 3W wintering habitat (2.15 square miles). However, 30.81 square miles of the area is Class 6 and 2.15 square miles is Class 4 which indicates poor deer reproductive potential (Goulden et al., 1970).

This region is, during normal years, a most important area for waterfowl in the Basin. There are substantial migration areas of Class 2S and 3S and Oak Lake itself is useful as a staging area although production from the lake is limited.

Table 37 - Wildlife Population Estimates - Oak-Plum Lakes Complex

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	-	-	negligible[a]
Muskrat	River Marsh	- 14,720-16,640[b]	- 13.15	193,568 - 218,816
Mink	All except urban & water	0.56	35.83	18
Sharp-tailed grouse	Grassland/Bush	75	17.89	1342
Ruffed grouse	Timber/Bush	25	2.82	71
Hungarian partridge	Bush	20	0.31	6
White-tailed jack rabbit	Cropland/Grassland	16	19.73	316
Snowshoe hare	Timber/Bush	300	2.82	846
Red fox	All except urban & water	0.75-1.00	35.83	27-36
Coyote	Timber/Bush	0.75	2.82	2
Striped skunk	Cropland	13.5	2.28	31
Red squirrel	Timber	389	2.51	976
American badger	All except urban & water	0.5	35.83	18
Ermine	All except urban & water	1.4	35.83	50
Lynx	All except urban & water	0.05-0.19	35.83	2-7
Raccoon	Timber/Bush	10	2.82	28
Meadow vole	All except urban, cropland, & water	128-216,876.8	33.55	2,956,983
White-tailed deer	Timber/Bush	0-42	CLI Class 2-1.07 CLI Class 3W-2.15 CLI Class 4-2.15 CLI Class 6-30.81	65-193
Waterfowl	All except urban & water	37.7	35.83	1351

a. H. Goulden and I. Millikan (personal communication)
b. Banfield (1974)

Table 38 indicates the areas of different C.L.I. classification (waterfowl) found adjacent to the Oak-Plum Lakes Complex.

Table 38 - C.L.I. Land Capability for Waterfowl - Oak-Plum Lakes Complex (Adams and Hutchinson, 1968).

Capability Class	Area (Sq. Miles)	% of Total Analyzed Area
2	1.57	3.0
2S	22.56	43.0
3S	4.20	8.0
3M	10.49	20.0
4	7.35	14.0
5	1.05	2.0
6	5.25	10.0
Total	52.47	100.0

Robertson (1967) indicated a minimum of 70,000 ducks and 7,000 Coots utilizing the whole Oak-Plum Lakes complex in August. He also estimated that there was a minimum population of 7,000 ducks and 3,500 Coots utilizing Oak Lake. This represents birds which nested, moulted or were raised in the area, as no significant migration had yet occurred.

Robertson (1967) also states that fall populations of White-fronted Geese peak near 2000, Canada Geese peak around 300. Only a few Snow Geese stage in the area during most years.

Webb (1968) estimated annual waterfowl production could be 25,000 juvenile birds, based on 1967 data, if the Plum Lakes area was maintained as Ducks Unlimited originally envisioned, i.e.,if the D.U. dam on Plum Lake was operationalized.

3.4.2.7 Plum Creek (21.8 miles)

Plum Creek drains the entire Oak-Plum Lakes Complex and meanders for 21.8 river miles until flowing into the Souris River at the Town of Souris. Plum Creek is a series of marshes for most of its length until nearing the Souris River where it becomes a fairly large creek. There is some forested area near the creek, but riparian vegetation consists primarily of species associated with marsh, bush, and grassland habitats.

Plum Creek is in a "no-flow" situation during some winter months in most years (Appendix I). It is possible, however, that deep water pockets may exist which are likely to support a winter population of aquatic animals such as muskrat and beaver.

Table 39 indicates areas of habitat types within approximately one half mile on either side of the creek.

Table 40 utilizes information presented in Table 39 to estimate wildlife populations for species listed.

Table 39 - Areas of Habitat Types - Plum Creek

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	0.87	5.7
Bush	0.41	2.7
Grassland	7.54	49.6
Cropland	5.03	33.1
Marsh	0.64	4.2
Bush/Grassland	0.06	0.4
Urban	0.66	4.3
Water	0.00	0.0
Total	15.21	100.0

Table 40 - Wildlife Population Estimates - Plum Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	21.8[b]	65
Muskrat	River Marsh	2[a] 64	21.8[b]) 0.64)	85
Mink	All except urban & water	0.5	14.55	7
Sharp-tailed grouse	Grassland/Bush	75	8.01	601
Ruffed grouse	Timber/Bush	25	1.28	32
Hungarian partridge	Bush	20	0.41	8
White-tailed jack rabbit	Cropland/Grassland	16	12.57	201
Snowshoe hare	Timber/Bush	300	1.28	384
Red fox	All except urban & water	0.75-1.00	14.55	11-15
Coyote	Timber/Bush	0.75	1.28	1
Striped skunk	Cropland	13.5	5.03	68
Red squirrel	Timber	389	0.87	338
American badger	All except urban & water	0.5	14.55	7
Ermine	All except urban & water	1.4	14.55	20
Lynx	All except urban & water	0.05-0.19	14.55	1-3
Raccoon	Timber/Bush	10	1.28	13
Meadow vole	All except urban, cropland, & water	128-216,876.8	9.52	184,002
White-tailed deer	Timber/Bush	0-42	CLI Class 3-1.16 CLI Class 4-2.33 CLI Class 6-11.06	31-84
Waterfowl	All except urban & water	37.7	14.55	549

a. Densities expressed per river mile
b. River miles

Deer production potential is almost nil along Plum Creek and no wintering areas are found in the immediate area (Goulden et al., 1970). C.L.I. Class 3 constitutes 1.16 square miles; 2.33 square miles is rated at Class 4 and the remaining 14.31 square miles is Class 6.

However, since Plum Creek is primarily marsh for a good portion of its length, waterfowl production potential is high (Adams and Hutchinson, 1968). These areas have a rating of Class 2 (2.91 square miles). The remaining analyzed area is Class 4 (6.26 square miles); Class 5 (4.80 square miles) and Class 7 (0.58 square miles).

3.4.2.8 Elgin Creek (9.7 miles)

This creek has its source north-east of Whitewater Lake and flows almost due north until it joins the Souris River downstream from the Town of Souris. Agricultural use of the land in this area extends to the creek's bank in places. Bush is the only other major riparian vegetation type found along the creek.

Aquatic organisms have sufficient opportunity to over-winter in Elgin Creek reservoir providing drastic fluctuations or draw-downs in the water regime do not occur.

Table 41 indicates areas of different habitat types found along Elgin Creek.

Table 41 - Areas of Habitat Types - Elgin Creek

Habitat Type	Area (Sq..Miles)	% of Total Analyzed Area
Timber	0.00	0.0
Bush	1.58	12.3
Grassland	0.18	1.4
Cropland	10.91	85.0
Marsh	0.04	0.3
Bush/Grassland	0.00	0.0
Urban	0.04	0.3
Water	0.08	0.7
Total	12.83	100.0

From the previous table, population estimates may be made for certain species (Table 42).

Potential for deer production or overwintering is negligible with the C.L.I. Land Capability for Ungulates (Deer) rating only 0.64 square miles of the analyzed area as Class 3. The remainder of the area is Class 5 or 6 (Goulden et al., 1970).

Waterfowl production potential is poor with lands rated at Class 3, 4, 5 and 6.

3.4.2.9 Black Creek (21.1 miles)

This creek has its source near Nesbitt and flows in an easterly direction for 21.1 miles joining the Souris River approximately one mile north of Wawanesa. Most of the analyzed area is cropland with cultivation often extending to creek edge, however a substantial block of timber predominates as the creek enters the Souris River. Table 43

Table 42 - Wildlife Population Estimates - Elgin Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	9.7[b]	29
Muskrat	River Marsh	2[a] 64	9.7[b] 0.04	22
Mink	All except urban & water	0.5	12.71	6
Sharp-tailed grouse	Grassland/Bush	75	1.76	132
Ruffed grouse	Timber/Bush	25	1.58	40
Hungarian partridge	Bush	20	1.58	32
White-tailed jack rabbit	Cropland/Grassland	16	11.09	177
Snowshoe hare	Timber/Bush	300	1.58	474
Red fox	All except urban & water	0.75-1.00	12.71	10-13
Coyote	Timber/Bush	0.75	1.58	1
Striped skunk	Cropland	13.5	10.91	147
Red squirrel	Timber	389	0.00	0
American badger	All except urban & water	0.5	12.71	6
Ermine	All except urban & water	1.4	12.71	18
Lynx	All except urban & water	0.05-0.19	12.71	1-2
Raccoon	Timber/Bush	10	1.58	16
Meadow vole	All except urban, cropland, & water	128-216	876.8 1.80	9950
White-tailed deer	Timber/Bush	0-42	CLI Class 3-0.64 CLI Class 5-1.78 CLI Class 6-10.30	13-55
Waterfowl	All except urban & water	37.7	12.71	479

a. Densities expressed per river mile
b. River miles

indicates areas of different habitat types.

Table 43 - Areas of Habitat Types - Black Creek

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	1.11	11.0
Bush	0.05	0.5
Grassland	0.60	6.0
Cropland	7.65	76.5
Marsh	0.12	1.2
Bush/Grassland	0.48	4.8
Urban	0.00	0.0
Water	0.00	0.0
Total	10.01	100.0

By utilizing information from the previous table, population estimates of certain wildlife species may be made (Table 44).

Potential for deer production is minimal along Black Creek. However, near the confluence with the Souris River, 2.50 square miles of the analyzed area is rated C.L.I. Class 2 (Imrie et al., 1974).

Waterfowl production potential is also negligible along Black Creek and within one half mile on either side with C.L.I. Class 4, 5 and 6 dominating (Hutchinson and Adams, 1970).

3.4.2.10 Oak Creek (9.8 miles)

This tributary of the Souris River has its source in the pothole region between Baldur and Belmont and flows about 9.8 river miles in a westerly direction, where it joins the Souris River south of Treesbank. Table 45 indicates areas of

Table 44 - Wildlife Population Estimates - Black Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	21.1[b]	63
Muskrat	River	2[a]	21.1[b]	
	Marsh	64	0.12)	50
Mink	All except urban & water	0.5	10.01	5
Sharp-tailed grouse	Grassland/Bush	75	1.13	85
Ruffed grouse	Timber/Bush	25	1.16	29
Hungarian partridge	Bush	20	0.05	1
White-tailed jack rabbit	Cropland/Grassland	16	8.25	132
Snowshoe hare	Timber/Bush	300	1.16	348
Red fox	All except urban & water	0.75-1.00	10.01	8-10
Coyote	Timber/Bush	0.75	1.16	1
Striped skunk	Cropland	13.5	7.65	103
Red squirrel	Timber	389	1.11	432
American badger	All except urban & water	0.5	10.01	5
Ermine	All except urban & water	1.4	10.01	14
Lynx	All except urban & water	0.05-0.19	10.01	1-2
Raccoon	Timber/Bush	10	1.16	12
Meadow vole	All except urban, cropland, & water	128-216.876.8	2.36	21,351
White-tailed deer	Timber/Bush	0-42	CLI Class 2-2.50 CLI Class 5-7.51	76-120
Waterfowl	All except urban & water	37.7	10.01	377

a. Densities expressed per river mile
b. River miles

habitat types found within one half mile on either side of Oak Creek.

Table 45 - Areas of Habitat Types - Oak Creek

Habitat Types	Area (Sq. Miles)	% of Total Analyzed Area
Timber	1.94	23.2
Bush	0.41	4.9
Grassland	2.68	32.1
Cropland	3.07	36.8
Marsh	0.00	0.0
Bush/Grassland	0.26	3.0
Urban	0.00	0.0
Water	0.00	0.0
Total	8.36	100.0

Table 46 estimates wildlife populations of listed species along Oak Creek.

Potential for deer production immediately adjacent to Oak Creek is fairly high with a C.L.I. Land Capability for Ungulates (Deer) rating of Class 2 for 0.25 square miles of the analyzed area. Some wintering habitat (0.50 square miles) is also present in the analyzed area but this is merely an extension of the Class 3W deer habitat found along the Assiniboine River (Imrie et al., 1974).

Waterfowl production is negligible along this watercourse. C.L.I. ratings indicate a capability of Class 4 to 7 for the area analyzed (Hutchinson and Adams, 1970).

3.4.2.11 Whitewater Lake

This lake is the largest in the Souris River Basin.

Table 46 - Wildlife Population Estimates - Oak Creek

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	3[a]	9.8[b]	29
Muskrat	River Marsh	2[a] 64	9.8[b] 0.00	20
Mink	All except urban & water	0.5	8.36	4
Sharp-tailed grouse	Grassland/Bush	75	3.35	251
Ruffed grouse	Timber/Bush	25	2.35	59
Hungarian partridge	Bush	20	0.41	8
White-tailed jack rabbit	Cropland/Grassland	16	5.75	92
Snowshoe hare	Timber/Bush	300	2.35	705
Red fox	All except urban & water	0.75-1.00	8.36	6-8
Coyote	Timber/Bush	0.75	2.35	2
Striped skunk	Cropland	13.5	3.07	41
Red squirrel	Timber	389	1.94	755
American badger	All except urban & water	0.5	8.36	4
Ermine	All except urban & water	1.4	8.36	12
Lynx	All except urban & water	0.05-0.19	8.36	0-2
Raccoon	Timber/Bush	10	2.35	24
Meadow vole	All except urban, cropland, & water	128-216,876.8	5.29	17,309
White-tailed deer	Timber/Bush	0-42	CLI Class 3 & 3W - 2.09 CLI Class 4-0.58 CLI Class 5-3.26 CLI Class 6-2.42	41-76
Waterfowl	All except urban & water	37.7	8.36	315

a. Densities expressed per river mile

b. River miles

It is not directly connected hydrologically to the Souris River. There is no definite above ground outlet and because of this the lake is prone to drastic fluctuations over the years. Normal conditions of the lake appear to occur when water levels are close to the long term average of 1626.8 feet a.s.l. (Ransom and Hochbaum, 1972). Under these circumstances, there are approximately 15,000 acres of open water with extensive beds of sage pondweed (Artemisia artimisia), approximately 3,000 acres of emergent vegetation such as cattail (Typha latifolia) and bulrush (Scirpus validus) that are flooded most of the time and another 7,000 acres that are flooded seasonally (Ransom and Hochbaum, 1972).

At an average level of 1628.8 feet, the lake covers approximately 15,000 acres to an average depth of 2.5 feet. It occasionally reaches 1630 feet a.s.l. and covers 25,500 acres (Ransom and Hochbaum, 1972). However, the lake reached a high of 1631.5 feet a.s.l. in 1975 and exceeded 1632 feet a.s.l. in 1976 (Austford, personal communication).

Table 47 indicates areas of different habitat types found adjacent to Whitewater Lake.

Table 47 - Areas of Habitat Types - Whitewater Lake

Habitat Type	Area (Sq. Miles)	% of Total Analyzed Area
Timber	0.21	0.6
Bush	0.45	1.3
Grassland	4.51	13.5
Cropland	2.81	8.4
Marsh	5.59	16.7
Bush/Grassland	0.06	0.2
Urban	0.00	0.0
Water	19.89	59.3
Total	33.52	100.0

Table 48 estimates populations of certain species found around and on Whitewater Lake.

Waterfowl production is relatively low at Whitewater Lake compared to potential nesting cover. However, concentrations as high as 130,000 ducks, 20,000 swans and more than 10,000 geese have been observed on Whitewater Lake during fall staging (Davies, 1968).

Muskrat production varies from nil to very high depending on marsh conditions. Only two muskrat lodges were known to exist on Whitewater Lake at freeze-up in 1970 (Ransom and Hochbaum, 1972). In 1946, lodges numbered in the thousands with 11,914 muskrats harvested that spring (Anon., 1946). In 1970-71, the lake completely froze to the bottom. This indicates the difficulties encountered in estimating wildlife populations in and around the lake because of these drastic water level fluctuations.

Table 48 - Wildlife Population Estimates - Whitewater Lake

Species	Habitat Type	Densities per Square Mile	Habitat Area (Square Miles)	Estimated Population
American beaver	River	-	-	negligible[a]
Muskrat	River/Marsh	-	-	negligible[a]
Mink	All except urban & water	0.5	13.63	7
Sharp-tailed grouse	Grassland/Bush	75	4.96	372
Ruffed grouse	Timber/Bush	25	0.66	17
Hungarian partridge	Bush	20	0.45	9
White-tailed jack rabbit	Cropland/Grassland	16	7.32	117
Snowshoe hare	Timber/Bush	300	0.66	198
Red fox	All except urban & water	0.75-1.00	13.63	10-14
Coyote	Timber/Bush	0.75	0.66	1
Striped skunk	Cropland	13.5	2.81	38
Red squirrel	Timber	389	0.21	82
American badger	All except urban & water	0.5	13.63	7
Ermine	All except urban & water	1.4	13.63	19
Lynx	All except urban & water	0.05-0.19	13.63	1-3
Raccoon	Timber/Bush	10	0.66	7
Meadow vole	All except urban, cropland, & water	128-216,876.8	10.82	1,252,338
White-tailed deer	Timber/Bush	0-42	CLI Class 4-0.55 CLI Class 5-0.55 CLI Class 6-12.53	6-48
Waterfowl	All except urban & water	37.7	13.63	514

a. Ransom and Hochbaum (1972)

Table 49 shows relative importance of Whitewater Lake compared to other lakes in the area with respect to staging and migration of waterfowl.

Table 19 The importance of Whitewater Lake to migrating ducks and geese relative to a group of lakes and marshes including Maple, Hunter, Oak, Plum, Bone, Overend, Pelican, Lorne, Louise, Rock and Swan Lakes during 1967, 1968 and 1969 as determined by aerial surveys (Ransom and Hochbaum, 1972)

	WHITEWATER LAKE		OTHER SOUTHWESTERN LAKES		IMPORTANCE RATIO
	Total Ducks All Flights	Av. No. of Ducks per Flight	Total Ducks All Flights	Av. No. of Ducks per Flight	Whitewater/Other Lakes
1967 (6 flights)	509,085	84,847	162,135	27,022	3.1/1
1968 (7 flights)	359,000	51,286	122,116	17,445	2.9/1
1969 (5 flights)	191,000	38,200	107,355	21,451	1.8/1
	1,059,085	58,838	391,606	26,645	2.7/1
	Total Geese All Flights	Av. No. of Geese per Flight	Total Geese All Flights	Av. No. of Geese per Flight	
1967 (6 flights)	13,448	2,241	3,779	629	3.7/1
1968 (7 flights)	21,059	3,008	2,301	328	9.1/1
1969 (5 flights)	7,716	1,543	2,351	470	3.3/1
	42,223	2,346	8,431	468	5.1/1

Percentage of total for Whitewater: Ducks (73%) Geese (83%)

CHAPTER 4

PRESENT USE OF WILDLIFE IN THE MANITOBA PORTION OF THE SOURIS RIVER BASIN

4.1 Introduction

Consumptive use* of wildlife in the Souris River Basin has been measured for residents and non-residents of Manitoba. Species investigated included upland game birds, white-tailed deer, fur bearers and migratory game birds. Raw data were acquired from Federal and Provincial reports, questionnaire results, publications and progress notes relevant to the Souris River Basin.

Analysis involved acquiring data on analytical units (of which the Souris River Basin is a portion) for the particular resource being investigated. The Basin area as a percentage of the unit area was determined for each resource. Data for the unit were then extrapolated for the Basin using this figure. It was assumed that resource use was evenly distributed over the total area of the analytical unit.

4.2 Upland Game Birds

The following data were extrapolated from questionnaire results returned from Upland Game Bird Unit 9 (Figure 4). The questionnaires were distributed and analyzed by the

*Due to the structure of the Souris River Basin Study, examination of the non-consumptive use of the wildlife resource (bird-watching, canoeing, etc.) was contained under the Recreation Sector's terms of reference and is therefore not discussed in this paper.

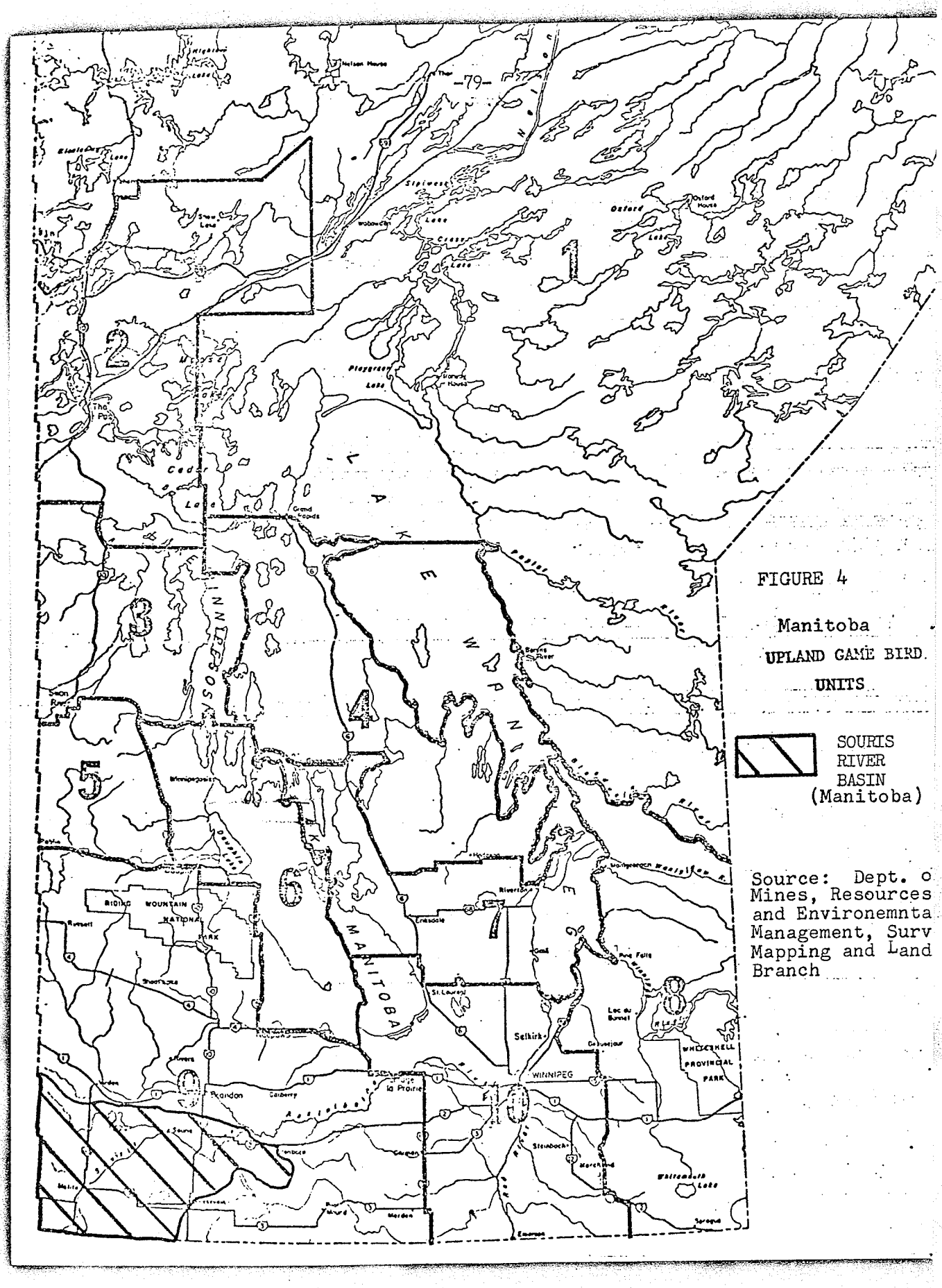


FIGURE 4

Manitoba

UPLAND GAME BIRD UNITS

SOURIS RIVER BASIN (Manitoba)

Source: Dept. o Mines, Resources and Environemnta Management, Surv Mapping and Land Branch

Manitoba Department of Renewable Resources and Transportation Services.

The Manitoba portion of the Souris River Basin is approximately 20% of Upland Game Bird Unit 9, by area. Information presented in Tables 50, 51 and 52 were extrapolated from questionnaire results using the assumption that 20% of the hunters in Unit 9 hunt in the Souris River Basin and that 20% of the birds taken from Unit 9 are harvested in the Basin. In addition, it has been assumed that 20% of the hunter-days occur within the Basin.

Table 50 - Estimates of Resident Upland Game Bird Hunter Activities for 1972-75: Souris River Basin.

Year	Hunters	Days	Days/ Hunter	Sharp-Tailed Grouse	Ruffed Grouse	Spruce Grouse	Hungarian Partridge	Total Harvest
1974-75	1,736	7,580	4.37	2,576	1,117	263	991	4,947
1973-74	1,156	5,485	4.74	2.223	1,350	110	1,223	4,906
1972-73	2,833	12,269	4.33	5,099	5,069	897	1,971	13,036

Table 51 - Estimates of Non-Resident Upland Game Bird Hunter Activities for 1972-75: Souris River Basin.

Year	Hunters	Days	Days/ Hunter	Sharp-Tailed Grouse	Ruffed Grouse	Spruce Grouse	Hungarian Partridge	Total Harvest
1974-75	83	332	4.00	147	33	3	55	238
1973-74	86	325	3.78	182	63	-	82	327
1972-73	213	693	3.25	231	243	4	99	577

Table 52 is the addition of data contained in Tables 50 and 51, indicating the total estimated Game Bird Hunter Use for the Souris River Basin.

Table 52 - Estimates of Total Upland Game Bird Hunter Activities for 1972-75: Souris River Basin.

Year	Hunters	Days	Days/ Hunter	Sharp-Tailed Grouse	Ruffed Grouse	Spruce Grouse	Hungarian Partridge	Total Harvest
1974-75	1,819	7,912	4.35	2,723	1,150	266	1,046	5,185
1973-74	1,242	5,810	4.68	2,405	1,413	110	1,305	5,233
1972-73	3,046	12,962	4.26	5,330	5,312	901	2,070	13,613

Hunter pressure occurs primarily in the Turtle Mountain area for ruffed grouse, north of Whitewater Lake and in the Broomhill, Lyleton, Pierson area for sharp-tailed grouse (Wardley and Peterson, personal communication). West of Highway 83 and from the U.S. border to Highway 2, there is minimal hunting pressure although upland game bird population densities are usually high, especially sharp-tailed grouse (Wardley and Peterson, personal communication).

Areas around and including the Lauder Sandhills W.M.A. support a high level of hunter effort (Wardley and Peterson, personal communication). This area is especially important for Hungarian partridge since hunting partridge occurs primarily in the agricultural regions of the Basin. Upland game bird hunter pressure in the Souris River Bend W.M.A. is primarily dependent on species population densities, seemingly moreso than for other areas of the Basin.

4.3 White-tailed Deer

Data were extrapolated from results of deer hunting

questionnaires distributed and analyzed by Manitoba's Department of Mines, Resources and Environmental Management. Results from Big Game Hunting Areas (G.H.A.) 27, 28, 29 and 29A were used in this report. Although these G.H.A. have occasionally been altered over the years, available data have been applied to the most recent delineation of these areas.

Figure 5 illustrates that the Souris River Basin traverses portions of six Big Game Hunting Areas. Specifically, these are G.H.A. 27, 28, 29, 29A, 31 and 31A. To facilitate analysis, data used for the Souris River Basin are the addition of information estimated from G.H.A..28 plus 62% of Area 27 plus 50% of Areas 29 and 29A. These percentages were determined by calculating the fraction of the Basin area in relation to the total area of the analytical unit. It is further assumed that deer taken from the Souris Basin situated in Areas 31 and 31A would be offset by harvest in the remainder of G.H.A. 28, not included in the Basin.

Table 53 = Estimated White-tailed Deer Hunter Activities: Souris River Basin

Year	Hunters	Days	Days/ Hunter	% Success Rate	Total Retrieved Kill
1973-74	5633	14,836	2.63	44.9	2531
1972-73	5326	14,445	2.71	49.8	2652
1971-72	4427	12,728	2.88	64.9	2871
1970-71	2359	4,888	2.07	46.9	1108
1969-70	4543	10,505	2.31	52.0	2363
1968-69	6107	15,197	2.49	54.0	3298

From the data presented in Table 53, it is not possible

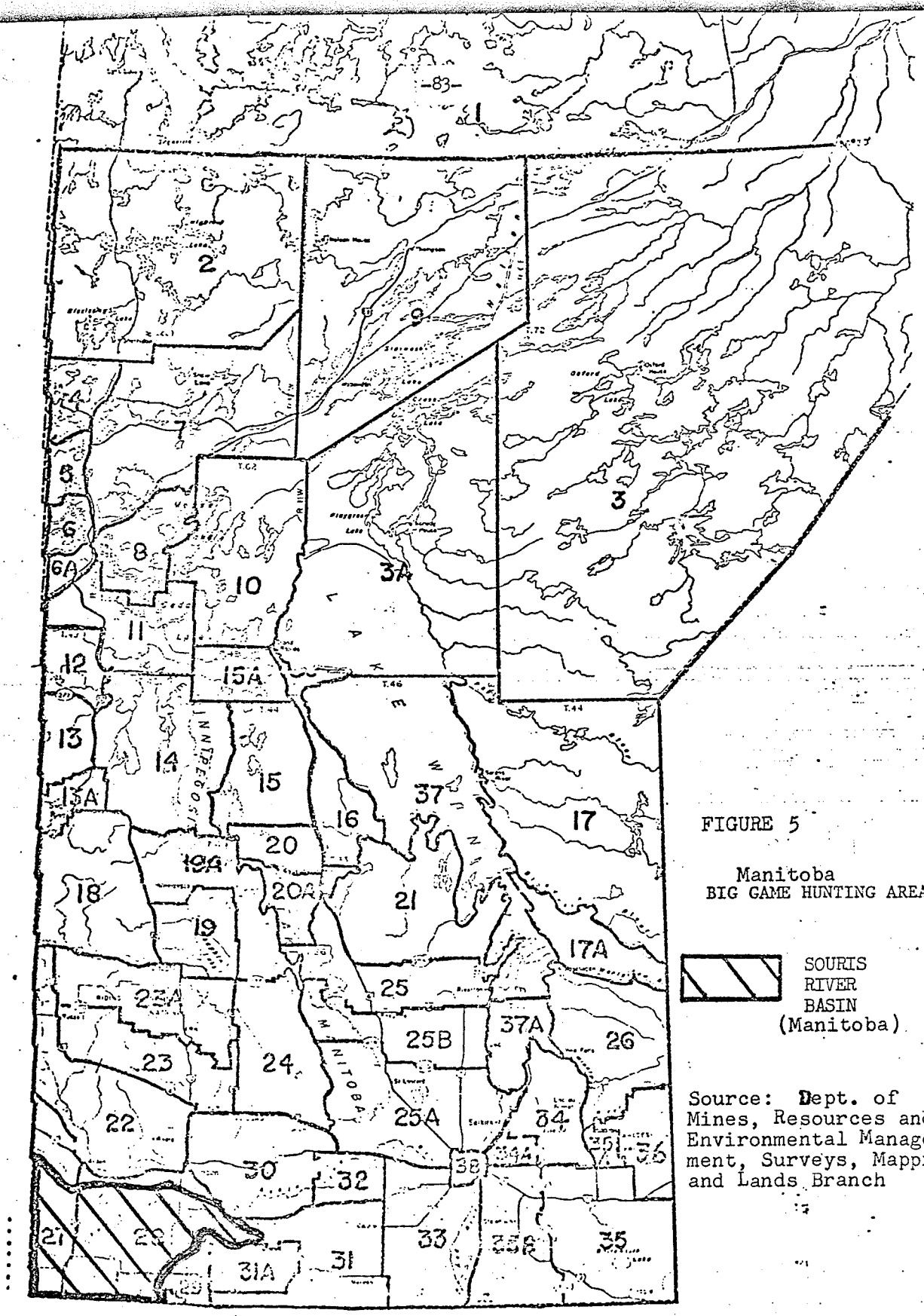


FIGURE 5

Manitoba
BIG GAME HUNTING AREAS

SOURIS RIVER BASIN (Manitoba)

Source: Dept. of Mines, Resources and Environmental Management, Surveys, Mapping and Lands Branch

to determine the number of resident or non-resident hunters.

Prior to 1974, deer hunting was concentrated in fairly specific areas within the Basin. A substantial proportion of the deer hunting activities took place in areas where optimal habitat exists (C.L.I. Class 1, 2, or 3). These areas include land adjacent to creeks between the Souris River and the Saskatchewan border up to and including Pipestone Creek. Of significance, however, are areas around Gainsborough Creek, Antler River and the Lauder Sandhills W.M.A. Two other fairly important regions are the Souris River Bend W.M.A. and Turtle Mountain. In addition, some hunting occurred in the area between Whitewater Lake and Regent and from Highway 2 north to the Town of Souris (Wardley and Peterson, personal communication).

4.4 Fur Bearers

The Souris River Basin in Manitoba is totally contained within Director Zone 3 of the Manitoba Registered Trappers Association (M.R.T.A.) and specifically the Local Fur Councils (L.F.C.) of Virden and Boissevain (Figure 6).

Table 54 indicates the fur harvest data for Manitoba from 1965-66 through 1974-75. The table includes only those species which were harvested from either the Virden or Boissevain L.F.C. in 1971-72 because this is the only year in which a detailed breakdown by species and by Local Fur Council is available.

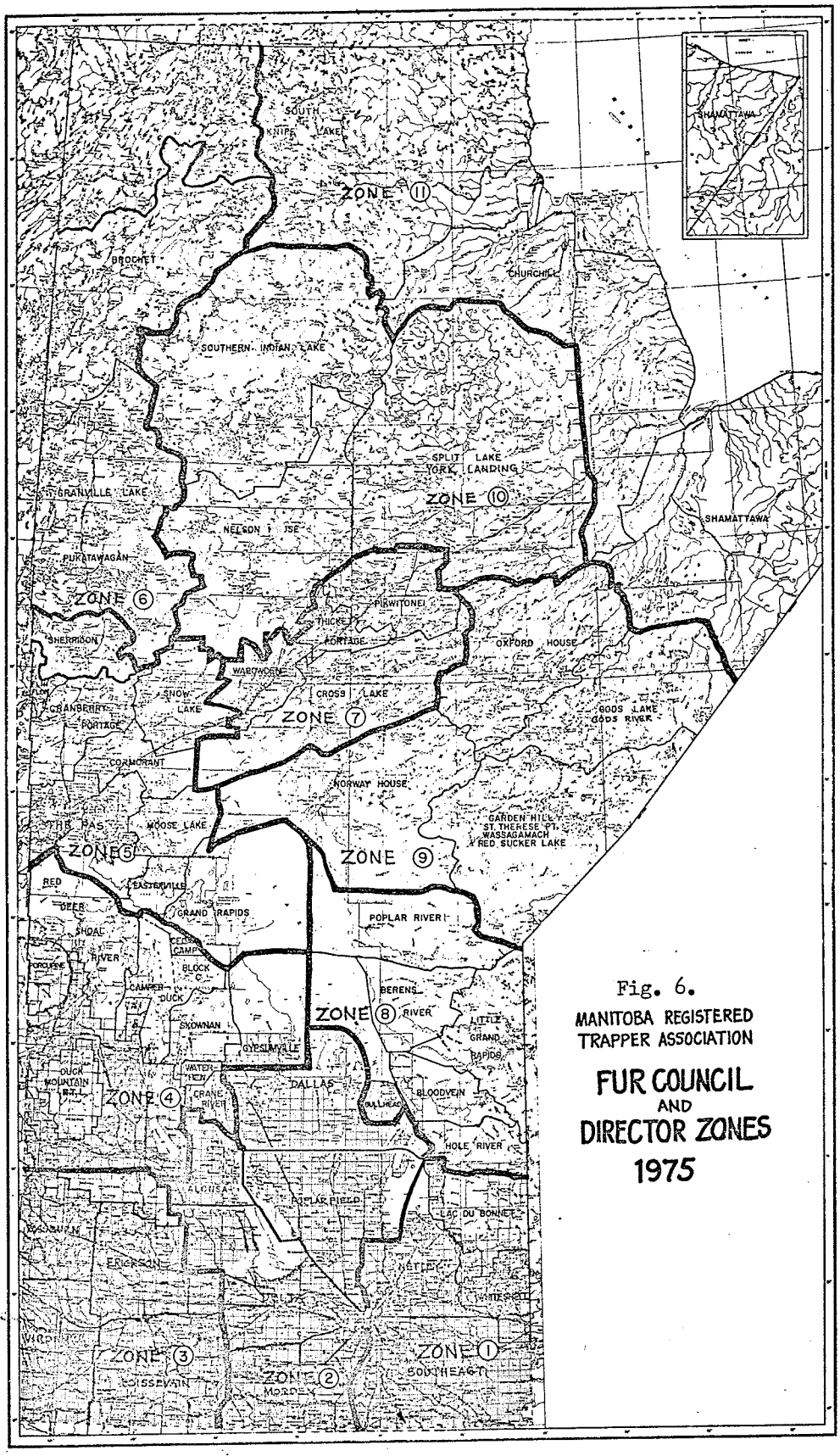


Fig. 6.

MANITOBA REGISTERED TRAPPER ASSOCIATION

FUR COUNCIL AND DIRECTOR ZONES 1975

Table 54 - Manitoba Fur Harvest for the Period 1965/66-1974/75* (Manitoba Department of Renewable Resources and Transportation Services, 1974)

	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75
Badger	147	315	279	301	425	330	409	573	699	608
Beaver	36,774	33,545	42,742	45,605	43,477	35,863	38,715	45,483	34,334	38,046
Coyote	3,197	3,241	2,116	5,304	4,871	5,194	9,445	14,270	13,225	9,734
Ermine	32,034	13,354	26,394	23,325	10,613	5,043	3,765	10,133	5,869	18,205
Cross Fox	180	86	115	178	253	227	366	608	229	216
Red Fox	5,593	7,071	4,866	8,538	9,363	7,186	11,047	14,337	14,838	10,129
Silver Fox	41	13	23	52	34	31	62	59	101	29
Lynx	1,171	1,102	1,389	4,088	6,695	6,228	7,309	4,520	1,476	779
Mink	15,778	20,099	25,874	33,104	21,522	9,592	10,686	20,368	10,904	12,420
Muskrat	589,290	387,875	442,268	294,116	250,212	388,714	472,579	247,175	122,182	285,557
Rabbit	1,803	1,010	973	1,107	703	310	85	2,250	65	223
Raccoon	733	725	946	1,596	2,046	772	1,786	4,315	2,892	4,247
Skunk	83	43	27	68	33	35	31	61	42	27
Squirrel	60,171	58,938	168,653	91,310	50,380	21,820	26,828	25,281	24,324	57,374
Wolf	191	213	139	118	138	167	324	332	349	395

NOTE: Species listed are only those which were harvested from Virden or Boissevain L.F.C. during 1971-72 season.

Ten years of fur harvest data are included in the previous table in order to indicate harvest of species whose populations are cyclic. If analyses were attempted with only a few years of data, a biased estimate of average, high and low fur harvests might be made for the Basin, depending on the stage of a species' particular cycle.

Extrapolations were made for the Virden and Boissevain L.F.C. In both cases 1971-72 is the only year in which the data are available for the actual harvest of each species. The other years are extrapolations based on the provincial trends found in Table 54. It is assumed that percent change in provincial fur harvest from year to year for each species is applicable to the two Local Fur Councils relevant to the Souris River Basin (Stardom, personal communication). Since a detailed breakdown is only available for 1971-72, all extrapolations for these L.F.C.'s are based on that year using percent change in provincial fur harvest.

A portion of the Souris River Basin constitutes 70.0% of the Virden L.F.C., by area. Similarly, the remainder of Manitoba's Souris Basin accounts for 43.6%, by area, of the Boissevain L.F.C. Therefore, it is assumed that 70.0% of the fur bearer harvest from the Virden L.F.C. and 43.6% of the harvest from the Boissevain L.F.C. occurs in the Souris River Basin. Using this analytical technique, it is assumed that harvest is evenly distributed over the entire area of each L.F.C. A further assumption must be made with respect to

species harvested in the two Local Fur Councils. Some species were harvested in the Boissevain L.F.C. which were not harvested in the Virden L.F.C. in 1971-72. It must be assumed, therefore, that species included in these tables are only those which had a possibility of being harvested over the ten year analytical period.

Tables 55, 56 and 57 indicate estimations of the fur harvest from the Manitoba portion of the Souris River Basin. Table 55 shows the estimated harvest of fur species within the portion of the Basin included in the Virden Local Fur Council.

Table 56 is the estimated harvest of fur bearers within the portion of the Basin included in the Boissevain L.F.C.

Table 57 is the combination of Tables 55 and 56 and indicates an estimation of harvested fur bearers, by species, from the Souris River Basin.

Table 58 displays data available for 1972-73 indicating numbers of trappers residing in communities within the boundaries of the Souris River Basin.

Special consideration should be given to the communities of Oak Lake (19 trappers in 1972-73) and Virden (35 trappers in 1972-73). Considering the proximity of these communities to the Basin, it is conceivable that many of these trappers trap within the Basin. Alternately, it is likely that trappers residing in communities within the Basin but on the very edge, such as Mariapolis and Baldur, trap outside the Basin.

Table 55 - Estimated Fur Harvest for the Period 1965/66-1974/75: Souris River Basin as a Portion of Virden L.F.C.

Species	Year										
	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	Average
Badger	16	35	31	33	48	36	45	64	68	67	45
Beaver	309	281	358	382	301	301	325	382	289	318	325
Coyote	67	67	44	111	102	109	197	297	275	202	147
Ermine	405	169	334	295	134	64	48	128	74	230	188
Red Fox	273	345	237	417	457	351	540	701	723	496	454
Lynx	1	1	1	3	4	4	4	3	1	1	2
Mink	617	785	1,012	1,294	841	376	418	798	426	484	705
Muskrat	12,450	8,196	9,345	6,215	5,427	8,187	9,985	5,192	2,596	5,991	7,358
Raccoon	75	74	97	162	209	78	182	440	295	431	204
Squirrel	113	111	317	172	95	41	50	48	46	108	110

Table 56.- Estimated Fur Harvest for the Period 1965/66-1974/75: Souris River Basin as a Portion of Boissevain L.F.C.

Species	Year										
	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	Average
Badger	8	18	15	17	24	19	23	32	40	34	23.0
Beaver	376	343	436	466	366	366	395	464	348	388	395
Coyote	174	177	116	290	266	283	516	779	722	531	385
Ermine	737	308	608	538	245	116	87	233	135	419	343
Cross Fox	1	0	0	1	1	1	2	3	1	1	1
Red Fox	339	428	294	517	567	435	669	869	896	615	563
Silver Fox	0	0	0	1	0	0	1	1	1	0	1
Lynx	0	0	0	2	3	3	3	2	0	0	1
Mink	494	630	811	1,037	674	301	335	640	341	397	566
Muskrat	14,204	9,350	10,661	7,090	6,032	9,341	11,391	5,923	2,962	6,835	8,370
Rabbit	638	358	344	392	249	110	30	796	23	79	302
Raccoon	60	59	78	131	168	63	146	354	237	347	164
Skunk	4	2	1	3	1	1	1	3	2	1	2
Squirrel	1,119	1,096	3,136	1,698	937	404	499	469	454	1,067	1,088
Wolf	3	4	2	2	2	3	5	5	6	6	4

Table 57 - Estimated Fur Harvest for the Period 1965/66-1974/75: Souris River Basin.

Species	Year										
	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	Average
Badger	24	53	46	50	72	55	68	96	118	101	68
Beaver	658	624	794	848	667	667	720	846	637	706	650
Coyote	241	244	160	401	368	392	713	1,076	997	733	533
Ermine	1,142	477	942	833	379	180	135	361	209	649	531
Cross Fox	1	0	0	1	1	1	2	3	1	1	1
Red Fox	612	773	541	934	1,024	786	1,209	1,570	1,619	1,111	1,018
Silver Fox	0	0	0	1	0	0	1	1	1	0	1
Lynx	1	1	1	5	7	7	7	5	1	1	4
Mink	1,111	1,415	1,823	2,331	1,515	677	753	1,438	767	881	1,271
Muskrat	26,654	17,546	20,006	13,305	11,459	17,528	21,376	11,115	5,558	12,826	15,737
Rabbit	638	358	344	392	249	110	30	796	23	79	302
Raccoon	135	133	175	293	377	141	328	794	532	778	369
Skunk	4	2	1	3	1	1	1	3	2	1	2
Squirrel	1,232	1,207	3,453	1,870	1,032	445	449	517	500	1,175	1,188
Wolf	3	4	2	2	2	3	5	5	6	6	4

Table 58 - Numbers of Trappers Residing in Communities within the Souris River Basin - 1972-73.

Community	Number of Trappers
Baldur	22
Belleview	2
Belmont	32
Boissevain	29
Carol	4
Coulter	6
Cromer	3
Deleau	3
Deloraine	66
Dunrea	12
Elgin	4
Elva	1
Fairfax	1
Finlay	2
Goodlands	4
Hartney	10
Lauder	3
Lyleton	7
Mariapolis	13
Medora	2
Melita	22
Minto	1
Napinka	1
Nesbitt	6
Pierson	12
Pipestone	6
Reston	7
Sinclair	3
Souris	16
Tilston	3
Treesbank	1
Wawanesa	16
Woodnorth	1
TOTAL	321

There are some preliminary data available, indicating the annual trapper use of the furbearing resource, however it is not yet of the nature to allow valid analyses.

Within the Basin, there has been minimal active trapping of aquatic furbearers outside of Oak-Plum Lakes, Turtle Mountain and Whitewater Lake. Mink are trapped in many of the small tributaries east and south of Souris, such as Elgin Creek (Wardley and Peterson, personal communication).

Fox and coyote are hunted intensively from snowmobiles in an area bounded by Graham Creek and the Souris River, west and south to the Saskatchewan and U.S. borders (Wardley and Peterson, personal communication). In addition, there is fairly heavy hunting pressure on fox and coyote in the Lauder, Turtle Mountain and Whitewater Lake areas (Wardley and Peterson, personal communication).

4.5 Migratory Game Birds

Data were extrapolated from questionnaire results distributed and analyzed by the Canadian Wildlife Service (C.W.S.).

Table 59 indicates the residence of hunters purchasing Manitoba migratory game bird hunting permits.

Detailed analysis of information presented in this table either by Strata or ideally by degree-blocks, was not possible because detailed data were not available.

Some waterfowl hunter-use information is available by degree-blocks for Manitoba, however, it is in a form whereby any analysis is subject to a certain amount of error due to assumptions which have to be made.

Table 59 - Manitoba Sales of Migratory Game Bird Hunting Permits by Residence. (C.W.S. Progress Notes, 1972-76).

Residence of Applicant	Year								
	1967	1968	1969	1970	1971	1972	1973	1974	1975
Manitoba	33,425	36,346	38,395	36,064	37,270	38,234	38,742	34,760	39,906
Non-Manitoban Canadian	397	374	614	489	484	956	309	358	352
Non-Canadian	1,591	1,757	2,170	2,318	2,665	1,943	2,643	2,049	2,588
Unknown	207	235	432	359	541	505	17	-	-
Total	35,620	38,712	41,611	39,230	40,960	41,133	41,711	37,167	42,846

The Souris River Basin is included in three degree-blocks. Specifically, these are 49°N latitude 99°W longitude, 49°N latitude, 100°W longitude and 49°N latitude, 101°W longitude. These reference points refer to the southeastern corner of a degree-block (Figure 7).

In estimating the waterfowl harvests presented in the following tables, a number of assumptions were necessary. It was assumed that 63.2% of the active duck hunters in Strata 01 were successful in retrieving at least one shot duck (C.W.S. Progress Notes, 1972-76). Similarly, it was assumed that 67% of the active goose hunters were successful in retrieving at least one shot goose (C.W.S. Progress Notes, 1972-76). In addition, the assumption was made that 94% of successful goose hunters were Canadian (C.W.S. Progress Notes, 1972-76). These assumptions are necessary in order to realize a connection between C.W.S. raw data sheets and information contained in the following tables.

Table 60.- Waterfowl Harvest Data for Degree-Block 49°N 99°W. (C.W.S., 1974)

Year	Active Hunters	Days	Days/ Active Hunter	Retrieved Kill	
				Geese	Ducks
1973	1483	11,730	7.90	3578	9,228
1972	1634	13,020	7.96	1788	14,457
1971	2019	11,251	5.57	2718	14,577
1970	1716	12,952	7.54	3100	16,420
1969	2086	15,950	7.64	2524	25,295

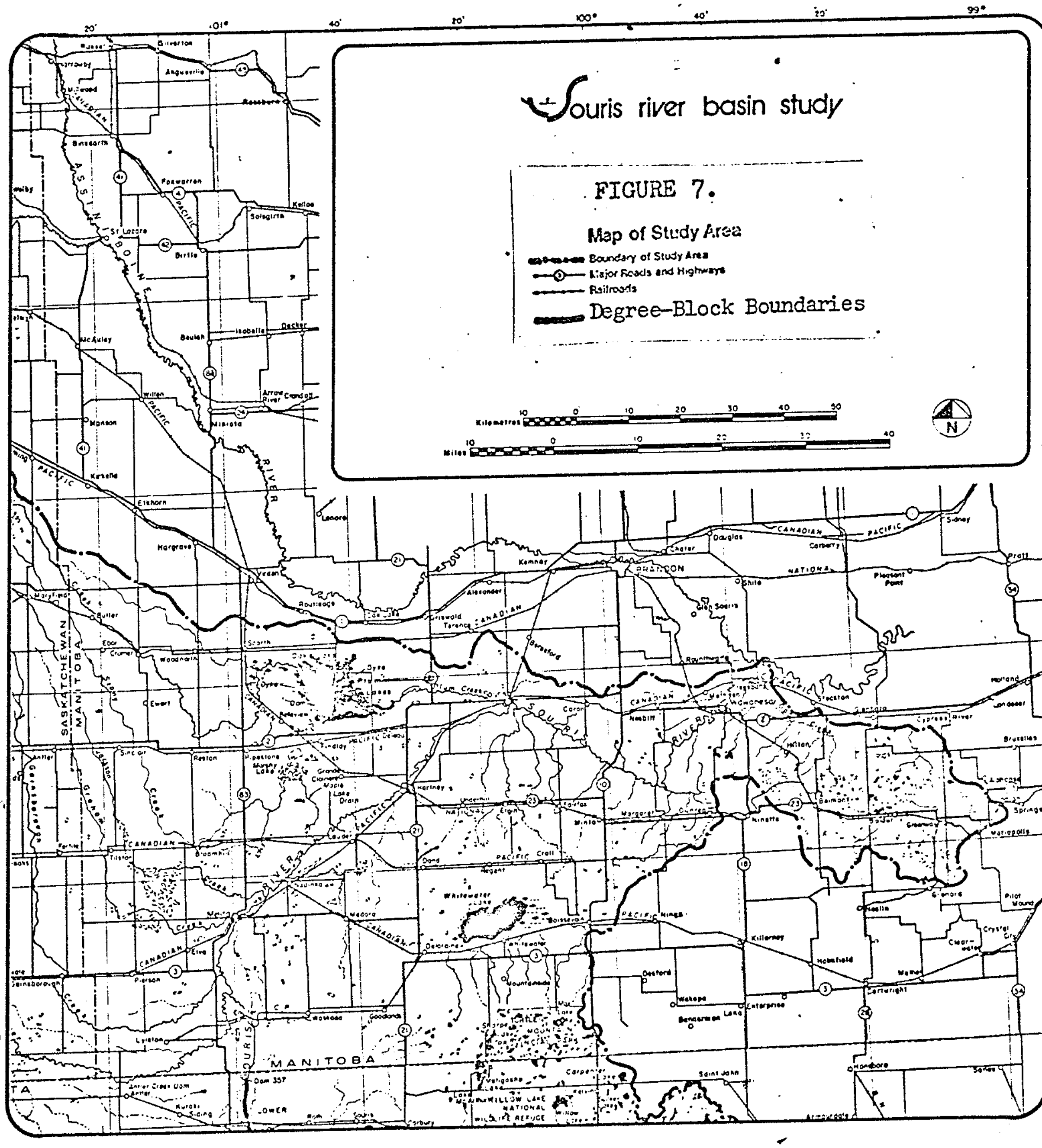


FIGURE 7.

Map of Study Area

Table 61 - Waterfowl Harvest Data for Degree-Block 49°N 100°W. (C.W.S., 1974)

Year	Active Hunters	Days	Days/ Active Hunter	Retrieved Kill	
				Geese	Ducks
1973	1686	9,834	5.83	4815	10,960
1972	2412	18,154	7.52	5749	22,800
1971	2304	14,052	6.09	4625	18,426
1970	2363	19,362	8.19	4737	27,636
1969	2003	16,242	8.10	2437	17,100

Table 62 - Waterfowl Harvest Data for Degree-Block 49°N 101°W. (C.W.S., 1974)

Year	Active Hunters	Days	Days/ Active Hunter	Retrieved Kill	
				Geese	Ducks
1973	398	2,786	7.00	609	1,757
1972	207	854	4.12	1,318	1,668
1971	224	1,528	6.82	372	2,796
1970	466	4,300	9.22	879*	5,698
1969	403	2,268	5.62	N/A	3,094

*Total should be greater: data for retrieved kill by American hunters were not available.

The Souris River Basin constitutes 23% of degree-block 49°N 99°W, 68% of degree-block 49°N 100°W, and 81% of degree-block 49°N 101°W, by area. It was assumed that there is an even distribution of harvest and hunter-days over the degree-block. Using these assumptions, an estimation of Manitoba hunter-use in the Souris Basin can be made. Table 63 represents estimated waterfowl harvest data for the Basin. It was compiled by adding 23% of the information presented in

Table 60, plus 68% of the information in Table 61, plus 81% of the data contained in Table 62.

Table 63 - Estimated Waterfowl Hunter Activities - Souris River Basin.

Year	Active Hunters	Days	Days/ Active Hunter	Retrieved Kill	
				Geese	Ducks
1973	1809	11,642	6.43	4590	10,998
1972	2184	16,032	7.34	5388	20,180
1971	2212	13,381	6.04	4071	18,148
1970	2379	19,628	8.25	4646*	27,184
1969	2168	16,551	7.63	2238*	19,952

*Total should be greater: data for retrieved kill by American hunters were not available for degree-block 49°N 101°W.

As expected, most waterfowl hunting in the Basin occurs where staging populations are high. Concentrated hunting effort exists in the Oak-Plum Lakes Complex as well as regions adjacent to Whitewater Lake. Marshy Lakes and areas along the Souris River south of Melita support a substantial number of hunter-days (Wardley and Peterson, personal communication).

Other areas with high waterfowl numbers include Nesbitt, south of the river; from Medora to Margaret and around Belmont. There is a substantial number of permanent and semi-permanent potholes in the Waskada area (the Blind Souris) which supports a high level of hunting, especially for geese.

Information which is available regarding non-waterfowl hunting, i.e. with respect to snipe and coots etc., does not lend itself to specific analysis.

CHAPTER 5

IMPACT ANALYSIS

5.1 Introduction

Various projects and programs have been suggested for implementation by different sectors of the Souris River Basin Study (Table 64). From this list, two projects have been chosen for impact analysis. Specifically, the two projects to be examined in detail regarding the potential impact on wildlife, will be Patterson Dam on Gainsborough Creek and High Souris Dam on the main stem of the Souris River (Figure 8).

The methodology used to evaluate impact on wildlife of these two projects may be used on other projects proposed for implementation in the Souris River Basin.

5.2 Economic Value of the Wildlife Resource

Estimating the economic value of an intangible public good such as wildlife is difficult, at best. The value of the wildlife habitat corresponds closely with its production or capability to sustain populations of wildlife.

Attempts to place values on wildlife have been traditionally unsatisfactory because of some basic errors which are commonly incorporated in any estimation. A frequently encountered error is the assertion that the value of a particular wildlife resource may be accurately measured by the

Table 64 - Water Development Projects: Souris River Basin - Manitoba. (Water Resources Branch, 1976)

WATER SUPPLY

1. Assiniboine River to Souris River Diversion
   i) Q = 500 c.f.s.
2. Qu'Appelle River to Souris River Diversion
   i) Q = 375 c.f.s.
3. Coulter Dam
   i) FSL = 1465
4. High Souris Dam
   i) FSL = 1385
5. Patterson Dam (Gainsborough Creek)
6. Blind Souris Project C
7. Dam #1, Near Elbow (main stem)
8. Finalized Apportionment Arrangements

FLOOD DAMAGE REDUCTION PROGRAMS

1. Agricultural Flood Protection
   a) land acquisition
   b) channel enlargements for the 12.5% flood
   c) dyking for the 12.5% flood
   d) the Souris River Valley Flooded Area Association's proposal
2. Urban Communities
   a) dyking for 1976 and 1:500 year floods
   b) land zoning
   c) land acquisition

RECREATION

1. Access and staging areas for canoe pickup, picknicking and hiking.
2. General use of staging areas for education oriented recreation such as geographical and ecological interpretation and wildlife observation.
3. Intensive use of recreation areas with campgrounds, day-use area and boating facilities.
   a) Lauder
   b) Blind Souris Valley
4. Motor Route #18a, Melita to U.S.A.

WILDLIFE

1. Plum Creek Wildlife Project
2. Construction of small dams and/or weirs at outlets and inlets of oxbows.
3. Land acquisition
   a) extension of Lauder Sandhills Wildlife Management Area
   b) extension of the Souris River Bend Wildlife Management Area
   c) Gainsborough Creek - deer wintering habitat protection
   d) Antler River - deer wintering habitat protection
   e) Souris River Valley in Manitoba

FISHERIES

1. Debris screen at Victoria Park (Plum Creek)
2. Fish Screens
3. Aeration Systems
4. Improvement to existing sites
5. Construction of rock groins
6. Construction of low head dams
7. Maintain minimum flow to support fishery (10% of mean flow)

EROSION CONTROL

1. Brochington archaeological site near Melita

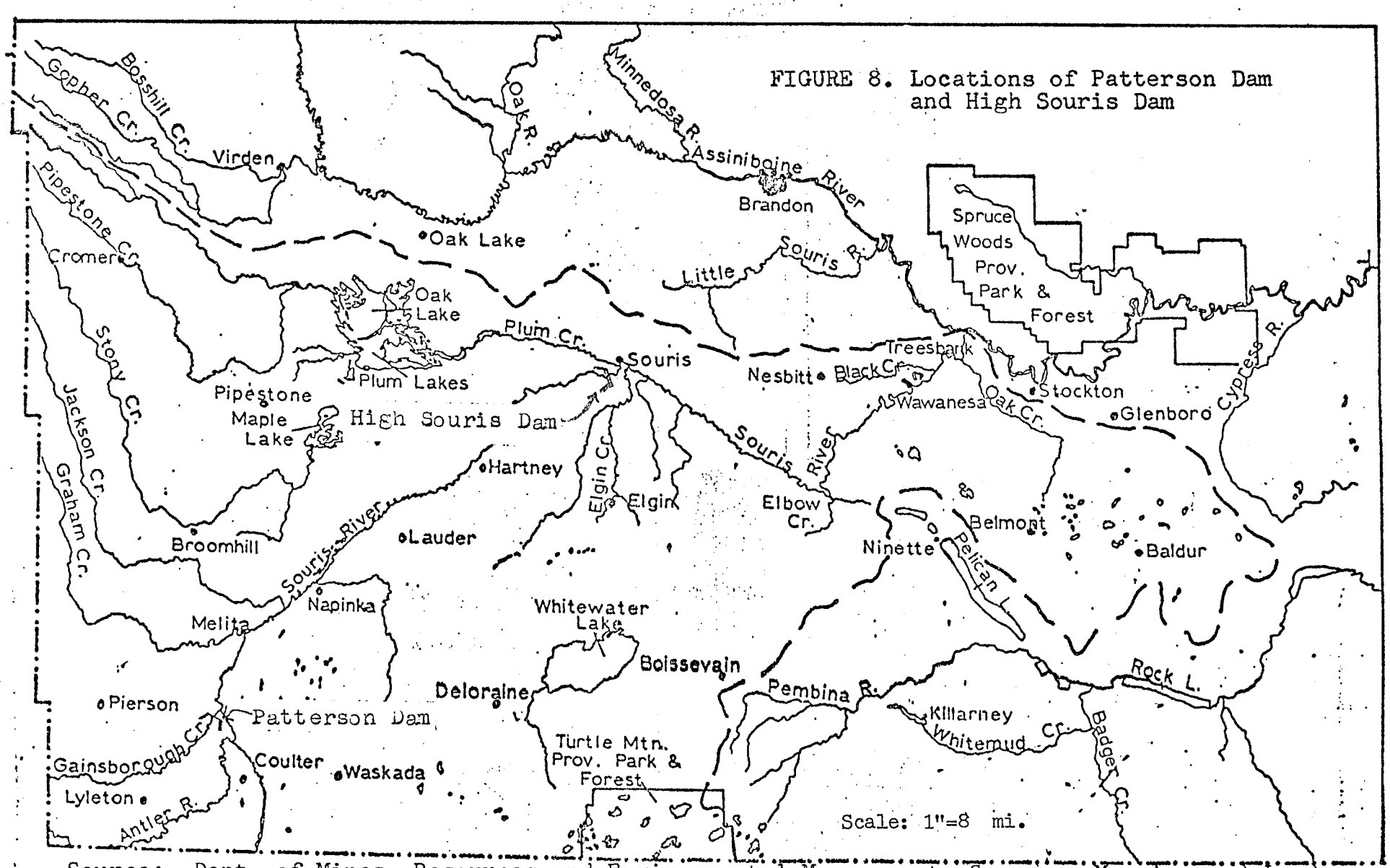


FIGURE 8. Locations of Patterson Dam and High Souris Dam

Source: Dept. of Mines, Resources and Environmental Management, Surveys, Mapping and Lands Branch

amount that hunters spend to procure the good. This method simply measures the cost of access to the resource but does not give an indication of its true net worth.

Transposing values from areas where wildlife are marketed and applying them to all wildlife is another error often encountered. The value of potentially huntable populations of wildlife are frequently and mistakenly characterized by the cost in terms of time and travel expense to get to the resource and how easily the resource can be hunted. To say that from a hunter's viewpoint, remote wildlife populations have the same value as more accessible populations is clearly a mistake. Based on expenditures a remote resource may be valued highly because it is very costly to reach and utilize and possibly affords few recreation days. However, in actuality, the resource which can be reached by many people and utilized at a lower cost is probably more valuable than the remote resource used by only a few.

The real value of a wildlife resource is more appropriately measured by what consumers would pay to use the resource if they were required to do so. The present system of licencing is nominal and does not truly reflect the value since licences are not levied with a view to maximizing government revenue (Ross, 1974).

Schellenberg and Craddock (1969) indicate that methods of determining benefits accruing from recreation can be divided into eight categories. These are: (1) benefits estimated by educated guess; (2) benefits equal market value

of catch or hunt; (3) benefits equal opportunity cost of time; (4) benefits equal project costs; (5) benefits equal the cost of alternatives; (6) benefits equal expenditures; (7) benefits estimated by imputed prices and values; and (8) benefits determined by indirect travel-cost techniques.

Ross (1974) indicates that there are problems in estimating the value of outdoor recreation. He categorizes into two groups the procedures which have been used in an effort to solve the problem of value. One group attempts to estimate benefits with no reference to a demand function. Ross (1974) calls this the naive approach. He describes those procedures which do utilize a demand function for evaluating resources, i.e. revenue maximizing monopolist and consumers' surplus.

Ross (1974) refers to naive procedures which ignore the demand function as estimating benefits through "educated guesses." He indicates that benefits from a recreational experience would probably be more accurately measured by first estimating the demand function.

In order to derive a demand function, one of two methods are generally used - the interview or direct approach, or the travel-cost or indirect approach (Ross, 1974). In the absence of a mechanism to estimate the market price of an intangible good, it is usually difficult, when utilizing the interview approach, to have the interviewee reveal his actual preference (Ross, 1974). If he was asked to state the value to him of a particular area or resource, he may state a lower than real value if he thought that he would be taxed to develop the

area. Alternately, if this person thought that someone may pay him a sum of money to forego the knowledge and satisfaction of an area being left free from development, he may overstate his preference. Clearly, bias and subjectivity may detract from the accuracy of this method.

Indirect approaches to estimate the demand function include travel cost and time cost methods and different models derived therefrom. Ross (1974) indicates that a frequently used method of resource valuation involves an indirect procedure. The Hotelling-Clawson Travel Cost Method attempts to value a recreational or other resource by measuring the consumer ability and willingness to pay from costs borne by the recreationist to gain access to the area. In addition, there are other methods of a similar nature which have been used in an endeavour to measure the value of a recreational resource.

The Environmental Research Group (1974) in a detailed interview analysis conducted in the southeastern United States, found that the average dollar value per day of hunting, by types of game, estimated by heads of households interviewed is as follows: $47.21*/day of hunting small game, $73.41/day of hunting big game and $59.09/day of hunting waterfowl in 1976 $. The interview method utilized in this survey ideally indicates what is the overall net worth of one day's hunting to the people interviewed. Similarly, Ross (1975) distributed a

*Except as indicated, all monetary estimations are adjusted to the 1976 Consumer Price Index Trend.

questionnaire to Saskatchewan sportsmen in an attempt to place a value on big game species in Saskatchewan. From the respondent's evaluation of a day of hunting (based on two most preferred species) Ross (1975) determined that $17.43 was the mean value for this day of hunting white-tailed deer (1976 $). Pearse Bowden Economic Consultants (1972) distributed a questionnaire to resident sportsmen in B.C. and found a daily value of white-tailed deer hunting in terms of average willingness-to-pay of $13.91 (1976 $).

Frequently, it may not be possible to estimate the total net worth of a resource by the interview or travel cost method because of time and budgetary constraints. In these instances, one must resort to relatively more primitive means of estimating value. This type of measurement, where information is lacking, takes the form of simply listing expenditures of hunters in the pursuit of the hunting experience. These expenditures include such items as fees and licences, guides, travel, food and lodging and special equipment. Pearse-Bowden Economic Consultants (1972) from their questionnaire found that resident hunters spent an average of $403/year or $29.91/day hunting all game (1976 $). Statistical analyses by Pearse and Bowden (1966) estimate average expenditures of all hunters (resident and non-resident hunters hunting in the East Kootneys) to be $210/hunter or $20/hunter/day for all game (1976 $).

Jones (1976) states that in 1976, hunters in Manitoba would have spent $31.00 per deer harvested or $3.44 per

hunter per day, as a conservative estimate, had there been a deer season.

The Canadian Wildlife Service estimated in 1961 that the average annual expenditure per hunter of waterfowl was $79.00 (Cowan, 1973). Adjusted to the 1976 Consumer Price Index Trend, a resultant annual expenditure per hunter of $148.74 is found. In this instance, the value of a hunter day is $20.26 (1976 $).

Hedlin Menzies and Associates (1967) in Barto (1974) found that the U.S. Fish and Wildlife Service generally uses a range of $0.60-$7.24 (1976 $) to indicate benefits associated with one day's hunting; U.S. Corps of Engineers use $0.60-$1.80/user/day; the Inter-Agency Committee on Water Resources uses $2.41-$7.24/user/day for upland game birds and waterfowl and the U.S. Department of the Interior suggests a range of $1.80-$5.43/user/day for deer and antelope hunting (1976 $). Table 65 summarizes data obtained through the Hedlin Menzies' survey.

Table 65 - Various Values Established for Wildlife by User-day Units (Barto, 1974).

Type of Activity	Range of values - Recreation Day of Hunting (1976 $)
Hunting	
Small Game	
Mammals	$0.60-7.24
Birds	1.21-3.62
Waterfowl	1.80-5.43
Big Game	
Deer-Antelope	1.80-5.43
Other	2.41-7.24

Average auction value of pelts taken in the wild over the past seven years may be seen in Table 66.

It is, therefore, substantially evident that no one single economic value may be accurately used to estimate benefits or costs associated with any wildlife resource.

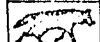
However, Table 67 indicates economic values and sources which have been used to estimate benefits or costs resulting from different hunting experiences.

Table 67 - Economic Values of Different Hunting Experiences

Types of Hunting Experience	Economic value per Hunter-day (1976 $)
Small Game	$ 47.21[a]
	$ 0.60-$3.62[b]
Big Game	$ 73.41[a]
	$ 1.80-$5.43[b]
	$ 3.44[c]
	$13.91[f]
	$17.43[d]
Waterfowl	$59.09[a]
	$ 1.80-$5.45[b]
	$20.26[e]
All Game	$29.91[f]
	$20.00[g]

Sources:
a. Environmental Research Group (1974)
b. Hedlin Menzies and Associates, Ltd. (1967)
c. Letter to Mr. H. Bostrom from Mr. R. Jones
d. Ross (1975)
e. Cowan (1973)
f. Pearse Bowden Economic Consultants, Ltd. (1972)
g. Pearse and Bowden (1966)

TABLE 66 - AVERAGE AUCTION VALUE OF PELTS TAKEN FROM THE WILD IN MANITOBA DURING THE FUR YEARS 1969-70 TO 1975-76.
(Manitoba Department of Renewable Resources and Transportation Services, 1976).

	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	Average
 BADGER	8.00	8.10	12.77	14.05	19.76	18.03	34.50	16.45
 BEAR	33.0	35.00	25.00	74.19	50.55	29.97	65.00	44.67
 BEAVER	19.00	14.09	18.18	20.05	19.50	15.34	20.00	18.02
 COYOTE	13.00	12.15	14.82	28.98	38.90	36.91	56.00	28.68
 ERMINE	.98	.52	.74	1.03	1.20	.80	.90	.88
 FISHER	23.00	31.20	27.34	37.13	43.25	45.38	97.00	43.47
 FOX, Blue	16.00	10.00	10.00	27.00	24.66	20.20	45.00	21.83
 FOX, Cross	18.00	21.90	19.98	43.93	67.00	48.06	85.00	43.41
 FOX, Red	10.00	12.40	15.15	29.40	39.20	30.87	43.00	25.71
 FOX, Silver	12.00	10.00	12.00	22.60	73.00	48.06	93.00	38.66
 FOX, White	16.00	15.00	27.40	22.00	36.33	20.20	42.00	25.56
 LYNX	30.00	29.50	39.31	90.15	90.00	123.01	257.00	94.13
 MARTEN	10.00	8.15	8.46	8.66	16.60	15.34	24.00	13.03
 MINK	13.00	11.20	19.32	23.40	22.00	13.13	26.00	18.29
 MUSKRAT	1.45	1.57	2.01	2.64	2.80	2.62	3.62	2.38
 OTTER	33.00	31.50	37.62	39.68	37.65	36.35	60.00	37.40
 RABBIT, Jack	.20	.12	.18	.18	.20	.20		.18
 RACCOON	6.00	2.85	6.19	11.18	16.40	13.56	22.00	11.16
 SKUNK	.75	1.00	1.00	.50	2.00	2.00		1.20
 SQUIRREL	.25	.25	.52	.50	.75	.63	.70	.51
 WOLF, Timber	38.00	23.00	37.68	53.08	63.72	62.22	101.00	54.10
 WOLVERINE	57.00	70.40	84.65	83.80	78.50	94.38	159.00	89.67

An opportunity cost equation will be utilized to evaluate the potential economic loss or gain resulting from project implementation with respect to the wildlife resource. The equation used here is similar to that used in Barto (1974):

$$OC = (\sum W_1V_1) + (\sum W_1V_2) - (\sum W_2V_2)$$

OC = total monetary value (1976 $) of the opportunity cost

$(\sum W_1V_1)$ = monetary value (1976 $) of wildlife potentially living in habitat flooded by implementation of project,

$(\sum W_1V_2)$ = present value (1976 $) of lost wildlife production due to decreased habitat at a discount rate of 10% in perpetuity,*

$(\sum W_2V_2)$ = present value (1976 $) of gained wildlife production due to increased habitat at a discount rate of 10% in perpetuity,

where,

W_1 = numerical figure of wildlife populations (by species) decreased due to project implementation,

W_2 = numerical figure of wildlife populations (by species) increased due to project implementation,

V_1 = market price (last year available) of each wildlife species in dollars, and

V_2 = average market price of each wildlife species in dollars, taken over a number of years.

---

*Calculation of present value of an infinite series of payments, $Vo = \frac{r}{i}$ where r is the payment and i is the discount rate.

For the purposes of this report, the economic value for different hunting experiences will be derived from information presented by the Environmental Research Group (1974) which are values estimated by the direct interview method. The value of fur bearing species will be the average auction value of pelts taken from the wild in Manitoba (Table 66).

Tables 68, 69 and 70 indicate the values per species hunted as translated from the chosen value/hunter day. This method implies that the value of the wildlife resource corresponds directly and entirely to the value which someone attaches to a day of hunting that resource. It then follows that by using this argument, any species which is not hunted has either a value approaching zero or infinity. This apparent diversity is explained by stating that abundant wildlife species (such as meadow voles) may have no economic value since there is no desire to hunt them. Alternately, a potentially huntable, but scarce species (such as the whooping crane) may have a value approaching infinity, since governments spend millions of dollars protecting them from extinction and the marginal value of the last whooping crane would have to include an estimation of the value of this last individual to everyone presently living in the world plus an estimation of the value of this last individual to all future generations. It is evident that this sum would be substantial.

Clearly, there are conceptual, practical and theoretical difficulties encountered when attempting to place an economic value on a particular wildlife species. Very basic questions

Table 68 - Derivation of Economic Value/Upland Game Bird

Year	Hunters	A Days/ Hunter	B Average Harvest per Hunter	A ÷ B Days/Upland Game Bird	Economic Value/ Upland Game Bird A ÷ B X $47.21
1974-75	1819	4.35	2.85	1.53	$ 72.23
1973-74	1242	4.68	4.21	1.11	$ 52.40
1972-73	3046	4.26	4.46	0.96	$ 45.32
AVERAGE	2036	4.43	3.84	1.20	$ 56.65

Table 69 - Derivation of Economic Value/Deer.

Year	Nos. of Hunters	A Days/ Hunter	B Deer/ Hunter	A ÷ B Days/ Deer	Economic Value/ Deer A ÷ B X $73.41
1973-74	5633	2.63	0.45	5.84	$ 428.71
1972-73	5326	2.71	0.50	5.42	$ 397.88
1971-72	4427	2.88	0.65	4.43	$ 325.21
1970-71	2359	2.07	0.47	4.40	$ 323.00
1969-70	4543	2.31	0.52	4.44	$ 325.94
1968-69	6107	2.49	0.54	4.61	$ 338.42
AVERAGE	4733	2.52	0.52	4.86	$ 356.53

Table 70 - Derivation of Economic Value/Migratory Game Bird.

Year	Hunters	A Days/ Hunter	B Avge.Harvest per Hunter	A ÷ B Days/Migratory Game Bird	Economic Value/ Migratory Game Bi A ÷ B X $59.09
1973	1809	6.43	8.62	0.75	$ 44.32
1972	2184	7.34	11.71	0.63	$ 37.23
1971	2212	6.04	10.04	0.60	$ 35.45
1970	2379	8.25	13.38	0.62	$ 36.64
1969	2168	7.63	10.24	0.75	$ 44.32
AVERAGE	2150	7.14	10.80	0.67	$ 39.59

must be answered before one endeavours to approximate the value of wildlife. Of primary concern is whether species which are not hunted have an imputed economic value or not. From an ecological, aesthetic and educational viewpoint, non-huntable wildlife populations do have an economic value. The problem then becomes one of measurement, how does one endeavour to measure the value of enjoyment?

The previous discussion focuses on the major difficulties of placing an accurate value on a non-market good and points out the near impossibility of this task.

Another difficulty, this of a more practical nature, is one of determining the relationship between hunting pressures and population densities of certain species and also equating the value of a hunter day under these different situations. Is a hunter-day as valuable to the hunter if there are many hunters in an area as it would be if he were alone? Also, does a hunter value one day of hunting where he bags no game as highly as a day where he does procure something? This relates to a question previously posed regarding what is it about hunting which is valuable. The relationship between population densities of species and number of hunter days in an area appears superficially to have a one-to-one correspondence. Population densities would definitely have an effect on success rates and if the hunter has this knowledge, some may be discouraged from partaking in a hunting experience. Others may still go hunting but in pursuit of a different species. To some consumers (hunters) a day in pursuit of a

scarce species may be more valuable than a day in pursuit of that species when populations are abundant. To other hunters, a day hunting scarce species may be looked upon as a wasted day and may therefore be valueless.

A basic assumption implied in Tables 68, 69 and 70 is that there is a value for the successful and the unsuccessful hunter day. With the assumptions and difficulties pointed out, the values in these tables may be used to estimate the value of wildlife lost or gained as a result of project implementation.

5.3 Patterson Dam

This dam would be situated on Gainsborough Creek, approximately two miles upstream of the confluence with the Souris River and 6 miles upstream of the Town of Melita (Figure 9). It would cost approximately $2,400,000 and would supply a firm draft of 2,600 acre-feet per year (Forsyth and Caligiuri, 1975). Table 71 shows the pertinent facts regarding Patterson Dam. The reservoir will flood approximately 870 acres of 1.36 square miles of habitat, the breakdown of which may be observed in Table 72.

Table 73 indicates estimated potential loss or gain in population of the listed wildlife species due to implementation of Patterson Dam. Estimated economic loss or gain is included in Table 74 using the opportunity cost equation.

It might be true that animals listed as a loss due to project implementations will not actually drown or be killed. However, because habitat will be forever lost, decreased

Table 71 - Patterson Dam - Pertinent Facts (Water Resources Branch, 1976)

Drainage Area	
Gross	520 sq. miles
Wet	325 sq. miles
Effective	154 sq. miles
Reservoir	
Full supply level	1472
Full supply capacity	16,700 acre-feet
Flooded area at F.S.L.	870 acres
Firm annual yield	2,600 acre-feet
Length of reservoir	8 miles
Project design flood -- 1%	3,300 cfs
Maximum water level - 1%	1473.0
Maximum depth at F.S.L.	49 feet
Mean annual runoff (1943-74)	9,000 acre-feet
Embankment	
Top elevation	1478.5
Total length	1,800 feet
Maximum height	56 feet
Volume of fill	212,000 cubic yards
Freeboard (1% design flood)	5.5 feet
Spillways	
Chute Spillway	
Width	40 feet
Crest elevation	1466
Radial gates	three gates 12 feet by 6 feet
Design discharge - 1% flood	2,500 cfs
Emergency Spillway	
Width	300 feet
Crest elevation	1474
Riparian Works	
Conduit	48" diameter x 8 gauge CMP
Length of conduit	310 feet
Gate	Armco 55-10C or equivalent
Discharge capacity at F.S.L.	220 cfs

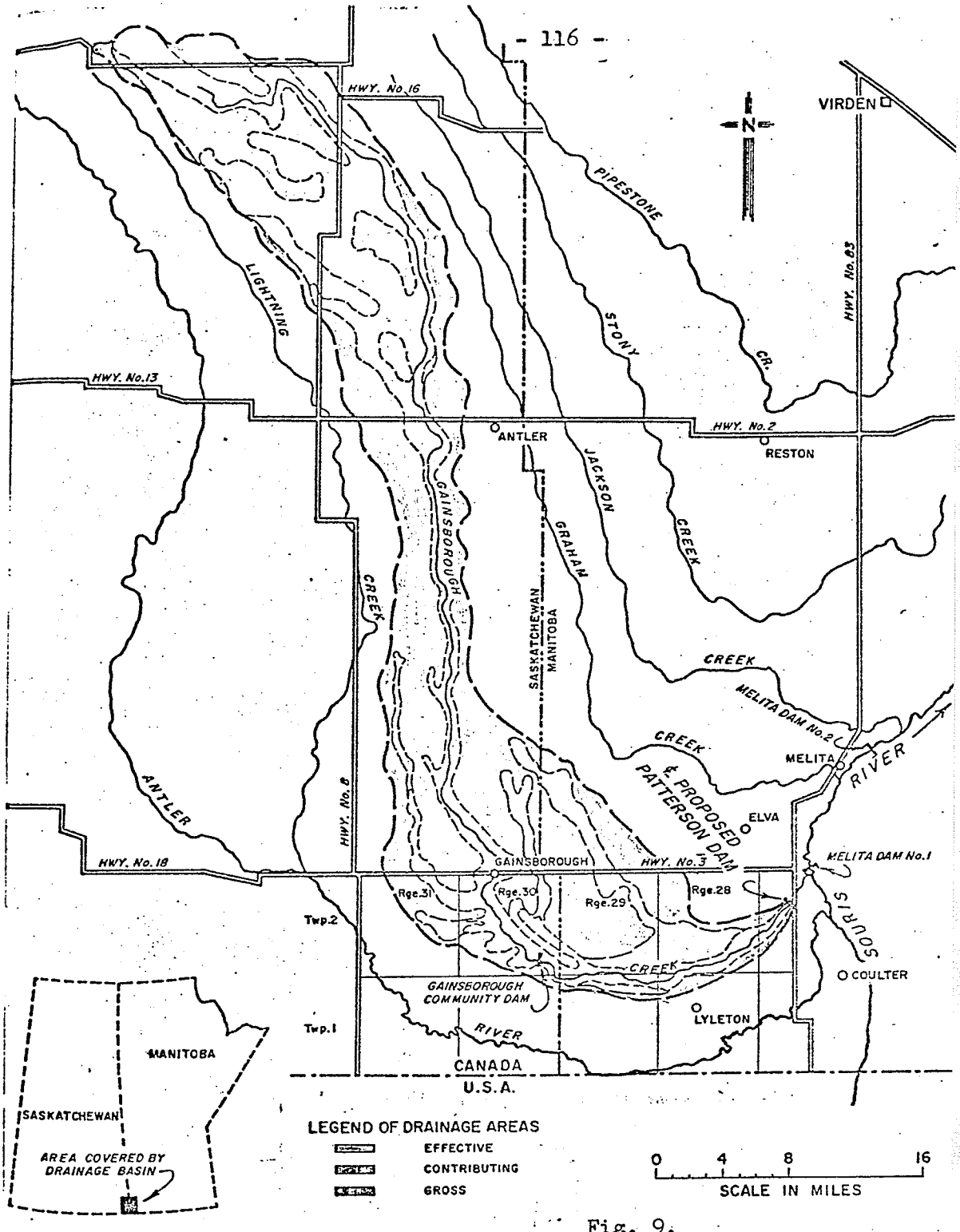


Fig. 9.

DESIGNED	CANADA	PATTERSON DAM
DRAWN	DEPARTMENT OF REGIONAL ECONOMIC EXPANSION	GAINSBOROUGH CREEK DRAINAGE BASIN
TRACED P.V. A.A.H.	P.F.R.A.	
CHECKED R.O.O.	ENGINEERING SERVICE	
SUBMITTED DATE	APPROVED DATE	SCALE AS SHOWN / DATE JAN. 1975 / SHEET 1 OF 2

Table 72 - Areas of Habitat Types Flooded - Patterson Dam.

Habitat Types	Reservoir	
	Area (Sq. Miles)	% of Total Analyzed Area
Timber	0.30	21.8
Bush	0.24	17.8
Grassland	0.00	0.0
Cropland	0.48	35.6
Marsh	0.00	0.0
Bush/Grassland	0.34	24.8
Urban	0.00	0.0
Water	0.00	0.0
TOTAL	1.36	100.0

Table 73 - Estimated Wildlife Population Loss (Gain) - Patterson Dam Reservoir.

Species	Habitat Type	Densities Per Square Mile	Habitat Area Flooded (Square Miles)	Estimated Population Loss (Gain)
American Beaver	River	3[a]	8[b]	24
Muskrat	River	2[a]	8[b]	16
	Marsh	64	-	
Mink	All except urban & water	0.5	1.36	1
Sharp-tailed Grouse	Grassland/Bush	75	0.24	18
Ruffed Grouse	Timber/Bush	25	0.54	14
Hungarian Partridge	Bush	20	0.24	5
White-tailed jack rabbit	Cropland/Grassland	16	0.48	8
Snowshoe Hare	Timber/Bush	300	0.54	162
Red Fox	All except urban & water	0.75-1.00	1.36	1
Coyote	Timber/Bush	0.75	0.54	0
Striped Skunk	Cropland	13.5	0.48	6
Red Squirrel	Timber	389	0.30	117
American Badger	All except urban & water	0.5	1.36	1
Ermine	All except urban & water	1.4	1.36	2
Lynx	All except urban & water	0.05-0.19	1.36	0
Raccoon	Timber/Bush	10	0.54	5
Meadow Vole	All except urban, cropland & water	128-216,876.8	0.88	1143
White-tailed Deer	Timber/Bush	0-42	CLI Class 3-0.59 CLI Class 4-0.77	13-21
Waterfowl	All except urban & water	37.7	1.36	51
	Water (fall)	640	1.18	(755)

a. Densities expressed per river mile.
b. River miles

Table 74 - Estimated Present Value (1976 $) of Wildlife Resource Lost (Gained) - Patterson Dam Reservoir

Species	ΣW_1V_1 $	ΣW_1V_2 $	ΣW_2V_2 $	OC $
American Beaver	480.00	4,324.80	0	4,804.80
Muskrat	57.92	380.80	0	438.72
Mink	26.00	182.90	0	208.90
White-tailed jack rabbit	1.60	14.40	0	16.00
Red Fox	43.00	257.10	0	300.10
Coyote	0	0	0	0
Striped Skunk	12.00	72.00	0	84.00
Red Squirrel	81.90	596.70	0	678.60
American Badger	34.50	164.50	0	199.00
Ermine	1.80	17.60	0	19.40
Lynx	0	0	0	0
Raccoon	110.00	558.00	0	668.00
Value of Fur Harvest Lost (Gained)	848.72	6,568.80	0	7,417.52
Sharp-tailed Grouse	1,390.14	10,197.00	0	11,587.14
Ruffed Grouse	1,011.22	7,931.00	0	8,942.22
Hungarian Partridge	361.15	2,832.50	0	3,193.65
White-tailed Deer	5,573.23-9,002.91	46,348.90-74,871.30	0	51,922.13-83,874.21
Waterfowl	2,260.32	20,190.90	0	22,451.22
Value of Huntable Populations Lost (Gained)	10,596.06-14,025.74	87,500.30-116,022.70	0	98,096.36-130,048.44

potential productivity of flooded areas is indicated in Table 73.

Macaulay (personal communication) indicates that for a reservoir of this type approximately 1 duck/acre (640/sq. mi.) would be attracted to it during fall migration. This figure will be used to estimate fall populations and therefore potential huntable populations of waterfowl.

The reservoir would be utilized primarily for winter supply which means drawdowns will occur between June and October of any year (Samp, personal communication). The average drawdown in a typical year would be approximately 4 feet below the full supply level (Samp, personal communication). The surface area of the Patterson Dam reservoir at 1468 a.s.l. would be 760 acres (1.18 sq. miles) which is the area used to calculate numbers of waterfowl which may be attracted in the fall.

Bidlake (1974) in his preliminary assessment of the impact to wildlife of Patterson Dam indicates it would be optimistic to expect an increased population of aquatic furbearers, especially with fluctuating water levels.

However, he does say that the reservoir may become attractive to waterfowl during the spring or fall as a staging area.

Most important would be the ultimate destruction of a significant area of white-tailed deer wintering habitat. The Antler River and Gainsborough Creek valleys provide the only deer wintering habitat south of P.T.H. #2 and west of the

Turtle Mountain escarpment (Goulden et al., 1970). Disappearance of deer habitat in this area has approximated 40% over the last 25 years (Bidlake, 1974). In order for deer populations to survive, prime deer wintering habitat, such as along Gainsborough Creek, cannot be eliminated.

As indicated in Table 74, it is apparent that there would be a net loss with respect to the wildlife resource if Patterson Dam is built. Any benefits potentially accruable from waterfowl attracted to the reservoir are not included because they would merely constitute a relocation of benefits rather than a net benefit to the reservoir itself.

5.4 High Souris Dam

This dam would be situated on the main stem of the Souris River, approximately 1½ miles upstream of the Town of Souris (Figure 10). It would cost approximately $12,300,000 and would supply a firm-draft of 19,000 acre-feet per year Water Resources Branch, 1976). Table 75 shows pertinent facts regarding the High Souris Dam. The reservoir will flood approximately 3500 acres or 5.47 square miles of habitat, the breakdown of which may be observed in Table 76.

Table 77 indicates estimated potential loss or gain of wildlife species due to the implementation of the High Souris Dam.

The reservoir would be utilized primarily for water supply which indicates that drawdowns will occur between June and October, as with the Patterson Dam reservoir. Average or typical drawdowns may approach 7-10 feet from

Table 75 - High Souris Dam - Pertinent Facts (Water Resources Branch, 1976)

General	
Location of High Souris Dam	Section 28-7-21 W1
Gross drainage area	21,700 square miles
Mean annual runoff (1913-67)	130,000 acre-feet
Highest observed mean daily flow at Wawanesa	8,090 cfs in 1960
Reservoir	
Full supply level	1385
Full supply capacity	53,000 acre-feet
Dependable annual yield	19,000 acre-feet
Flooded area at FSL	3,500 acres
Maximum reservoir depth at FSL	43 feet
Length of reservoir	30 miles
Project design flood - 0.2%	16,000 cfs
Maximum reservoir level for design flood	1394.1
Probable maximum flood	30,000 cfs
Maximum water level for probable maximum flood	1398.7
Embankment	
Top elevation	1402
Total length	2,650 feet
Maximum height	60 feet
Volume of fill	330,000 cu yd
Spillway	
Width	130 feet
Crest elevation	1385
Spillway design discharge - 0.2% flood	13,000 cfs
Riparian Outlet Works	
Type of conduit	Reinforced concrete horseshoe
Diameter of conduit	Upstream of gatewell - 8 ft. Downstream of gatewell - 9 ft.
Total length of conduit	214 feet
Discharge capacity at FSL	1,900 cfs
Number and size of gates	4 gates, each 4' by 5'

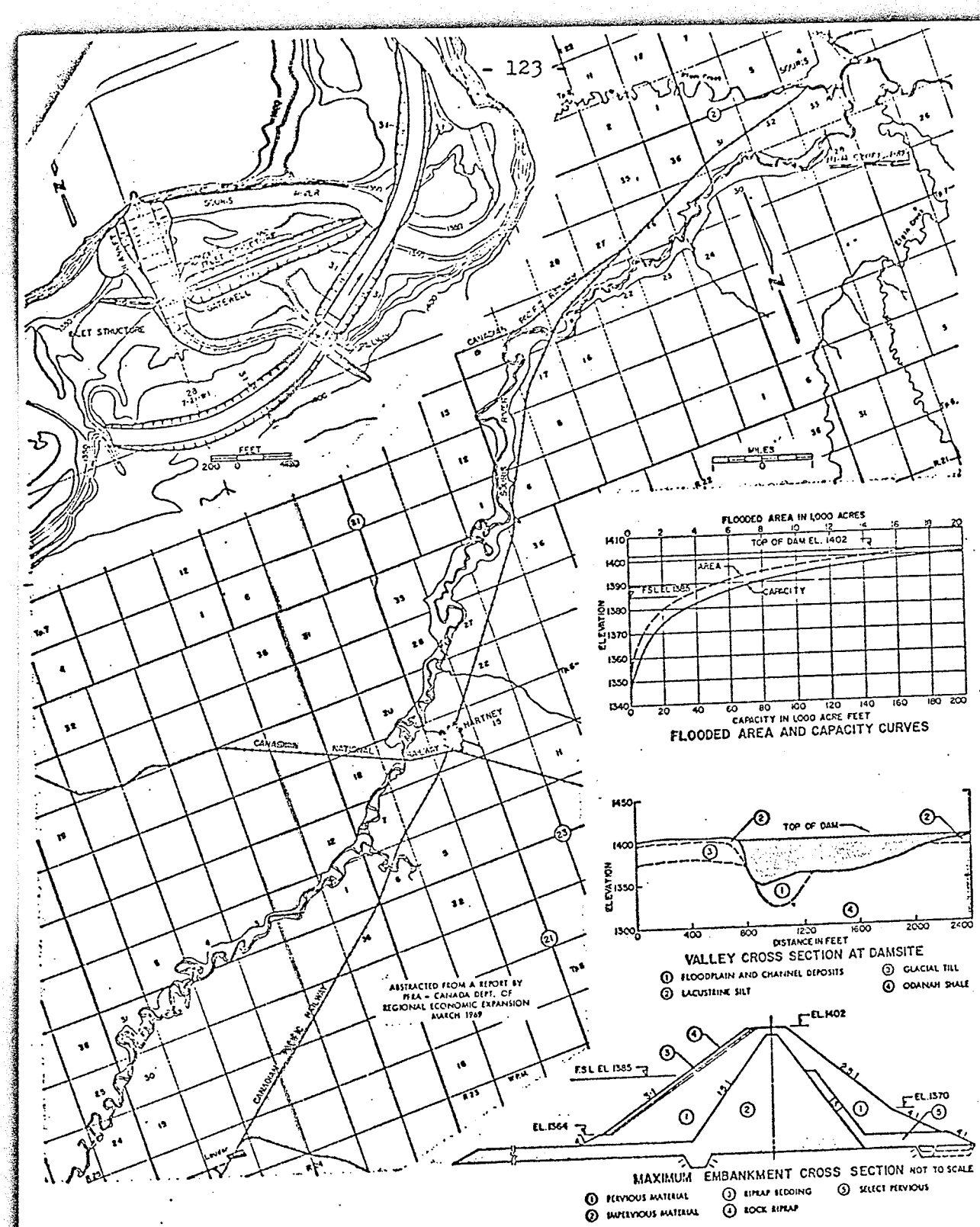


Fig. 10. High Souris Dam Reservoir.

Table 76 - Areas of Habitat Types Flooded - High Souris Dam Reservoir

Habitat Types	Area (Sq. Miles)	% of Total Analyzed Area
Timber	2.02	36.8
Bush	0.42	7.6
Grassland	0.39	7.2
Cropland	2.53	46.3
Marsh	0.08	1.5
Bush/Grassland	0.03	0.6
Urban	0.00	0.0
Water	0.00	0.0
TOTAL	5.47	100.0

Table 77 - Estimated Wildlife Population Loss (Gain) - High Souris Dam Reservoir.

Species	Habitat Type	Densities Per Square Mile	Habitat Area Flooded (Square Miles)	Estimated Population Loss (Gain)
American Beaver	River	3[a]	30[b]	90
Muskrat	River	2[a]	30[b]	
	Marsh	64	0.08)	65
Mink	All except urban & water	0.5	5.47	3
Sharp-tailed Grouse	Grassland/Bush	75	0.84	63
Ruffed Grouse	Timber/Bush	25	2.44	61
Hungarian Partridge	Bush	20	0.42	8
White-tailed jack rabbit	Cropland/Grassland	16	2.92	47
Snowshoe Hare	Timber/Bush	300	2.44	732
Red Fox	All except urban & water	0.75-1.00	5.47	4-5
Coyote	Timber/Bush	0.75	2.44	2
Striped Skunk	Cropland	13.5	2.53	34
Red Squirrel	Timber	389	2.02	786
American Badger	All except urban & water	0.5	5.47	3
Ermine	All except urban & water	1.4	5.47	8
Lynx	All except urban & water	0.05-0.19	5.47	0-1
Raccoon	Timber/Bush	10	2.44	24
Meadow Vole	All except urban, cropland & water	128-216,876.8	2.94	20,226
White-tailed Deer	Timber/Bush	0-42	CLI Class 2-3.20 CLI Class 3-2.27	97-142
Waterfowl	All except urban & water	37.7	5.47	206
	Water (fall)	640	1.88	(1203)

a. Densities expressed per river mile
b. River miles

the full supply level of 1385 a.s.l. (Samp, personal communication). The surface area of the High Souris Dam reservoir at 1375 a.s.l. would be 1200 acres (1.88 sq. miles) which is the area used to calculate numbers of waterfowl which may be attracted to the reservoir in the fall.

Using the opportunity cost equation mentioned previously, Table 78 indicates the economic value of lost or gained wildlife production resulting from project implementation.

Similar to Patterson Dam, it appears as if there would be a net loss accruing as a result of implementing the High Souris Dam, as observed in Table 78. Again, no benefits from hunting waterfowl are included since any benefits from this activity would simply be losses elsewhere. There is also a non-quantifiable value in the knowledge that there are a variety of species found in a particular area. Implementation of these dams would preclude this non-quantifiable significance, therefore the values described may not necessarily reflect true worth of each species lost.

Table 78 - Estimated Present Value (1976 $) of Wildlife Resourse Lost (Gained) - High Souris Dam Reservoir

Species	ΣW_1V_1 $	ΣW_1V_2 $	ΣW_2V_2 $	OC $
American Beaver	1,800.00	16,218.00	0	18,018.00
Muskrat	235.30	1,547.00	0	1,782.30
Mink	78.00	548.70	0	626.70
White-tailed Jack Rabbit	9.40	84.60	0	94.00
Red Fox	172.00-215.00	1,028.40-1,285.50	0	1,200.40-1,500.50
Coyote	112.00	573.60	0	685.60
Striped Skunk	68.00	408.00	0	476.00
Red Squirrel	550.20	4,008.60	0	4,558.80
American Badger	103.50	493.50	0	597.00
Ermine	7.20	70.40	0	77.60
Lynx	0 - 257.00	0 - 941.30	0	0 - 1,198.30
Raccoon	528.00	2,678.40	0	3,206.40
Value of Fur Harvest Lost (Gained)	3,663.60-3,963.60	27,659.20-28,857.60	0	31,322.80-32,821.20
Sharp-tailed Grouse	4,550.49	35,689.50	0	40,239.99
Ruffed Grouse	4,406.03	34,556.50	0	38,962.53
Hungarian Partridge	577.84	4,532.00	0	5,109.84
White-tailed Deer	41,584.87-60,876.82	345,834.10-506,272.60	0	387,418.97-567,149.42
Waterfowl	9,129.92	81,555.40	0	90,685.32
Value of Huntable Populations Lost (Gained)	60,249.15-79,541.10	502,167.50-662,606.00	0	562,416.65-742,147.10

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 Summary

This report attempted to provide information regarding the wildlife resource of Manitoba's portion of the Souris River Basin. What is there in terms of populations and species and how the resource is used are the two essential questions answered in the report. How the present utilization of the wildlife resource in the Souris Basin compares to provincial totals may be examined in Tables 79-82.

In addition, cursory impact analyses were undertaken along with an attempt at quantifying the economic effect on wildlife of project implementation. The preceding economic analyses have shown that there would be a net loss in terms of decreasing the economic value of wildlife resulting from implementation of Patterson Dam and a net loss if the High Souris Dam is implemented. However, if intangible costs were included (and if they could be measured in the first place), then the result could very well be a greater net disbenefit from reservoir formation. It must be mentioned that this analysis was undertaken with the premise that only if every aquatic furbearer, upland game bird, migratory game bird and white-tailed deer lost because of the reservoir would ordinarily have been harvested would this loss accrue. Clearly,

Table 79 - Upland Game Bird Hunter Activities - Souris River Basin

Year	Hunters		Days		Days/Hunter		Sharp-tailed Grouse		Ruffed Grouse		Spruce Grouse		Hungarian Partridge		Total Harvest	
	Basin Total	% of Prov. Total	Basin Total	% of Prov. Total	Basin Avge.	Prov. Avge.	Basin Total	% of Prov. Total	Basin Total	% of Prov. Total	Basin Total	% of Prov. Total	Basin Total	% of Prov. Total	Basin Total	% of Prov. Total
1974-75	1,819	(5%)	7,912	(4%)	4.35	(4.89)	2,723	(6%)	1,150	(2%)	266	(1%)	1,046	(10%)	5,185	(4%)
1973-74	1,242	(2%)	5,810	(5%)	4.68	(4.40)	2,405	(8%)	1,413	(5%)	110	(1%)	1,305	(12%)	5,233	(6%)
1972-73	3,046	(6%)	12,962	(5%)	4.26	(5.30)	5,330	(7%)	5,312	(6%)	901	(4%)	2,070	(10%)	13,613	(6%)

Table 80 - Estimated White-tailed Deer Hunter Activities - Souris River Basin.

Year	Hunters		Days		Days/Hunter		% Success Rate		Total Retrieved Kill	
	Basin Total	% of Prov. Total	Basin Total	% of Prov. Total	Basin Average	Prov. Average	Basin	Province	Basin Total	% of Prov. Total
1973-74	5633	(15%)	14,836	(8%)	2.63	(4.90)	44.9	(28.4%)	2531	(15%)
1972-73	5326	(14%)	14,445	(8%)	2.71	(4.80)	49.8	(54%)	2652	(13%)
1971-72	4427	(10%)	12,728	(8%)	2.88	(3.70)	64.9	(59%)	2871	(11%)
1970-71	2359	(5%)	4,888	(3%)	2.07	(3.03)	46.9	(46.7%)	1108	(5%)
1969-70	4543	(11%)	10,505	(8%)	2.31	(2.94)	52.0	(51.5%)	2363	(11%)
1968-69	6107	(13%)	15,197	(13%)	2.49	(2.63	54.0	(53.9%)	3298	(14%)

Table 81 - Estimated Fur Harvest for the Period 1965/66-1974/75: Souris River Basin

Species	Year											% of Provincial 10 Year Average
	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	Average	
Badger	24	53	46	50	72	55	68	96	118	101	68	16
Beaver	658	624	794	848	667	667	720	846	637	706	650	1
Coyote	241	244	160	401	368	392	713	1,076	997	733	533	7
Ermine	1,142	477	942	833	379	180	135	361	209	649	531	3
Cross Fox	1	0	0	1	1	1	2	3	1	1	1	1
Red Fox	612	773	541	934	1,024	786	1,209	1,570	1,619	1,111	1,018	10
Silver Fox	0	0	0	1	0	0	1	1	1	0	1	1
Lynx	1	1	1	5	7	7	7	5	1	1	4	1
Mink	1,111	1,415	1,823	2,331	1,515	677	753	1,438	767	881	1,270	7
Muskrat	26,654	17,546	20,006	13,305	11,459	17,528	21,376	11,115	5,558	12,826	15,737	4
Rabbit	638	358	344	392	249	110	30	796	23	79	301	35
Raccoon	135	133	175	293	377	141	328	794	532	778	369	18
Skunk	4	2	1	3	1	1	1	3	2	1	2	4
Squirrel	1,232	1,207	3,453	1,870	1,032	445	449	517	500	1,175	1,188	2
Wolf	3	4	2	2	2	3	5	5	6	6	4	1

NOTE: The last column in the above table indicates the average fur harvest for each species from the Basin as a percentage of the 10 year average provincial fur harvest.

Table 82 - Estimated Waterfowl Hunter Activities - Souris River Basin

Year	Active Hunters		Days		Days/ Active Hunter		Retrieved Kill			
							Geese		Ducks	
	Basin Total	(% of Provincial Total)	Basin Total	(% of Provincial Total)	Basin Avge.	(Provincial Average)	Basin Total	(% of Provincial Total)	Basin Total	(% of Provincial Total)
1973	1809	(4%)	11,642	(4%)	6.43	(6.53)	4590	(5%)	10,998	(4%)
1972	2184	(5%)	16,032	(6%)	7.34	(6.56)	5388	(8%)	20,180	(5%)
1971	2212	(6%)	13,381	(6%)	6.04	(5.61)	4071	(7%)	18,148	(5%)
1970	2379	(6%)	19,628	(8%)	8.25	(7.19)*	4646*	(9%)	27,184	(5%)
1969	2168	(5%)	16,551	(6%)	7.63	(7.06)*	2238**	(6%)	19,942	(4%)

* Presented in days/successful hunter.

** Total should be more: data for retrieved kill by American hunters is not available for degree-block 49°N 101°W.

the answer is negative, however, this analysis does indicate the present value of total net possible costs resulting from project implementation, with respect to the wildlife resource in the Basin.

6.2 Conclusions

1. While populations of upland game birds, migratory game birds, white-tailed deer and various fur species may be abundant at times, population levels of most species are inextricably linked to the availability and quality of habitat. Since most of the Souris River Basin in Manitoba is utilized for agricultural purposes, maintenance or enhancement of the Basin's wildlife resource is dependent on the sound management of habitat types which are primarily riparian in nature.

2. Manitoba's portion of the Souris River Basin represents approximately 1.5% of the province's total area. Utilization of the Basin's wildlife resource is greater than expected, considering its area in relation to the remainder of the province. This productivity and utilization occurs despite the fact that most of the Souris River Basin is intensively developed for agriculture.

3. The total lost value (in perpetuity) of the potentially harvestable fur resource may be in the order of $7,400 (1976$) if Patterson Dam is implemented. In addition, the total value (in perpetuity) of potentially huntable animal populations lost due to the Patterson Dam reservoir may approximate $100,000-130,000 in 1976$.

4. The total lost value (in perpetuity) of the potentially harvestable fur resource may be in the order of $30,000 (1976$) if High Souris Dam is implemented. In addition, the total value of potentially huntable animal populations lost due to High Souris Dam reservoir may approximate $560,000-740,000 in 1976$.

In summation, it is evident that implementation of these two projects would result in a loss in terms of populations and an economic loss in terms of foregone benefits from potentially harvestable or huntable wildlife populations.

LITERATURE CITED

Adams, G. D. and Hutchinson, R. C. 1968. Land Capability for Wildlife (Waterfowl). Virden 62-F. Canada Land Inventory.

Anon. 1946. Game Branch, Manitoba Department of Mines and Natural Resources: Annual Report for the fiscal year ending April 30, 1946.

Banfield, A. W. F. 1974. The Mammals of Canada. National Museums of Canada.

Barto, W. P. 1974. The Agricultural, Forestry, Recreational and Wildlife Opportunity Cost of Pipelines, Hydro Lines and Highways. The Natural Resource Institute.

Bidlake, L. 1974. Patterson Dam Proposal - Impact to Wildlife (Appendix G). IN: Evaluation of the Proposed Patterson Dam - Gainsborough Creek. P.F.R.A. Planning Division.

Bossenmaier, E. F. 1971. Development of Plum Lakes for Wildlife. Manitoba Department of Mines and Natural Resources.

Canadian Wildlife Service. 1974. Province of Manitoba - Changes in Waterfowl Hunter - Use Areas: Harvest Data for 1969, 1970, 1971, 1972 and 1973.

Canadian Wildlife Service Progress Notes.

28. Cooch, F. G., Kaiser, G. W., and Wight, L. 1972. Report on the sales of the Canada migratory game bird hunting permit, migratory game bird harvest and hunting activity, 1971.

34. _____. 1973. Report on the 1972 sales of the Canada migratory game bird hunting permit, migratory game bird harvest and hunter activity.

41. _____. 1974. Report on the 1973 sales of the Canada migratory game bird hunting permit, migratory game bird harvest and hunter activity.

51. Cooch, F. G. and Raible, H. A. 1975. Report on the 1974 sales of the Canada migratory game bird hunting permit, waterfowl harvest and hunter activity.

52. _____. 1975. Harvest of migratory game birds other than waterfowl in Canada, 1974.

75. Anon. 1976. Preliminary data on the 1975 sales of the Canada migratory game bird hunting permit, migratory game bird harvest and hunting activity.

Cowan, W. 1973. Preliminary Investigation of the Impact of Lake Manitoba Water Regulation Patterns on Wildlife and Wildlife Habitat. Interim Report. Canadian Wildlife Service.

Createplan, Ltd. 1970. Recreation-Resource Aspects of the Proposed Patterson-Coulter Reservoirs.

Davies, D. 1968. Southwest Waterfowl Investigations. Manitoba Department of Mines and Natural Resources.

Environmental Research Group. 1974. Detailed Analysis - Economic Survey of Wildlife Recreation. Georgia State University.

Forsyth, G. and Caligiuri, E. 1975. Evaluation of Proposed Patterson Dam - Gainsborough Creek. P.F.R.A. Planning Division.

Gollop, J. B. and Domitrovich, C. F. 1975. May Waterfowl and Pond Estimates for the Prairie Provinces 1955-1974. Canadian Wildlife Service.

Goodwin, G. M. and Koonz, W. H. 1976. Wildlife Populations and Habitat in the Souris River Basin - Manitoba. Souris River Basin Study.

Goulden, H. D., Goulden, R. C. and Scott, V. H. 1970. Land Capability for Wildlife(Ungulates). Virden 62-F. Canada Land Inventory.

Goulden, R. C. and Goulden, H. D. 1969. White-tailed Deer Capability: Antler River - Gainsborough Creek Area of Southwestern Manitoba. Manitoba Department of Mines and Natural Resources. C.L.I. Project #5.

Hale, R. A. 1975. The Canadian Portion of the Souris River Basin: Background Notes. Inland Waters Directorate, Environment Canada.

Hedlin Menzies and Associates, Ltd. 1967. A Proposed Economic Evaluation Procedure for Waterfowl Habitat in Canada. IN: Barto (1974).

Hunt, H. M. 1974. Habitat Relations and Reproductive Ecology of Hugarian Partridge in a Hedgerow Complex in Saskatchewan. Wildlife Report #3. Saskatchewan Department of Tourism and Renewable Resources.

Hutchinson, R. C. and Adams, C. D. 1970. Land Capability for Wildlife (Waterfowl). Brandon 62-G. Canada Land Inventory.

Imrie, M. R., Millikan, I. J. and Goulden, H. D. 1974. Land Capability for Wildlife (Ungulates). Brandon 62-G. Canada Land Inventory.

Inland Waters Directorate. 1973. Historical Summary: Manitoba to 1973. Environment Canada.

Jones, R. 1976. Manitoba Wildlife Society. Letter to Mr. H. Bostrom, Manitoba Minister of Renewable Resources and Transportation Services.

Koonz, W. H. and Goodwin, G. M. 1976a. Present Use of the Wildlife Resource in the Souris River Basin - Manitoba. Souris River Basin Study.

Koonz, W. H. and Goodwin, G. M. 1976b. Management Options for Wildlife Enhancement: Souris River Basin (Manitoba). Souris River Basin Study.

Lombard North Planning, Ltd. 1972. Souris River Watershed: Resource Base-Land Use Capabilities.

Lynch, G. M. 1972. Effect of Strychnine Control on Nest Predators of Dabbling Ducks. Journal of Wildlife Management, 36: 436-440.

Manitoba Department of Mines, Resources and Environmental Management. 1974. Manitoba Wildlife Lands Book second edition.

Manitoba Department of Renewable Resources and Transportation Services, Research Branch. 1974. Manitoba Fur Fact Book.

Manitoba Evaluation Task Force Meeting #2: Memo. 1976. Souris River Basin Study.

Nellis, C. H., Wetmore, S. P. and Keith, L. B. 1972. Lynx-prey Interactions in Central Alberta. Journal of Wildlife Management, 36: 320-329.

Novakowski, N. S. 1965. Population Dynamics of a Beaver Population in Northern Latitudes. Ph.D. Thesis - University of Saskatchewan-Saskatoon.

Olson, P. 1955. Muskrat Investigations at the Delta Waterfowl Research Station, June-September, 1955. Preliminary Report, Department of Wildlife Management. University of Michigan.

Pearse Bowden Economic Consultants, Ltd. 1972. The Value of Resident Hunting in British Columbia.

Pearse, P. H. and Bowden, G. 1966. Big Game Hunting in the East Kootneys: A Statistical Analysis.

Ransom, A. B. and Hochbaum, G. 1972. Wildlife Management Problems and Potentials at Whitewater Lake. Manitoba Department of Mines, Resources and Environmental Management.

Robertson, R. J. 1967. Evaluation of Wildlife Benefits Provided by the Oak-Plum and Maple-Hunter Marsh Complexes. Manitoba Department of Mines, Resources and Environmental Management.

Ross, C. 1974. The Estimation of Demand for and Benefits Derived from Outdoor Recreation at Proposed Sites in the Souris River Basin, Manitoba. University of Manitoba, Ph.D. Thesis

_____. 1975. Economic Evaluation of Resident Big Game Hunting in Saskatchewan, Research Report #1. Research, Planning and Policy Branch.

Schellenberg, H. D. and Craddock, W. J. 1969. A Preliminary Economic Analysis of Outdoor Recreation in the Souris River Basin. Agassiz Center for Water Studies.

Thomson, A. M. 1975. Summary of Proposed Study Plan for the Souris River Basin (Draft).

Toews, W. H. and Partridge, D. 1976. Agriculture Base Study: Souris River Watershed. Souris River Basin Study.

Vermeer, K. 1972. Variation in Density of Breeding Ducks across the Aspen Parklands and Grasslands of Canada. The Blue Jay, 30: 154-158.

Water Control and Conservation Branch. 1967. Planning Study of Measures for Flood Control in the Maple Lake Area. Manitoba Department of Highways.

Water Resources Branch, Manitoba Department of Mines, Resources and Environmental Management. 1976. Souris River Basin Study - Memo.

Webb, R. 1968. Management of Plum Lakes Marshes. Manitoba Department of Mines and Natural Resources.

Wrigley, R. E. 1974. Ecological Notes on Animals of the Churchill Region of Hudson Bay. Arctic, 27: 201-214.

APPENDIX I

Historical streamflow summarys (as of 1973) are included for the Souris River and where available for some of the larger tributaries in the Manitoba portion of the Souris River Basin (Source: Inland Waters Directorate, 1973).

STREAMFLOW DATA

ANTLER RIVER NEAR MELITA - STATION NO. 05NF002

MONTHLY MEAN DISCHARGES AND MEAN DISCHARGES FOR MAR TO OCT IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1935	---	---	---	---	---	---	---	---	---	0.02	---	---	---	1935
1936	---	---	---	---	11.4	1.3	---	---	---	---	---	---	---	1936
1938	---	---	---	1.0	0.06	---	---	---	---	---	---	---	---	1938
1943	---	---	---	400	32.4	52.5	16.4	2.1	0.80	0.29	---	---	---	1943
1944	---	---	---	9.1	4.8	22.2	48.4	9.1	3.7	0.68	---	---	---	1944
1945	---	---	---	18.8	4.7	6.4	13.2	2.1	0.05	---	---	---	---	1945
1946	---	---	---	228	11.4	3.7	1.7	---	---	---	---	---	---	1946
1947	---	---	---	254	21.9	119	128	9.7	1.2	0.16	---	---	---	1947
1948	---	---	---	---	290	24.6	18.5	17.2	1.9	0.46	---	---	---	1948
1949	---	---	---	---	28.8	126	9.4	4.8	0.38	0.60	0.82	---	---	1949
1950	---	---	---	254	123	54.5	54.1	119	19.0	25.8	---	---	---	1950
1951	---	---	---	---	354	41.4	9.6	11.8	3.9	1.7	---	---	---	1951
1952	---	---	---	111	9.4	0.37	2.1	0	0	0.10	---	---	---	1952
1953	---	---	---	100	13.7	78.0	30.9	2.0	0	3.5	10.1	---	---	1953
1954	---	---	---	14.1	11.4	160	138	10.1	11.6	19.5	23.0	---	---	1954
1955	---	---	---	551	284	95.1	52.1	9.8	3.6	4.6	---	---	---	1955
1956	---	---	0.06	407	84.6	16.5	7.7	0.71	0	0.16	---	---	63.7	1956
1957	---	---	21.5	57.5	12.4	7.9	0.13	0	0	0	---	---	12.3	1957
1958	---	---	24.6	165	8.7	0.09	0	0	0	0	---	---	24.5	1958
1959	---	---	13.1	6.3	0.66	0.04	0	0	0	0.09	---	---	2.5	1959
1960	---	---	0.55	211	8.0	2.5	0.04	0	0	0	---	---	27.3	1960
1961	---	---	0.19	0.05	0.12	0	0	0	0	0	---	---	0.05	1961
1962	---	---	0	0	0	0	0	0	0	0	---	---	0	1962
1963	---	---	0	0	0	27.1	1.7	5.2	21.9	1.9	---	---	7.1	1963
1964	---	---	0	145	76.9	13.0	5.9	0.96	0.14	0.09	---	---	30.0	1964
1965	---	---	0	61.7	23.9	14.2	2.3	0.38	0.23	1.1	---	---	12.8	1965
1966	---	---	45.6	106	33.8	12.2	4.3	0.20	0	0	---	---	27.6	1966
1967	---	---	0.37	12.9	8.8	1.7	0.12	0	0	0	---	---	3.0	1967
1968	---	---	7.2	6.5	0.37	0	0.44	0.54	0.21	0.01	---	---	1.9	1968
1969	---	---	0	1050	76.9	20.9	91.5	19.5	1.2	3.2	---	---	156	1969
1970	---	---	1.6	179	348	36.6	10.3	6.4	0.49	4.4	---	---	73.3	1970
1971	---	---	0.35	57.4	15.7	41.1	13.8	0.22	0.02	0.20	---	---	15.9	1971
1972	---	---	243	145	26.2	33.0	11.4	7.1	1.7	0.40	---	---	58.5	1972
1973	---	---	16.5	8.7	7.0	16.7	2.2	0.10	0.02	0.02	---	---	6.4	1973
MEAN	---	---	20.8	157	59.0	32.1	21.7	8.0	2.4	2.3	11.3	---	29.0	MEAN

LOCATION - LAT 49 03 34 N, LONG 101 02 56 W DRAINAGE AREA 1240 SQ MILES, NATURAL FLOW

ANTLER RIVER NEAR MELITA - STATION NO. 05NF002

EXTREMES OF DISCHARGE IN CFS AND TOTAL DISCHARGE IN AC-FT FOR MAR TO OCT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1935	---	---	0 CFS ON SEP 26 *	---	1935
1936	---	---	---	---	1936
1938	---	---	0 CFS ON MAY 15	---	1938
1943	---	1670 CFS ON APR 9	0 CFS ON APR 1	---	1943
1944	---	161 CFS ON JUL 2	0 CFS ON APR 1	---	1944
1945	---	114 CFS ON MAR 29	0 CFS ON SEP 5	---	1945
1946	---	1460 CFS ON MAR 31	0 CFS ON AUG 7	---	1946
1947	---	1050 CFS ON JUN 29	0 CFS ON APR 1	---	1947
1948	---	2610 CFS ON APR 26	---	---	1948
1949	---	2100 CFS ON APR 14	---	---	1949
1950	---	556 CFS ON APR 21	---	---	1950
1951	---	1220 CFS ON APR 14	---	---	1951
1952	---	303 CFS ON APR 5	0 CFS ON JUN 7	---	1952
1953	---	352 CFS ON APR 7	0 CFS ON AUG 29	---	1953
1954	---	423 CFS ON JUN 21	0 CFS ON APR 1	---	1954
1955	---	2080 CFS ON APR 9	---	---	1955
1956	---	1080 CFS ON APR 15	0 CFS ON MAR 1	30900 AC-FT	1956
1957	---	237 CFS ON MAR 30	0 CFS ON MAR 1	5980 AC-FT	1957
1958	---	624 CFS ON APR 4	0 CFS ON MAR 1	11900 AC-FT	1958
1959	---	73.0 CFS ON MAR 30	0 CFS ON MAR 1	1230 AC-FT	1959
1960	---	760 CFS ON APR 7	0 CFS ON MAR 1	13300 AC-FT	1960
1961	---	1.0 CFS ON MAR 20	0 CFS ON MAR 1	22.0 AC-FT	1961
1962	---	0 CFS ON MAR 1	0 CFS ON MAR 1	0 AC-FT	1962
1963	---	93.6 CFS ON JUN 9	0 CFS ON MAR 1	3460 AC-FT	1963
1964	---	350 CFS ON APR 8	0 CFS ON MAR 1	14600 AC-FT	1964
1965	---	236 CFS ON APR 17	0 CFS ON MAR 1	6230 AC-FT	1965
1966	---	305 CFS ON APR 6	0 CFS ON MAR 1	13400 AC-FT	1966
1967	---	25.0 CFS ON APR 21	0 CFS ON MAR 1	1440 AC-FT	1967
1968	---	31.0 CFS ON APR 3	0 CFS ON MAR 1	922 AC-FT	1968
1969	---	3750 CFS ON APR 17 *	0 CFS ON MAR 1	75600 AC-FT	1969
1970	---	960 CFS ON MAY 5	0 CFS ON MAR 1	35600 AC-FT	1970
1971	---	160 CFS ON APR 13	0 CFS ON AUG 24	7730 AC-FT	1971
1972	---	800 CFS ON MAR 26	0 CFS ON MAR 1	28400 AC-FT	1972
1973	---	44.8 CFS ON MAR 25	0 CFS ON MAR 1	3090 AC-FT	1973
		* - EXTREME RECORDED FOR THE PERIOD OF RECORD		14100 AC-FT	MEAN

ELGIN CREEK NEAR SOURIS - STATION NO. 05NG012

MONTHLY MEAN DISCHARGES AND MEAN DISCHARGES FOR MAR TO OCT IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1961	---	---	6.3	15.0	3.1	0	0	0	0	0	---	---	3.0	1961
1962	---	---	0	44.2	3.0	4.5	1.7	0.67	1.3	0	---	---	6.8	1962
1963	---	---	3.7	7.8	0.08	0.81	0	0	0	0	---	---	1.5	1963
1964	---	---	0	18.9	5.1	0.03	0	0	0	0	---	---	3.0	1964
1965	---	---	0	97.2	1.5	0.51	49.1	2.7	6.7	2.4	---	---	19.8	1965
1966	---	---	16.4	16.3	4.5	2.1	0.28	0	0	0	---	---	4.9	1966
1967	---	---	0.38	24.8	4.6	0.01	0	0	0	0	---	---	3.7	1967
1969	---	---	0	92.7	3.8	0.19	11.9	0.76	0.07	0	---	---	13.5	1969
1970	---	---	0	148	32.9	1.5	12.3	0.55	0	0	---	---	24.1	1970
1971	---	---	0.05	18.5	3.4	11.5	4.9	0.01	0	0	---	---	4.7	1971
1972	---	---	62.6	10.1	3.1	0.30	0.03	2.8	0.10	0	---	---	10.0	1972
1973	---	---	0	0	0	0.96	8.1	2.1	1.5	0.61	---	---	1.7	1973
MEAN	---	---	7.5	41.1	5.4	1.9	7.4	0.80	0.81	0.25	---	---	8.1	MEAN

LOCATION - LAT 49 35 28 N
LONG 100 14 05 W

DRAINAGE AREA 181 SQ MILES
NATURAL FLOW

GAINSBOROUGH CREEK NEAR MELITA - STATION NO. 05NF003

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1935	---	---	---	---	1935
1936	---	---	---	---	1936
1943	---	710 CFS ON APR 8	0 CFS ON APR 1 *	---	1943
1944	---	33.0 CFS ON JUL 1	0 CFS ON APR 1	---	1944
1945	---	21.6 CFS ON MAR 28	0 CFS ON AUG 30	---	1945
1946	---	496 CFS ON APR 2	0 CFS ON JUL 2	---	1946
1947	---	425 CFS ON JUN 29	0 CFS ON APR 1	---	1947
1948	---	1300 CFS ON APR 25 *	0 CFS ON OCT 13	---	1948
1949	---	1280 CFS ON APR 12	0 CFS ON APR 1	---	1949
1950	---	395 CFS ON APR 21	1.8 CFS ON NOV 6	---	1950
1951	---	1010 CFS ON MAY 6	0 CFS ON JUL 3	---	1951
1952	---	263 CFS ON APR 10	0 CFS ON MAY 26	---	1952
1953	---	117 CFS ON APR 9	0 CFS ON MAR 27	---	1953
1954	---	121 CFS ON JUL 10	0 CFS ON APR 1	---	1954
1955	---	959 CFS ON APR 9	0 CFS ON JUL 19	--- AC-FT	1955 MEAN

* - EXTREME RECORDED FOR THE PERIOD OF RECORD

GAINSBOROUGH CREEK NEAR LYLETON - STATION NO. 05NF007

MONTHLY MEAN DISCHARGES AND MEAN DISCHARGES FOR MAR TO OCT IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1956	---	---	---	195	27.8	8.8	3.6	1.1	0	0	0	---	---	1956
1957	---	---	8.3	12.5	5.0	3.6	0.52	0	0.20	0	---	---	3.8	1957
1958	---	---	17.9	57.6	2.6	0.07	0	0	0	0	---	---	9.7	1958
1959	---	---	2.6	1.1	0	0	0	0	0	0	---	---	0.46	1959
1960	---	---	1.5	67.0	4.5	0.89	0.02	0	0	0	---	---	9.1	1960
1961	---	---	0	0	0	0	0	0	0	0	---	---	0	1961
1962	---	---	0	0	0	0	0	0	0	0	---	---	0	1962
1963	---	---	0	0	0	0	0	0	0	0	---	---	0	1963
1964	---	---	0	65.9	65.6	4.8	3.7	0.55	0.46	1.3	---	---	17.7	1964
1965	---	---	0	42.2	10.3	6.5	2.5	0.62	1.4	2.1	---	---	8.1	1965
1966	---	---	15.5	74.6	15.6	10.0	3.4	0.19	1.1	0.20	---	---	14.9	1966
1967	---	---	0.95	3.9	3.6	0.44	0	0	0	0	---	---	1.1	1967
1968	---	---	0.65	0.56	0.23	0	0.03	0.15	0.46	0.41	---	---	0.31	1968
1969	---	---	0	420	16.7	1.5	36.8	9.0	6.1	4.5	---	---	60.9	1969
1970	---	---	0	111	154	9.1	3.1	1.8	1.2	0.09	---	---	35.0	1970
1971	---	---	0.37	4.6	2.4	18.5	9.3	0.30	3.0	0.46	---	---	4.8	1971
1972	---	---	78.7	93.5	14.6	9.3	0.45	2.8	5.2	0.28	---	---	25.5	1972
1973	---	---	1.1	0.89	1.6	6.0	0.63	0.03	0.30	0.54	---	---	1.4	1973
MEAN	---	---	7.5	63.9	18.0	4.4	3.6	0.92	1.1	0.55	0	---	11.3	MEAN

LOCATION - LAT 49 05 45 N, LONG 101 11 00 W DRAINAGE AREA 473 SQ MILES, REGULATED

GAINSBOROUGH CREEK NEAR LYLETON - STATION NO. 05NF007

EXTREMES OF DISCHARGE IN CFS AND TOTAL DISCHARGE IN AC-FT FOR MAR TO OCT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1956	---	717 CFS ON APR 19	0 CFS ON AUG 21 *	---	1956
1957	---	31.0 CFS ON MAR 29	0 CFS ON MAR 1	1820 AC-FT	1957
1958	---	338 CFS ON APR 4	0 CFS ON MAR 1	4700 AC-FT	1958
1959	---	36.0 CFS ON MAR 27	0 CFS ON MAR 1	225 AC-FT	1959
1960	---	247 CFS ON APR 5	0 CFS ON MAR 1	4410 AC-FT	1960
1961	---	0 CFS ON MAR 1	0 CFS ON MAR 1	0 AC-FT	1961
1962	---	0 CFS ON MAR 1	0 CFS ON MAR 1	0 AC-FT	1962
1963	---	0 CFS ON MAR 1	0 CFS ON MAR 1	0 AC-FT	1963
1964	492 CFS AT 0200 CST ON MAY 7	363 CFS ON MAY 9	0 CFS ON MAR 1	8610 AC-FT	1964
1965	281 CFS AT 1415 CST ON APR 17	170 CFS ON APR 17	0 CFS ON MAR 1	3940 AC-FT	1965
1966	---	239 CFS ON APR 6	0 CFS ON MAR 1	7240 AC-FT	1966
1967	---	11.0 CFS ON MAY 11	0 CFS ON MAR 1	582 AC-FT	1967
1968	---	2.0 CFS ON MAR 20	0 CFS ON MAR 1	152 AC-FT	1968
1969	1630 CFS AT 1640 CST ON APR 16 *	1550 CFS ON APR 16 *	0 CFS ON MAR 1	29600 AC-FT	1969
1970	654 CFS AT 1115 CST ON MAY 1	635 CFS ON MAY 1	0 CFS ON MAR 1	17000 AC-FT	1970
1971	---	80.2 CFS ON JUN 14	0 CFS ON MAR 1	2330 AC-FT	1971
1972	---	251 CFS ON MAR 27	0 CFS ON MAR 1	12400 AC-FT	1972
1973	92.5 CFS AT 0352 CST ON JUN 3	49.0 CFS ON JUN 3	0 CFS ON MAR 1	669 AC-FT	1973
	* - EXTREME RECORDED FOR THE PERIOD OF RECORD			5510 AC-FT	MEAN

GAINSBOROUGH CREEK NEAR MELITA - STATION NO. 05NF003

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1935	---	---	---	---	---	---	---	---	---	0.55	---	---	---	1935
1936	---	---	---	---	9.4	0.70	---	---	---	---	---	---	---	1936
1943	---	---	---	176	13.3	17.3	5.0	0.15	0	---	---	---	---	1943
1944	---	---	---	0.22	0.10	7.1	7.9	1.0	0.88	0.24	---	---	---	1944
1945	---	---	---	4.5	0.72	2.1	2.6	0.22	0	0	---	---	---	1945
1946	---	---	---	100	3.5	0.93	---	---	---	---	---	---	---	1946
1947	---	---	---	76.0	26.8	36.5	49.5	1.8	0.02	---	---	---	---	1947
1948	---	---	---	---	120	11.6	1.7	2.7	0.42	0.25	---	---	---	1948
1949	---	---	---	178	11.5	58.0	4.8	1.6	0.12	---	---	---	---	1949
1950	---	---	---	---	95.2	21.2	41.4	115	25.2	5.7	---	---	---	1950
1951	---	---	---	306	260	11.8	2.3	1.3	0.37	0	---	---	---	1951
1952	---	---	---	56.5	2.7	0	0.58	---	---	---	---	---	---	1952
1953	---	---	---	25.7	6.8	2.5	3.3	---	---	---	---	---	---	1953
1954	---	---	---	0.93	0	24.8	78.1	6.0	4.3	4.9	2.7	---	---	1954
1955	---	---	---	264	81.8	13.7	1.4	0.97	0	0	---	---	---	1955
MEAN	---	---	---	108	45.1	14.9	16.5	13.1	3.1	1.5	2.7	---	---	MEAN

LOCATION - LAT 49 09 50 N, LONG 101 02 46 W DRAINAGE AREA 521 SQ MILES, NATURAL FLOW

PIPESTONE CREEK NEAR PIPESTONE - STATION NO. 05NG003

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1936	---	---	---	---	115	18.6	---	---	---	---	---	---	---	1936
1943	---	---	---	811	61.2	43.8	---	---	---	---	---	---	---	1943
1957	---	---	55.1	189	82.3	27.2	15.0	6.0	106	62.8	11.8	2.4	---	1957
1958	0.19	0.04	39.1	230	31.7	2.5	3.9	0.97	0.71	20.5	9.0	0	28.1	1958
1959	0	0	22.4	19.3	4.7	1.6	0.83	0.16	8.9	4.1	3.9	1.6	5.6	1959
1960	0	0	0.39	244	22.5	13.0	5.1	4.1	4.7	37.1	13.2	4.0	28.7	1960
1961	1.7	1.7	14.4	25.5	8.3	2.6	0.78	0.09	0.05	0.15	1.4	2.0	4.9	1961
1962	1.9	2.0	2.1	31.1	2.7	15.1	3.2	8.0	0.26	0	0	---	---	1962
1963	---	---	45.6	21.1	14.3	35.2	31.7	16.6	8.9	9.2	15.6	11.3	---	1963
1964	8.6	3.4	1.3	213	105	28.1	7.4	7.1	17.2	26.9	14.9	4.4	36.2	1964
1965	2.9	2.9	4.1	289	21.6	32.4	78.3	10.4	44.1	40.2	15.4	13.5	46.0	1965
1966	6.3	0.85	28.0	254	69.0	33.4	11.3	8.4	10.8	13.9	10.0	14.9	38.3	1966
1967	16.9	17.8	28.4	222	78.7	6.0	2.3	0.61	0.57	2.7	1.2	1.4	31.4	1967
1968	5.7	5.9	91.4	46.5	6.5	0.54	0.16	1.2	2.7	1.9	1.8	3.1	14.0	1968
1969	0	0	0	708	80.9	29.5	103	19.5	4.8	10.7	42.9	12.0	83.8	1969
1970	5.5	14.8	17.5	375	355	54.1	29.4	15.6	22.9	20.7	19.2	13.7	78.7	1970
1971	12.4	7.3	10.7	172	33.0	25.5	22.5	3.9	31.8	27.5	10.6	5.7	30.1	1971
1972	3.4	2.8	183	257	37.6	21.0	5.6	8.1	12.8	19.5	10.6	2.2	46.8	1972
1973	0.80	1.7	13.3	15.1	11.5	2.5	5.0	3.6	11.7	25.5	8.7	6.3	8.9	1973
MEAN	4.4	4.1	32.8	229	60.1	20.7	19.1	6.7	17.0	19.0	11.2	6.2	34.4	MEAN

LOCATION - LAT 49 35 40 N
LONG 100 56 30 W

DRAINAGE AREA 1560 SQ MILES
REGULATED

PIPESTONE CREEK NEAR PIPESTONE - STATION NO. 05NG003

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1936	---	---	---	---	1936
1943	---	1990 CFS ON APR 10	---	---	1943
1957	---	292 CFS ON APR 8	---	---	1957
1958	---	710 CFS ON APR 5	0 CFS ON JAN 7 *	20400 AC-FT	1958
1959	---	104 CFS ON SEP 7	0 CFS ON JAN 1	4090 AC-FT	1959
1960	---	738 CFS ON APR 14	0 CFS ON JAN 1	20800 AC-FT	1960
1961	---	34.2 CFS ON APR 11	0 CFS ON AUG 18	3530 AC-FT	1961
1962	---	147 CFS ON AUG 11	0 CFS ON OCT 1	---	1962
1963	---	336 CFS ON MAR 23	0 CFS ON MAR 1	---	1963
1964	---	682 CFS ON APR 16	0.80 CFS ON AUG 6	26300 AC-FT	1964
1965	---	911 CFS ON APR 19	1.8 CFS ON AUG 22	33400 AC-FT	1965
1966	---	850 CFS ON APR 6	0 CFS ON MAR 2	27700 AC-FT	1966
1967	---	812 CFS ON APR 15	0.20 CFS ON AUG 30	22700 AC-FT	1967
1968	---	245 CFS ON MAR 26	0 CFS ON JUN 20	10200 AC-FT	1968
1969	---	4000 CFS ON APR 15 *	0 CFS ON JAN 1	60600 AC-FT	1969
1970	---	1050 CFS ON MAY 1	3.2 CFS ON JAN 13	57000 AC-FT	1970
1971	---	557 CFS ON APR 12	0.30 CFS ON AUG 27	21800 AC-FT	1971
1972	---	720 CFS ON MAR 25	1.0 CFS ON DEC 31	34000 AC-FT	1972
1973	71.0 CFS AT 2140 CST ON OCT 21 *	66.9 CFS ON SEP 27.	0.50 CFS ON JAN 10	6420 AC-FT	1973
		* - EXTREME RECORDED FOR THE PERIOD OF RECORD		24900 AC-FT	MEAN

PIPESTONE CREEK NEAR RESTON - STATION NO. 05NG006

MONTHLY MEAN DISCHARGES AND MEAN DISCHARGES FOR APR TO OCT IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1943	---	---	---	---	---	---	13.7	3.7	2.0	3.4	---	---	---	1943
1944	---	---	---	17.0	8.7	23.2	28.3	6.0	5.7	3.4	---	---	13.2	1944
1945	---	---	---	35.9	18.5	21.6	32.4	5.3	1.1	3.8	---	---	16.9	1945
1946	---	---	---	278	26.8	11.8	88.9	5.7	1.3	11.6	---	---	60.1	1946
1947	---	---	---	519	90.0	272	135	19.9	11.2	8.6	---	---	149	1947
1948	---	---	---	---	361	56.8	34.0	19.8	6.6	---	---	---	---	1948
1949	---	---	---	277	26.9	89.2	14.1	14.4	1.8	7.8	---	---	60.8	1949
1950	---	---	---	398	209	91.2	116	117	20.3	13.6	---	---	137	1950
1951	---	---	---	408	310	32.8	23.5	8.4	8.8	---	---	---	---	1951
1952	---	---	---	238	34.7	17.2	18.2	4.8	31.0	5.8	---	---	49.3	1952
1953	---	---	---	286	57.0	423	153	27.0	4.3	11.2	---	---	136	1953
1954	---	---	---	124	87.1	522	847	86.2	87.8	163	95.7	---	274	1954
1955	---	---	---	845	1090	584	270	37.6	44.2	5.1	---	---	409	1955
1956	---	---	---	618	254	69.2	72.6	26.4	7.9	53.3	48.4	37.5	156	1956
1957	36.0	36.0	48.0	168	70.5	22.7	12.0	5.0	97.3	---	---	---	---	1957
MEAN	36.0	36.0	48.0	324	189	160	124	25.8	22.1	24.2	72.1	37.5	133	MEAN

LOCATION - LAT 49 40 30 N, LONG 101 08 45 W DRAINAGE AREA 1540 SQ MILES, REGULATED

PIPESTONE CREEK NEAR RESTON - STATION NO. 05NG006

EXTREMES OF DISCHARGE IN CFS AND TOTAL DISCHARGE IN AC-FT FOR APR TO OCT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1943	---	---	---	---	1943
1944	---	104 CFS ON JUN 29	0 CFS ON APR 1 *	5590 AC-FT	1944
1945	---	98.0 CFS ON APR 1	0.20 CFS ON SEP 2	7170 AC-FT	1945
1946	---	995 CFS ON APR 1	0 CFS ON SEP 21	25600 AC-FT	1946
1947	---	1280 CFS ON JUN 27	0 CFS ON APR 1	63300 AC-FT	1947
1948	---	1310 CFS ON APR 23	---	---	1948
1949	---	921 CFS ON APR 12	0 CFS ON APR 1	25800 AC-FT	1949
1950	---	1140 CFS ON APR 20	9.8 CFS ON SEP 22	58300 AC-FT	1950
1951	---	1060 CFS ON MAY 7	0 CFS ON APR 1	---	1951
1952	---	636 CFS ON APR 10	1.0 CFS ON AUG 24	21000 AC-FT	1952
1953	---	1130 CFS ON JUN 10	0 CFS ON SEP 20	57700 AC-FT	1953
1954	---	2260 CFS ON JUL 11	5.0 CFS ON APR 1	117000 AC-FT	1954
1955	---	2600 CFS ON MAY 7 *	1.0 CFS ON SEP 3	174000 AC-FT	1955
1956	---	1560 CFS ON APR 19	3.0 CFS ON AUG 22	66300 AC-FT	1956
1957	---	247 CFS ON APR 7	---	---	1957
		* - EXTREME RECORDED FOR THE PERIOD OF RECORD		56500 AC-FT	MEAN

PLUM CREEK NEAR SOURIS - STATION NO. 05NG007

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1956	---	---	---	141	510	433	217	143	133	102	62.9	44.1	---	1956
1957	10.4	6.0	11.0	142	166	126	71.5	58.9	45.4	54.8	30.6	0.35	60.4	1957
1958	0	2.3	2.6	113	91.1	20.4	6.0	0	0	0	0	0	19.6	1958
1959	0	0	3.4	2.5	0.45	0	0	0	0	0.13	0.97	0.27	0.64	1959
1960	0.15	0	0	42.3	33.4	20.6	2.8	0.28	0	0	0	0	8.3	1960
1961	0	0	0.35	2.2	1.1	0.10	0	0	0	0	0	0	0.31	1961
1962	0	0	0	2.8	0.31	0.11	0	0	0	0	0	0	0.27	1962
1963	0	0	0.23	0.40	0.54	14.1	0.71	0.15	0.02	0	0	0	1.3	1963
1964	0	0	0	12.7	7.9	0.27	0.11	0	0	0	0	0	1.7	1964
1965	0	0	0	15.9	5.8	5.0	8.0	4.6	9.9	7.1	3.1	1.4	5.1	1965
1966	0.10	0	1.3	33.0	110	32.0	12.0	7.6	2.9	0.69	0.42	0	16.8	1966
1967	0	0	0	20.0	20.5	16.5	4.8	0.07	0	0	0	0	5.2	1967
1968	0	0	3.0	2.7	0.04	0	0	0	0	0.19	0.37	0	0.53	1968
1969	0	0	0	201	429	57.3	70.8	50.4	33.9	28.9	23.9	13.7	76.3	1969
1970	4.4	0	0	35.2	406	191	104	66.9	68.6	43.1	42.8	10.0	81.6	1970
1971	1.7	0	0	34.0	108	101	66.1	19.7	22.0	29.1	7.7	0.63	32.6	1971
1972	0	0	7.6	71.5	140	59.2	19.5	6.6	4.6	2.9	1.1	0.04	26.2	1972
1973	0	0	0.61	0.90	3.1	1.1	0.32	0.15	0.19	0.61	0.45	0.02	0.63	1973
MEAN	0.99	0.49	1.8	48.5	113	59.9	32.4	19.9	17.8	15.0	9.7	3.9	19.9	MEAN

LOCATION - LAT 49 37 30 N
LONG 100 18 20 W

DRAINAGE AREA 2590 SQ MILES
REGULATED

PLUM CREEK NEAR SOURIS - STATION NO. 05NG007

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1956	---	788 CFS ON JUN 22	---	---	1956
1957	---	301 CFS ON APR 27	0 CFS ON DEC 10 *	43700 AC-FT	1957
1958	---	149 CFS ON APR 14	0 CFS ON JAN 1	14200 AC-FT	1958
1959	---	25.0 CFS ON MAR 31	0 CFS ON JAN 1	463 AC-FT	1959
1960	---	185 CFS ON APR 11	0 CFS ON FEB 1	6000 AC-FT	1960
1961	---	7.7 CFS ON APR 3	0 CFS ON JAN 1	224 AC-FT	1961
1962	---	11.4 CFS ON APR 21	0 CFS ON JAN 1	195 AC-FT	1962
1963	---	54.0 CFS ON JUN 16	0 CFS ON JAN 1	961 AC-FT	1963
1964	---	38.3 CFS ON APR 18	0 CFS ON JAN 1	1270 AC-FT	1964
1965	---	41.9 CFS ON APR 14	0 CFS ON JAN 1	3680 AC-FT	1965
1966	---	153 CFS ON MAY 5	0 CFS ON JAN 11	12200 AC-FT	1966
1967	41.0 CFS AT 1600 CST ON APR 23	37.8 CFS ON APR 24	0 CFS ON JAN 1	3730 AC-FT	1967
1968	---	12.9 CFS ON MAR 24	0 CFS ON JAN 1	385 AC-FT	1968
1969	866 CFS AT 1708 CST ON MAY 1 *	863 CFS ON MAY 2 *	0 CFS ON JAN 1	55300 AC-FT	1969
1970	626 CFS AT 1741 CST ON MAY 16	622 CFS ON MAY 16	0 CFS ON JAN 24	59000 AC-FT	1970
1971	140 CFS AT 1541 CST ON JUN 16	139 CFS ON JUN 16	0 CFS ON JAN 26	23600 AC-FT	1971
1972	245 CFS AT 1730 CST ON APR 15	215 CFS ON APR 15	0 CFS ON JAN 1	19000 AC-FT	1972
1973	8.4 CFS AT 1508 CST ON MAY 13	7.6 CFS ON MAY 13	0 CFS ON JAN 1	457 AC-FT	1973
				14400 AC-FT	MEAN

* - EXTREME RECORDED FOR THE PERIOD OF RECORD

SOURIS RIVER AT MELITA - STATION NO. 05NF001

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1913	---	---	---	---	---	134	84.4	36.9	33.9	28.2	---	---	---	1913
1914	---	---	---	---	---	---	151	111	42.3	19.6	---	---	---	1914
1915	0	0	0	25.2	71.5	38.9	27.6	9.7	22.6	23.8	7.0	0	19.0	1915
1916	0	0	0	1560	2270	1320	339	183	58.8	54.3	20.0	5.0	484	1916
1917	4.2	3.9	16.7	712	942	367	90.5	17.2	9.6	8.0	15.8	2.1	183	1917
1918	0	0	64.2	383	169	72.5	17.3	17.4	12.1	12.6	10.0	---	---	1918
1919	---	---	---	1100	966	115	24.1	6.1	5.7	13.0	---	---	---	1919
1920	---	---	---	872	1550	721	135	55.8	28.6	21.5	---	---	---	1920
1921	---	---	---	200	145	86.1	148	157	56.5	33.0	18.7	---	---	1921
1922	---	---	33.4	1240	1020	358	120	62.3	31.5	---	---	---	---	1922
1935	---	---	---	---	---	---	---	---	---	2.5	---	---	---	1935
1936	---	---	---	332	29.9	3.4	1.4	0	0	---	---	---	---	1936
MEAN	1.1	0.98	22.9	714	796	322	103	59.7	27.4	21.3	14.3	2.4	229	MEAN

LOCATION - LAT 49 15 50 N
LONG 100 58 20 W

DRAINAGE AREA 19937 SQ MILES
REGULATED

SOURIS RIVER AT MELITA - STATION NO. 05NF001

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1913	---	---	---	---	1913
1914	---	---	---	---	1914
1915	---	181 CFS ON JUN 18	0 CFS ON JAN 1 *	13700 AC-FT	1915
1916	---	3790 CFS ON APR 22 *	0 CFS ON JAN 1	351000 AC-FT	1916
1917	---	1030 CFS ON MAY 5	1.0 CFS ON DEC 7	132000 AC-FT	1917
1918	---	545 CFS ON APR 10	0 CFS ON JAN 1	---	1918
1919	---	1410 CFS ON APR 21	0 CFS ON AUG 23	---	1919
1920	---	2330 CFS ON APR 24	0 CFS ON APR 1	---	1920
1921	---	500 CFS ON APR 15	0 CFS ON APR 1	---	1921
1922	---	1630 CFS ON APR 8	0 CFS ON MAR 1	---	1922
1935	---	---	---	---	1935
1936	---	989 CFS ON APR 16	0 CFS ON APR 1	---	1936
		* - EXTREME RECORDED FOR THE PERIOD OF RECORD		166000 AC-FT	MEAN

SOURIS RIVER AT WAWANESA - STATION NO. 05NG001

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1912	---	---	---	---	---	---	---	---	---	80.1	---	---	---	1912
1913	10.0	---	---	967	990	166	50.2	41.6	43.6	37.2	24.9	15.0	---	1913
1914	5.0	0	0	500	683	236	163	97.5	55.0	28.4	20.0	5.0	150	1914
1915	0	0	2.0	121	67.4	49.8	39.8	4.4	29.9	33.5	15.2	2.0	30.4	1915
1916	1.0	0	2.0	1980	2630	1650	485	217	84.2	79.0	59.9	20.0	600	1916
1917	0	0	14.7	843	1050	517	133	38.2	14.0	12.8	24.3	3.0	221	1917
1918	0	0	73.5	459	208	106	27.1	20.8	12.4	36.8	32.6	18.2	82.8	1918
1919	6.3	0	9.6	1320	1170	189	63.7	25.2	14.0	11.0	8.0	1.0	235	1919
1920	0	0	0	691	1820	990	186	71.3	45.5	40.4	20.0	---	---	1920
1921	---	---	---	250	196	124	102	189	75.0	48.6	25.9	---	---	1921
1922	---	---	23.4	1280	1090	464	135	77.9	40.4	34.3	41.0	---	---	1922
1923	---	---	---	1650	2030	1420	591	460	138	88.9	78.0	---	---	1923
1924	---	---	---	---	495	205	281	73.4	33.0	48.3	---	---	---	1924
1925	---	---	---	1700	1410	1010	293	82.1	45.1	50.0	---	---	---	1925
1926	---	---	---	114	110	78.5	99.5	49.9	42.9	44.5	---	---	---	1926
1927	---	---	---	1510	2030	2800	1860	603	367	290	282	---	---	1927
1928	---	---	---	1530	1490	862	1140	998	486	207	115	---	---	1928
1929	---	---	---	433	238	295	103	19.9	35.9	23.5	11.4	---	---	1929
1930	---	---	---	1270	595	195	80.7	14.1	2.4	7.7	---	---	---	1930
1931	---	---	---	40.1	11.9	5.1	3.1	0.09	0.02	0.03	0.04	0	---	1931
1932	0	0	0	126	90.4	41.4	24.7	3.2	0.31	3.7	---	---	---	1932
1933	---	---	---	1050	367	90.9	151	52.2	27.3	3.9	---	---	---	1933
1934	---	---	---	493	88.7	17.6	1.5	0	0	0	0	0	---	1934
1935	0	0	---	170	93.9	72.8	727	168	33.0	8.4	5.0	0	---	1935
1936	0	0	0	860	90.1	25.1	1.7	0	0	0	0	0	80.4	1936
1937	0	0	0	25.2	10.6	14.9	2.0	4.3	0.02	0	0	0	4.7	1937
1938	0	0	199	37.9	12.2	3.8	0.83	0.06	0	0	0	0	21.5	1938
1939	0	0	124	304	10.4	7.7	0.97	0	0	---	---	---	---	1939
1940	---	---	---	---	13.3	2.1	0.57	1.2	0.69	---	---	---	---	1940
1941	---	---	---	---	34.6	12.5	3.2	1.6	14.7	23.8	---	---	---	1941
1942	---	---	---	---	499	122	32.3	20.5	31.6	---	---	---	---	1942
1943	---	---	---	1430	1830	1530	788	292	56.2	67.5	---	---	---	1943
1944	---	---	---	182	319	329	1260	301	316	169	---	---	---	1944
1945	---	---	---	852	347	68.7	74.4	88.6	20.0	17.7	---	---	---	1945
1946	---	---	---	870	88.0	32.2	27.1	9.2	35.7	57.1	---	---	---	1946
1947	---	---	---	1460	1030	430	792	375	177	53.5	---	---	---	1947
1948	---	---	---	---	3430	2110	957	607	167	115	---	---	---	1948
1949	---	---	---	4100	3320	1070	291	142	82.9	64.6	---	---	---	1949
1950	---	---	---	1240	2730	2510	931	692	353	234	---	---	---	1950
1951	---	---	---	2580	3690	2140	630	113	169	150	---	---	---	1951
1952	---	---	---	1000	789	149	90.8	68.1	38.7	4.9	---	---	---	1952
1953	---	---	---	383	566	836	1070	1070	224	110	238	60.0	---	1953
1954	135	125	175	379	350	1020	1720	787	290	592	396	235	520	1954
1955	185	158	116	3440	3710	2770	1560	573	327	323	153	55.0	1120	1955
1956	21.9	22.7	18.3	2650	2960	2360	766	355	263	229	265	102	833	1956
1957	36.9	22.6	191	326	369	321	201	183	139	94.0	108	77.4	173	1957
1958	14.0	32.9	147	530	162	113	50.7	17.8	17.0	23.1	9.9	0.81	92.9	1958
1959	0.10	0.10	98.3	119	23.9	21.5	19.6	6.1	18.6	57.6	122	37.7	43.8	1959
1960	30.1	26.7	20.9	3020	1470	607	83.0	28.2	33.7	38.8	25.7	12.5	447	1960
1961	6.0	5.8	28.1	106	39.8	11.9	12.1	0.61	1.5	7.2	10.4	2.9	19.4	1961
1962	1.4	1.6	2.2	379	48.5	54.6	19.9	25.6	29.0	44.9	10.0	7.7	51.7	1962
1963	2.6	0	32.8	115	44.5	209	126	20.2	23.5	21.5	20.3	5.7	51.8	1963
1964	0.99	2.2	5.2	475	475	72.2	165	33.5	75.5	128	28.4	5.2	122	1964
1965	4.8	2.9	3.5	600	457	599	516	215	296	267	100	58.4	261	1965
1966	54.9	41.2	738	812	1060	460	167	71.5	26.7	27.8	20.3	9.9	292	1966
1967	8.9	6.8	25.4	540	595	188	24.1	7.8	3.0	23.4	22.6	7.1	121	1967
1968	3.9	4.6	132	70.1	24.7	17.5	26.4	48.1	211	200	69.2	21.2	69.1	1968
1969	16.6	21.5	17.3	5630	5950	2820	870	661	142	75.5	68.4	63.5	1360	1969
1970	69.6	66.6	49.7	1130	3030	2990	1800	557	107	93.7	78.5	24.9	837	1970
1971	15.3	31.5	55.6	812	1390	707	465	392	78.4	115	219	114	368	1971
1972	87.1	73.0	692	2630	2680	904	718	256	145	147	239	25.5	717	1972
1973	15.9	31.7	115	61.0	185	134	125	72.7	75.6	155	36.8	22.3	86.4	1973
MEAN	21.6	20.5	94.3	1030	1030	645	379	187	92.0	83.9	73.3	29.8	311	MEAN

LOCATION - LAT 49 36 05 N, LONG 99 40 55 W DRAINAGE AREA 23800 SQ MILES, REGULATED

SOURIS RIVER AT WAWANESA - STATION NO. 05NG001

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1912	---	---	---	---	1912
1913	---	1500 CFS ON MAY 3	---	---	1913
1914	---	1090 CFS ON APR 25	0 CFS ON FEB 1 *	109000 AC-FT	1914
1915	---	298 CFS ON APR 14	0 CFS ON JAN 1	22000 AC-FT	1915
1916	---	6100 CFS ON APR 19	0 CFS ON FEB 1	436000 AC-FT	1916
1917	---	1520 CFS ON APR 16	0 CFS ON JAN 1	160000 AC-FT	1917
1918	---	767 CFS ON APR 7	0 CFS ON JAN 1	59900 AC-FT	1918
1919	---	2040 CFS ON APR 7	0 CFS ON FEB 1	170000 AC-FT	1919
1920	---	2800 CFS ON APR 27	0 CFS ON JAN 1	---	1920
1921	---	---	---	---	1921
1922	---	2030 CFS ON APR 12	0 CFS ON MAR 1	---	1922
1923	---	5900 CFS ON APR 18	---	---	1923
1924	---	---	---	---	1924
1925	---	3000 CFS ON APR 3	---	---	1925
1926	---	512 CFS ON APR 20	---	---	1926
1927	---	2960 CFS ON JUN 8	---	---	1927
1928	---	2300 CFS ON MAR 30	---	---	1928
1929	---	1290 CFS ON APR 15	---	---	1929
1930	---	2680 CFS ON APR 5	---	---	1930
1931	---	130 CFS ON APR 11	0 CFS ON APR 1	---	1931
1932	---	270 CFS ON APR 15	0 CFS ON JAN 1	---	1932
1933	---	---	---	---	1933
1934	---	1150 CFS ON APR 7	0 CFS ON APR 1	---	1934
1935	---	1410 CFS ON JUL 3	0 CFS ON JAN 1	---	1935
1936	---	2400 CFS ON APR 13	0 CFS ON JAN 1	58300 AC-FT	1936
1937	---	66.0 CFS ON APR 16	0 CFS ON JAN 1	3430 AC-FT	1937
1938	---	1200 CFS ON MAR 20	0 CFS ON JAN 1	15600 AC-FT	1938
1939	---	1280 CFS ON APR 3	0 CFS ON JAN 1	---	1939
1940	---	---	---	---	1940
1941	---	---	---	---	1941
1942	---	---	---	---	1942
1943	---	2040 CFS ON MAY 15	---	---	1943
1944	---	1490 CFS ON JUL 18	0 CFS ON APR 1	---	1944
1945	---	1080 CFS ON APR 11	---	---	1945
1946	---	1770 CFS ON APR 7	---	---	1946
1947	---	2020 CFS ON APR 17	---	---	1947
1948	---	4140 CFS ON MAY 9	---	---	1948
1949	---	8280 CFS ON APR 11	---	---	1949
1950	---	3790 CFS ON MAY 11	---	---	1950
1951	---	4330 CFS ON MAY 12	---	---	1951
1952	---	1360 CFS ON MAY 2	0 CFS ON OCT 8	---	1952
1953	---	1260 CFS ON AUG 18	---	---	1953
1954	---	1880 CFS ON JUL 26	90.0 CFS ON FEB 2	377000 AC-FT	1954
1955	---	4090 CFS ON APR 24	40.0 CFS ON DEC 31	809000 AC-FT	1955
1956	---	7250 CFS ON APR 15	11.0 CFS ON MAR 23	604000 AC-FT	1956
1957	---	850 CFS ON MAR 23	7.0 CFS ON FEB 2	125000 AC-FT	1957
1958	---	1100 CFS ON APR 8	0.10 CFS ON DEC 16	67200 AC-FT	1958
1959	---	500 CFS ON MAR 27	0.10 CFS ON JAN 1	31700 AC-FT	1959
1960	9300 CFS AT 0800 CST ON APR 12	8090 CFS ON APR 12	5.8 CFS ON DEC 1	325000 AC-FT	1960
1961	252 CFS AT 1900 CST ON APR 7	198 CFS ON APR 7	0.10 CFS ON AUG 11	14000 AC-FT	1961
1962	---	2300 CFS ON APR 18	0 CFS ON NOV 11	37500 AC-FT	1962
1963	539 CFS AT 2300 CST ON JUN 29	500 CFS ON JUN 30	0 CFS ON JAN 26	37500 AC-FT	1963
1964	---	1120 CFS ON APR 16	0.60 CFS ON JAN 20	88800 AC-FT	1964
1965	3190 CFS AT 0230 CST ON JUL 22	2660 CFS ON APR 12	0.70 CFS ON MAR 6	189000 AC-FT	1965
1966	---	2740 CFS ON MAR 21	1.2 CFS ON DEC 10	212000 AC-FT	1966
1967	---	896 CFS ON APR 21	0 CFS ON SEP 9	87700 AC-FT	1967
1968	287 CFS AT 1210 CST ON SEP 14	285 CFS ON SEP 14	0 CFS ON FEB 18	50200 AC-FT	1968
1969	11500 CFS AT 1200 CST ON APR 22 *	11400 CFS ON APR 22 *	8.0 CFS ON APR 5	988000 AC-FT	1969
1970	5040 CFS AT 2207 CST ON APR 26	4590 CFS ON APR 26	16.8 CFS ON DEC 31	607000 AC-FT	1970
1971	2110 CFS AT 1315 CST ON APR 16	1790 CFS ON APR 16	12.4 CFS ON FEB 13	267000 AC-FT	1971
1972	3510 CFS AT 2400 CST ON APR 30	3510 CFS ON APR 30	18.0 CFS ON DEC 21	521000 AC-FT	1972
1973	419 CFS AT 1353 CST ON MAY 27	417 CFS ON MAY 27	14.3 CFS ON JAN 10	62500 AC-FT	1973
		* - EXTREME RECORDED FOR THE PERIOD OF RECORD		225000 AC-FT	MEAN

SOURIS RIVER NEAR MELITA - STATION NO. 05NF009

MONTHLY MEAN DISCHARGES AND MEAN DISCHARGES FOR MAR TO OCT IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1963	---	---	0.18	1.7	0.88	160	54.3	23.9	20.4	19.6	---	---	34.8	1963
1965	---	---	1.0	128	418	628	187	216	259	218	---	---	256	1965
1966	---	---	96.6	552	878	204	68.5	35.6	19.2	19.9	---	---	234	1966
1967	---	---	4.6	340	495	114	23.1	16.4	16.6	25.9	---	---	129	1967
1968	---	---	10.9	8.2	5.2	14.9	14.9	29.3	220	180	---	---	60.1	1968
1969	---	---	6.1	4900	4860	1800	529	523	43.6	30.6	---	---	1580	1969
1970	---	---	37.0	700	2290	2830	1300	361	8.1	14.3	---	---	940	1970
1971	---	---	55.2	801	1350	410	335	308	53.3	103	---	---	427	1971
1972	---	---	601	2740	1970	828	623	115	101	140	---	---	887	1972
1973	---	---	46.5	20.1	192	61.9	130	37.7	77.9	116	---	---	85.7	1973
MEAN	---	---	85.9	1020	1250	705	326	167	81.9	86.7	---	---	463	MEAN

LOCATION - LAT 49 10 20 N, LONG 101 01 48 W DRAINAGE AREA 19000 SQ MILES, REGULATED

SOURIS RIVER NEAR MELITA - STATION NO. 05NF009

EXTREMES OF DISCHARGE IN CFS AND TOTAL DISCHARGE IN AC-FT FOR MAR TO OCT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1963	---	472 CFS ON JUN 25	0 CFS ON MAR 1 *	16900 AC-FT	1963
1965	842 CFS AT 1730 CST ON JUN 26	836 CFS ON JUN 26	1.0 CFS ON MAR 1	124000 AC-FT	1965
1966	---	1080 CFS ON MAY 4	9.0 CFS ON OCT 31	114000 AC-FT	1966
1967	881 CFS AT 1830 CST ON APR 19	859 CFS ON APR 19	0 CFS ON MAR 1	62700 AC-FT	1967
1968	---	266 CFS ON SEP 9	0 CFS ON APR 22	29200 AC-FT	1968
1969	---	10800 CFS ON APR 17 *	1.0 CFS ON MAR 16	768000 AC-FT	1969
1970	3360 CFS AT 2351 CST ON JUN 7	3330 CFS ON JUN 5	0.29 CFS ON OCT 6	457000 AC-FT	1970
1971	---	1580 CFS ON MAY 6	37.3 CFS ON OCT 8	208000 AC-FT	1971
1972	3740 CFS AT 1707 CST ON APR 21 *	3670 CFS ON APR 21	50.0 CFS ON MAR 1	430000 AC-FT	1972
1973	418 CFS AT 0807 CST ON MAY 24	414 CFS ON MAY 24	16.5 CFS ON APR 17	81600 AC-FT	1973
	* - EXTREME RECORDED FOR THE PERIOD OF RECORD			225000 AC-FT	MEAN

SOURIS RIVER NEAR WESTHOPE - STATION NO. 05NF012

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1929	---	---	---	---	---	---	---	13.4	6.5	8.3	---	---	---	1929
1930	---	---	---	922	388	101	41.0	5.4	8.7	11.1	15.2	5.0	---	1930
1931	0.50	0.50	1.0	58.4	22.5	4.8	2.2	0	0	5.3	7.9	2.0	8.7	1931
1932	1.0	1.0	5.2	73.8	60.5	26.3	12.6	2.1	0	0	8.4	2.0	16.0	1932
1933	1.0	1.0	140	875	219	183	209	55.1	10.3	6.2	14.0	3.0	143	1933
1934	1.0	1.0	71.3	295	56.2	4.6	0.77	0	0	0	0	0	35.6	1934
1935	0	0	6.9	55.5	75.0	17.9	163	68.6	7.9	0.31	0	0	33.3	1935
1936	0	0	0	32.1	0.01	7.7	3.7	0	0	0	0	0	3.6	1936
1937	0	0	0	1.9	0	0	0	0	0	0	0	0	0.15	1937
1938	0	0	0.16	0.03	0	7.5	0.01	7.8	0.28	0	0	0	1.3	1938
1939	0	0	0.05	0.22	0.01	8.5	0	4.6	1.2	10.2	0	0	2.1	1939
1940	0	0	0	0.25	1.00	0.70	2.4	2.6	2.4	3.0	0.02	0	1.0	1940
1941	0	0	0	0.01	0.11	6.3	7.3	11.6	16.5	8.6	0.65	0	4.3	1941
1942	0	0	0.60	408	252	25.7	18.4	28.0	23.3	25.1	0.96	0	65.2	1942
1943	0	0	0.16	616	2110	1170	827	120	85.3	49.4	12.0	0.12	419	1943
1944	0.02	5.9	22.9	186	266	294	1290	123	343	94.2	67.2	141	238	1944
1945	117	72.0	157	754	168	26.2	19.1	89.0	18.2	18.8	0.67	0	120	1945
1946	0	0	2.0	321	24.3	19.2	15.7	20.7	63.7	12.1	0.52	0	39.6	1946
1947	0.28	1.0	1.0	1040	676	195	383	286	73.3	10.7	10.1	0.80	224	1947
1948	0.59	0.22	0.47	890	2190	1700	340	247	42.8	19.9	47.0	66.6	462	1948
1949	32.3	13.5	7.5	3220	1460	612	39.4	39.5	32.4	11.8	1.0	1.3	454	1949
1950	2.5	3.0	6.1	733	2070	1310	372	149	62.1	27.9	13.3	47.4	401	1950
1951	121	173	97.4	1840	2490	1520	241	26.6	145	73.0	65.3	162	580	1951
1952	39.4	27.8	119	784	540	9.8	93.9	76.1	13.7	3.4	24.6	42.5	148	1952
1953	16.8	13.7	24.9	184	471	795	1210	1010	144	155	176	105	363	1953
1954	140	135	152	347	238	789	1560	389	71.2	450	183	101	382	1954
1955	67.9	69.2	71.6	2110	2030	1500	621	281	122	132	7.3	2.8	585	1955
1956	12.6	15.0	52.6	1030	2380	1020	340	163	141	114	186	55.0	460	1956
1957	44.7	26.6	37.9	17.7	139	188	72.8	26.5	23.1	22.3	118	51.1	64.0	1957
1958	17.7	14.1	0.38	7.0	62.1	85.7	32.9	28.7	21.3	14.7	1.0	0.10	23.8	1958
1959	0.10	0.05	0.95	0.28	0.74	24.9	24.0	19.2	16.4	20.2	64.3	14.6	15.5	1959
1960	19.8	20.0	58.4	1630	843	453	20.7	13.7	33.0	23.6	5.1	2.1	259	1960
1961	0.07	0.51	5.4	5.3	10.3	20.7	19.2	10.7	9.7	11.1	3.4	1.0	8.2	1961
1962	0	0	0	1.9	4.9	4.8	6.5	10.4	10.4	17.0	0.35	0.10	4.7	1962
1963	0.10	0.10	0.27	0.10	0.39	161	43.2	21.7	20.3	23.1	1.4	0	22.6	1963
1964	0	0	0.12	0.39	142	44.0	105	17.0	99.4	82.7	0.21	0.10	41.2	1964
1965	0.08	0.10	0.12	14.9	359	622	167	232	268	204	70.6	48.3	166	1965
1966	48.5	41.3	106	473	773	174	71.9	39.2	22.5	22.1	6.9	0.12	149	1966
1967	0.05	0	0.25	335	473	91.1	25.7	22.6	17.7	25.2	1.4	0.07	83.1	1967
1968	0	0	0.20	0.37	5.7	24.3	19.7	22.1	198	120	31.3	22.5	37.0	1968
1969	13.1	3.8	6.1	3240	4530	1790	388	500	33.8	24.0	24.9	76.8	889	1969
1970	86.9	56.7	43.1	500	2340	2730	1190	317	20.1	20.0	11.8	3.3	612	1970
1971	30.3	57.1	59.2	704	1150	333	348	298	33.5	101	221	97.8	287	1971
1972	76.5	59.0	310	2380	1610	750	591	98.4	95.5	150	226	22.6	530	1972
1973	18.6	43.5	26.2	4.6	206	45.2	139	32.3	81.1	105	24.2	23.7	62.9	1973
MEAN	21.2	19.9	37.1	593	701	429	252	110	54.2	49.7	37.6	25.0	196	MEAN

LOCATION - LAT 48 59 47 N, LONG 100 57 29 W DRAINAGE AREA 17600 SQ MILES, REGULATED INTERNATIONAL GAUGING STATION

SOURIS RIVER NEAR WESTHOPE - STATION NO. 05NF012

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1929	---	---	---	---	1929
1930	---	---	---	---	1930
1931	---	118 CFS ON APR 6	0 CFS ON JUL 20	6320 AC-FT	1931
1932	---	148 CFS ON MAY 4	0 CFS ON AUG 17	11600 AC-FT	1932
1933	---	1130 CFS ON APR 17	1.0 CFS ON JAN 1	103000 AC-FT	1933
1934	---	524 CFS ON APR 7	0 CFS ON JUL 27	25800 AC-FT	1934
1935	---	279 CFS ON JUL 7	0 CFS ON JAN 1	24100 AC-FT	1935
1936	---	139 CFS ON APR 14	0 CFS ON JAN 1	2590 AC-FT	1936
1937	---	9.0 CFS ON APR 11	0 CFS ON JAN 1	110 AC-FT	1937
1938	51.0 CFS AT 1200 CST ON JUN 18	42.0 CFS ON JUN 18	0 CFS ON JAN 1	956 AC-FT	1938
1939	29.0 CFS ON OCT 23	27.0 CFS ON OCT 21	0 CFS ON JAN 1	1500 AC-FT	1939
1940	---	14.0 CFS ON OCT 13	0 CFS ON JAN 1	750 AC-FT	1940
1941	36.0 CFS AT 0600 CST ON JUN 12	25.0 CFS ON SEP 8	0 CFS ON JAN 1	3100 AC-FT	1941
1942	1100 CFS AT 1930 CST ON APR 21	1000 CFS ON APR 22	0 CFS ON JAN 1	47200 AC-FT	1942
1943	---	2240 CFS ON MAY 22	-35.0 CFS ON APR 8 •	303000 AC-FT	1943
1944	---	2000 CFS ON JUL 9	0 CFS ON JAN 6	173000 AC-FT	1944
1945	---	1040 CFS ON MAR 31	0 CFS ON NOV 16	86600 AC-FT	1945
1946	---	600 CFS ON APR 8	0 CFS ON JAN 1	28600 AC-FT	1946
1947	---	1800 CFS ON APR 19	0 CFS ON JAN 1	162000 AC-FT	1947
1948	---	2900 CFS ON APR 26	0 CFS ON JAN 17	336000 AC-FT	1948
1949	6400 CFS ON APR 18 •	6300 CFS ON APR 18 •	1.0 CFS ON NOV 1	329000 AC-FT	1949
1950	2650 CFS AT 2200 CST ON MAY 17	2630 CFS ON MAY 17	2.0 CFS ON JAN 1	290000 AC-FT	1950
1951	---	3100 CFS ON APR 29	1.9 CFS ON NOV 7	420000 AC-FT	1951
1952	---	1420 CFS ON APR 24	1.9 CFS ON OCT 31	107000 AC-FT	1952
1953	1550 CFS AT 1300 CST ON AUG 13	1540 CFS ON AUG 13	3.0 CFS ON SEP 18	262000 AC-FT	1953
1954	1780 CFS AT 1300 CST ON JUL 13	1760 CFS ON JUL 14	22.0 CFS ON SEP 21	277000 AC-FT	1954
1955	3500 CFS AT 2000 CST ON APR 14	3430 CFS ON APR 14	1.0 CFS ON DEC 6	424000 AC-FT	1955
1956	3040 CFS AT 2300 CST ON MAY 21	2930 CFS ON MAY 22	8.0 CFS ON JAN 1	335000 AC-FT	1956
1957	---	268 CFS ON JUN 14	3.5 CFS ON APR 21	46400 AC-FT	1957
1958	563 CFS AT 1500 CST ON MAY 12	202 CFS ON MAY 12	0 CFS ON MAR 6	17300 AC-FT	1958
1959	187 CFS ON JUN 3	187 CFS ON NOV 6	0.05 CFS ON FEB 1	11200 AC-FT	1959
1960	2120 CFS AT 0900 CST ON APR 23	2040 CFS ON APR 23	0 CFS ON DEC 26	188000 AC-FT	1960
1961	---	26.0 CFS ON JUN 2	0 CFS ON JAN 1	5910 AC-FT	1961
1962	208 CFS AT 1030 CST ON AUG 7	30.0 CFS ON OCT 17	0 CFS ON JAN 1	3430 AC-FT	1962
1963	600 CFS AT 1130 CST ON JUN 24	530 CFS ON JUN 23	0 CFS ON MAR 6	16300 AC-FT	1963
1964	---	518 CFS ON MAY 16	0 CFS ON JAN 1	29900 AC-FT	1964
1965	864 CFS AT 1700 CST ON JUN 28	850 CFS ON JUN 27	0 CFS ON JAN 11	120000 AC-FT	1965
1966	850 CFS AT 0300 CST ON MAY 2	846 CFS ON MAY 3	0.05 CFS ON DEC 17	108000 AC-FT	1966
1967	889 CFS AT 1900 CST ON APR 20	853 CFS ON APR 20	0 CFS ON FEB 1	60100 AC-FT	1967
1968	292 CFS AT 0900 CST ON SEP 9	277 CFS ON SEP 8	0 CFS ON JAN 1	26800 AC-FT	1968
1969	6300 CFS AT 1400 CST ON APR 22	6200 CFS ON APR 22	1.0 CFS ON MAR 16	644000 AC-FT	1969
1970	3120 CFS AT 0700 CST ON JUN 6	3110 CFS ON JUN 6	1.6 CFS ON DEC 1	443000 AC-FT	1970
1971	---	1340 CFS ON APR 30	1.7 CFS ON JAN 1	208000 AC-FT	1971
1972	3060 CFS ON APR 20	3050 CFS ON APR 17	18.0 CFS ON DEC 12	385000 AC-FT	1972
1973	444 CFS ON MAY 20	438 CFS ON MAY 20	0.40 CFS ON APR 4	45600 AC-FT	1973
				142000 AC-FT	MEAN

• - EXTREME RECORDED FOR THE PERIOD OF RECORD

APPENDIX II

List of field observations by the Wildlife Sector between Coulter and Wawanesa (July 1976).

Observation	Reach 1 Border-Melita	Reach 2 Melita-Hartney	Reach 3 Hartney-Souris	Reach 4 Souris-Elbow	Reach 5 Elbow-Assiniboine	Total
American beaver	6	5	0	4	0	15
Beaver lodges	13	21	1	16	4	55
Muskrat	3	10	1	1	2	17
American mink	0	6	4	2	0	12
White-tailed deer	2	5	4	1	0	12
Common snapping turtle	0	0	3	0	0	3
Western painted turtle	1	23	20	4	0	48
Mallard	105	549	37	134	21	846
Pintail	17	3	0	0	0	20
American Widgeon	16	0	0	0	0	16
Wood Duck	30	259	63	52	22	426
Canvasback	1	0	0	0	0	1
Redhead	1	0	0	0	0	1
Lesser Scaup	1	0	0	0	0	1
Gadwall	50	16	0	0	0	66
Blue-winged Teal	35	59	8	3	0	105
Northern Shoveler	8	0	5	0	0	13
Unidentified dabblers	44	16	2	3	0	65
Blue Goose	1	0	0	0	0	1
Great Blue Heron	39	133	30	58	32	292
Black-crowned Night Heron	17	42	0	2	0	61
American Coot	2	0	0	0	0	2
Double-crested Cormorant	1	9	0	0	0	10
American Bittern	0	3	0	0	0	3
Pied-billed Grebe	0	0	2	2	0	4
Great horned Owl	5	2	1	6	3	17
Barred Owl	0	0	1	0	0	1
Goshawk	0	0	0	1	0	1
Red-tailed Hawk	0	1	4	13	7	25
Marsh Hawk	0	1	0	2	0	3
Swainson's Hawk	0	1	1	1	0	3
Unidentified Hawks	0	1	1	2	0	4
Nighthawk	0	1	0	0	0	1
Coyote	0	0	0	1	1	2
Unidentified bats	0	2	0	0	0	2

APPENDIX III

The Canada Land Inventory (C.L.I.) classification system is based on two important considerations:

1. Capability ratings are established on the basis of the optimum vegetational stage (successional stage) that can be maintained when good wildlife management is practiced,
2. Capability ratings assigned do not reflect present land use (except in extreme cases such as heavily populated urban areas), ownership, lack of access, distance from cities, or amount of hunting pressure.

C.L.I. Land Capability for Wildlife (Ungulates)

Description of Classes:

Class 1 - Lands in this class have no significant limitations to the production of ungulates. Capability on these lands is high. They provide a wide variety and abundance of food plants and other habitat elements.

Class 1W -Lands in this special class are Class 1 areas that are winter ranges on which animals from surrounding areas depend.

Class 2 - Lands in this class have very slight limitations to the production of ungulates. Capability on these lands is high but less than Class 1. Slight limitations are due to climatic or other factors.

Class 2W - Lands in this special class are Class 2 areas that are winter ranges on which animals from surrounding areas depend.

Class 3 - Lands in this class have slight limitations to the production of ungulates. Capability on these lands is moderately high, but productivity may be reduced in some years. Slight limitations are due to characteristics of the land that affect the quality and quantity of habitat, or to climatic factors that limit the mobility of ungulates or the availability of food and cover.

Class 3W - Lands in this special class are Class 3 areas that are winter ranges on which animals from surrounding areas depend.

Class 4 - Lands in this class have moderate limitations to the production of ungulates. Capability on these lands is moderate. Limitations are similar to those in Class 3 but the degree is greater.

Class 5 - Lands in this class have moderately severe limitations to the production of ungulates. Capability on these lands is moderately low. Limitations are usually a combination of two or more of climate, soil moisture, fertility, depth to bedrock or other impervious layer, topography, flooding, exposure, and adverse soil characteristics.

Class 6 - Lands in this class have severe limitations to the production of ungulates. Capability on these lands is very low. Limitations are so severe that they are easily recognized; for example, soil depth may be negligible or climatic factors so extreme that ungulate populations are severely reduced.

Class 7 - Lands in this class have limitations so severe that there is no ungulate production.

C.L.I. Land Capability for Wildlife (Waterfowl)

Description of Classes:

Class 1 - Lands in this class have no significant limitations to the production of waterfowl. Capability on these lands is very high. They provide a wide variety and abundance of important habitat elements, rolling topography is well suited to the formation of wetlands. Predominent water areas on these lands are both shallow and deep permanent marshes, and deep-open water areas with well developed marsh edges.

Class 1S -Water areas in this special class are Class 1 areas that also serve as important migration stops.

Class 2 - Lands in this class have very slight limitations to the production of waterfowl. Capability on

these lands is high but less than Class 1. Slight limitations are due to climate, fertility, or permeability of the soils. Topography tends to be more undulating than rolling; a higher proportion of the water areas than in Class 1 are small temporary ponds or deep, open water areas with poorly developed marsh edges.

Class 2S - Water areas in this special class are Class 2 areas that also serve as important migration stops.

Class 3 - Lands in this class have slight limitations to the production of waterfowl. Capability on these lands is moderately high, but productivity may be reduced in some years because of occasional droughts. Slight limitations are due to climate or to characteristics of the land that affect the quality and quantity of habitat. These lands have a high proportion of both temporary and semi-permanent shallow marshes poorly interspersed with deep marshes and bodies of open water.

Class 3S - Water areas in this special class are Class 3 areas that also serve as important migration stops.

Class 3M - Lands in this special class may not be useful for waterfowl production, but are important as migration or wintering areas. This class has no subclasses.

Class 4 - Lands in this class have moderate limitations to the production of waterfowl. Capability on these lands is moderate. Limitations are similar to those in Class 3, but the degree is greater. Water areas are predominantly temporary ponds, or deep, open waters with poorly developed marsh edges or both.

Class 5 - Lands in this class have moderately severe limitations to the production of waterfowl. Capability on these lands is moderately low. Limitations are usually a combination of two or more of the following factors: climate, soil moisture, permeability, fertility, topography, salinity, flooding, and poor interspersion of water areas.

Class 6 - Lands in this class have severe limitations to the production of waterfowl. Capability on these lands is very low. Limitations are easily identified. They may include aridity, salinity, very flat topography, steep-sided lakes, extremely porous soils, and soils containing few available minerals.

Class 7 - Lands in this class have such severe limitations that almost no waterfowl are produced. Capability on these lands is negligible or nonexistent. Limitations are so severe that waterfowl production is precluded or nearly precluded.

APPENDIX IV

Bird List - Souris River Basin

LEGEND:

O - Observed occurrence
P - probable occurrence - greater than 50% probability
X - possible occurrence - less than 50% probability
M - on migration
B - substantiated breeding population
* - probable breeding population- greater than 50% probability
**- possible breeding population - less than 50% probability

Species	Occurrence	Breeding Status
Common Loon - Gavia immer	O	**
Western Grebe - Aechmophorus occidentalis	O	**
Red-necked Grebe - Podiceps grisegena	O	*
Horned Grebe - Podiceps auritus	O	*
Eared Grebe - Podiceps nigricollis	O	B
Pied-billed Grebe - Podilymbus podiceps	O	*
White Pelican - Pelecanus erythrorhynchos	O	*
Double-crested Cormorant - Phalacrocorax auritus	O	B
Whistling Swan - Olor columbianus	O (M)	
Canada Goose - Branta canadensis	O	B
White-fronted Goose - Anser albifrons	O (M)	
Blue Goose - Chen caerulescens	O (M)	
Snow Goose - Chen caerulescens	O (M)	
Ross' Goose - Chen rossii	X (M)	
Mallard - Anas platyrhynchos	O	B
Black Duck - Anas rubripes	O	
Pintail - Anas acuta	O	B
Gadwall - Anas strepera	O	B
American Widgeon - Anas americana	O	B
Northern Shoveler - Anas clypeata	O	B
Blue-winged Teal - Anas discors	O	B
Cinnamon Teal - Anas cyanoptera	O	B
Green-winged Teal - Anas crecca carolinensis	O	*
Wood Duck - Aix sponsa	O	B
Redhead - Aythya americana	O	B
Canvasback - Aythya valisineria	O	B
Ring-necked Duck - Aythya collaris	O	*
Greater Scaup - Aythya marila	O (M)	
Lesser Scaup - Aythya affinis	O	*
Common goldeneye - Bucephala clangula	O	*
Bufflehead - Bucephala albeola	O	*
Whitewinged Scoter - Melanitta deglandi	O	*
Ruddy Duck - Oxyura jamaicensis	O	B
Common Merganser - Mergus merganser	O	*
Red-breasted Merganser - Mergus serrator	O	B

Species	Occurrence	Breeding Status
Hooded Merganser - Lophodytes cucullatus	O	**
Turkey Vulture - Cathartes aura	O	
Rough-legged Hawk - Buteo lagopus	O (M)	
Ferruginous Hawk - Buteo regalis	O	**
Red-tailed Hawk - Buteo jamaicensis	O	B
Swainson's Hawk - Buteo swainsoni	O	B
Broad-winged Hawk - Buteo platypterus	O	*
Goshawk - Accipiter gentilis	O	*
Cooper's Hawk - Accipiter cooperii	O	*
Sharp-shinned Hawk - Accipiter striatus	O	*
Marsh Hawk - Circus cyaneus	O	B
Golden Eagle - Aquila chrysaetos	X (M)	
Osprey - Pandion haliaetus	O	**
Bald Eagle - Haliaeetus leucocephalus	O	**
Gyrfalcon - Falco rusticolus	O	
Prairie Falcon - Falco mexicanus	O	**
Peregrine Falcon - Falco peregrinus	O (M)	
Merlin - Falco columbarius	O	*
American Kestrel - Falco sparverius	O	B
Spruce Grouse - Canachites canadensis	X	
Ruffed Grouse - Bonasa umbellus	O	B
Sharp-tailed Grouse - Pedioecetes phasianellus	O	B
Greater Prairie Chicken - Tympanuchus cupido	O	
Ring-necked Pheasant - Phasianus colchicus	O	*
Hungarian Partridge - Perdix perdix	O	B
Common Egret - Casmerodius albus	O	B
Great Blue Heron - Ardea herodias	O	B
Black-crowned Night Heron - Nycticorax nycticorax	O	B
American Bittern - Botaurus lentiginosus	O	B
Least Bittern - Ixobrychus exilis	X	
Sandhill Crane - Grus canadensis	O (M)	
Virginia Rail - Rallus limicola	O	
Sora - Porzana carolina	O	B
Yellow Rail - Coturnicops noveboracensis	O	B
American Coot - Fulica americana	O	B
American Avocet - Recurvirostra americana	O	B
American Golden Plover - Pluvialis dominica	O (M)	
Black-bellied Plover - Pluvialis squatarola	O (M)	
Ruddy Turnstone - Arenaria interpres	O	
Piping Plover - Charadrius melodus	P	*
Killdeer - Charadrius vociferus	O	B
Semi-palmated Plover - Charadrius semipalmatus	O (M)	
Long-billed Curlew - Numenius americanus	P	*
Marbled Godwit - Limosa fedoa	O	*
Hudsonian Godwit - Limosa haemastica	O (M)	
Upland Sandpiper - Bartramia americana	O	*
Buff-breasted Sandpiper - Tryngites subruficollis	O (M)	
Solitary Sandpiper - Tringa solitaria	O (M)	
Spotted Sandpiper - Actitis macularia	O	*

Species	Occurrence	Breeding Status
Willet - Catoptrophorus semipalmatus	O	*
Greater Yellowlegs - Tringa melanoleuca	O	**
Lesser Yellowlegs - Tringa flavipes	O	**
Stilt Sandpiper - Micropalama himantopus	O (M)	
Knot - Caldris canulus	O	
Short-billed Dowitcher - Limnodromus griseus	O (M)	
Long-billed Dowitcher - Limnodromus scolopaceus	O (M)	
Pectoral Sandpiper - Calidris melanotos	O (M)	
Sanderling - Calidris alba	O (M)	
White-rumped Sandpiper - Calidris fuscicollis	X (M)	
Baird's Sandpiper - Calidris bairdii	O (M)	
Least Sandpiper - Calidris minutilla	O	*
Semipalmated Sandpiper - Calidris pusilla	O (M)	
Western Sandpiper - Calidris mauri	X (M)	
Wilson's Phalarope - Steganopus tricolor	O	B
Northern Phalarope - Lobipes lobatus	O (M)	
Common Snipe - Capella gallinago	O	B
Herring Gull - Larus argentatus	O	**
California Gull - Larus californicus	P	**
Ring-billed Gull - Larus delawarensis	O	B
Franklin's Gull - Larus pipixcan	O	B
Bonaparte's Bull - Larus philadelphia	O (M)	
Common Tern - Sterna hirundo	O	B
Forster's Tern - Sterna forsteri	O	B
Caspian Tern - Hydroprogne caspia	O (M)	
Black Tern - Chlidonias niger	O	B
Rock Dove - Columba livia	O	B
Mourning Dove - Zenaida macroura	O	B
Black-billed Cuckoo - Coccyzus erythropthalmus	O	B
Screech Owl - Otus asio	O	*
Great-horned Owl - Bubo virginianus	O	B
Long-eared Owl - Asio otus	O	*
Short-eared Owl - Asio flammeus	O	*
Snowy Owl - Nyctea scandiaca	O	
Hawk Owl - Surnia ulula	O	
Barred Owl - Strix varia	O	*
Great Gray Owl - Strix nebulosa	P	
Burrowing Owl - Speotyto cunicularia	O	*
Saw-whet Owl - Aegolius acadicus	O	*
Boreal Owl - Aegolius funereus	O	
Whip-poor-will - Caprimulgus vociferus	P	*
Common Nighthawk - Chordeiles minor	O	*
Chimney Swift - Chaetura pelagica	O	*
Ruby-throated Hummingbird - Archilochus colubris	O	*
Belted Kingfisher - Megaceryle alcyon	O	B
Common Flicker - Colaptes auratus	O	B
Pileated Woodpecker - Dryocopus pileatus	O	*
Red-headed Woodpecker - Melanerpes erythrocephalus	O	*
Yellow-bellied Sapsucker - Sphyrapicus varius	O	*

Species	Occurrence	Breeding Status
Hairy Woodpecker - Dendrocopos villosus	O	*
Downy Woodpecker - Dendrocopos pubescens	O	*
Black-backed Three-toed Woodpecker - Picoides articus	X	
Eastern Kingbird - Tyrannus tyrannus	O	B
Western Kingbird - Tyrannus verticalis	O	*
Great-crested Flycatcher - Myiarchus crinitus	O	*
Eastern Phoebe - Sayornis phoebe	O	B
Say's Phoebe - Sayornis saya	O	*
Yellow-bellied Flycatcher - Empidonax flaviventris	O	
Alder Flycatcher - Empidonax alnorum	O	*
Least Flycatcher - Empidonax minimus	O	B
Eastern Wood Pewee - Contopus virens	O	*
Western Wood Pewee - Contopus sordidulus	P	*
Olive-sided Flycatcher - Nuttallornis borealis	O	*
Horned Lark - Eremophila alpestris	O	*
Barn Swallow - Hirundo rustica	O	B
Cliff Swallow - Petrochelidon pyrrhonota	O	B
Tree Swallow - Iridoprocne bicolor	O	*
Bank Swallow - Riparia riparia	O	B
Rough-winged Swallow - Stelgidopteryx ruficollis	O	B
Purple Martin - Progne subis	O	*
Blue Jay - Cyanocitta cristata	O	*
Gray Jay - Perisoreus canadensis	O	
Black-billed Magpie - Pica pica	O	B
Common Raven - Corvus corax	O	
Common Crow - Corvus brachyrhynchos	O	B
Black-capped Chickadee - Parus atricapillus	O	B
Boreal Chickadee - Parus hudsonicus	P	**
White-breasted Nuthatch - Sitta carolinensis	O	*
Red-breasted Nuthatch - Sitta canadensis	O	*
Brown Creeper - Certhia familiaris	O	*
House Wren - Troglodytes aedon	O	*
Long-billed Marsh Wren - Telmatodytes palustris	O	B
Short-billed Marsh Wren - Cistothorus platensis	O	*
Gray Catbird - Dumetella carolinensis	O	*
Northern Mockingbird - Mimus polyglottos	O	
Brown Thrasher - Toxostoma rufum	O	*
American Robin - Turdus migratorius	O	B
Hermit Thrush - Catharus guttatus	O (M)	
Swainson's Thrush - Catharus ustulatus	X (M)	
Gray-cheeked Thrush - Catharus minimus	O (M)	
Veery - Catharus fuscescens	O	*
Eastern Bluebird - Sialia sialis	O	*
Mountain Bluebird - Sialia currucoides	O	*
Golden-crowned Kinglet - Regulus satrapa	O (M)	
Ruby-crowned Kinglet - Regulus calendula	O (M)	
Water Pipit - Anthus spinoletta	O (M)	
Sprague's Pipit - Anthus spragueii	O	*
Bohemian Waxwing - Bombycilla garrulus	O (M)	

Species	Occurrence	Breeding Status
Cedar Waxwing – Bombycilla cedrorum	O	*
Northern Shrike – Lanius excubitor	O (M)	
Loggerhead Shrike – Lanis ludovicianus	O	*
Starling – Sturnus vulgaris	O	B
Solitary Vireo – Vireo solitarius	P	*
Red-eyed Vireo – Vireo olivaceus	O	B
Philadelphia Vireo – Vireo philadelphicus	P	*
Warbling Vireo – Vireo gilvus	O	B
Black and white Warbler – Mniotilta varia	O	*
TennesseeWarbler – Vermivora peregrina	O	*
Orange-crowned Warbler – Vermivora celata	O	*
Nashville Warbler – Vermivora ruficapilla	O	*
Yellow Warbler – Dendroica petechia	O	B
Magnolia Warbler – Dendroica magnolia	O	*
Cape May Warbler – Dendroica tigrina	O (M)	
Yellow-rumped Warbler – Dendroica coronata	O	*
Black-throated Green Warbler – Dendroica virens	O (M)	
Blackburnian Warbler – Dendroica fusca	O (M)	
Chestnut-sided Warbler – Dendroica pensylvanica	O	*
Bay-breasted Warbler – Dendroica castanea	O	*
Blackpoll Warbler – Dendroica striata	O (M)	
Palm Warbler – Dendroica palmarum	O (M)	
Ovenbird – Seiurus aurocapillus	O	*
Northern Waterthrush – Seiurus noveboracensis	O (M)	
Pine Warbler – Dendroica pinus	P	**
Common Yellowthroat – Geothlypis trichas	O	B
Mourning Warbler – Oporornis philadelphia	O	*
Connecticut Warbler – Oporornis agilis	O	
Wilson's Warbler – Wilsonia pusilla	O (M)	
Canada Warbler – Wilsonia canadensis	O	
American Redstart – Setophaga ruticilla	O	*
House Sparrow – Passer domesticus	O	*
Bobolink – Dolichonyx oryzivorus	O	B
Western Meadowlark – Sturnella neglecta	O	*
Yellow-headed Blackbird – Xanthocephalus xanthocephalus	O	B
Red-winged Blackbird – Agelainus phoeniceus	O	B
Rusty Blackbird – Euphagus carolinus	O (M)	
Brewer's Blackbird – Euphagus cyanocephalus	O	*
Common Grackle – Quiscalus quiscala	O	*
Brown-headed Cowbird – Molothrus ater	O	*
Northern Oriole – Icterus galbula	O	B
Scarlet Tanager – Piranga olivacea	O	*
Rose-breasted Grosbeak – Pheucticus ludovicianus	O	*
Evening Grosbeak – Hesperiphona vespertina	O	
Purple Finch – Carpodacus purpureus	O	*
Pine Grosbeak – Pinicola enucleator	O	
Hoary Redpoll – Acanthis hornemanni	O (M)	
Common Redpoll – Acanthis flammea	O (M)	
Pine Siskin – Spinus pinus	O	*
American Goldfinch – Spinus tristis	O	*

Species	Occurrence	Breeding Status
Red Crossbill - Loxia curvirostra	O	
White-winged Crossbill - Loxia leucoptera	O	
Rufous-sided Towhee - Pipilo erythrophthalmus	O	*
Dickcissel - Spiza americana	P	*
Savannah Sparrow - Passerculus sandwichensis	O	B
Grasshopper Sparrow - Ammodramus savannarum	O	B
Baird's Sparrow - Ammordramus bairdii	O	*
Le Conte's Sparrow - Ammospiza leconteii	O	B
Sharp-tailed Sparrow - Ammospiza caudacuta	O	*
Lark Bunting - Calamospiza melanocorys	O	B
Vesper Sparrow - Pooecetes grammineus	O	B
Lark Sparrow - Chondestes grammacus	O	*
Dark-eyed Junco - Junco hyemalis	O (M)	
Tree Sparrow - Spizella arborea	O (M)	
Chipping Sparrow - Spizella passerina	O	*
Clay-colored Sparrow - Spizella pallida	O	*
Harris' Sparrow - Zonotrichia querula	O (M)	
White-crowned Sparrow - Zonotrichia leucophrys	O (M)	
White-throated Sparrow - Zonotrichia albicollis	O (M)	
Fox Sparrow - Passerella iliaca	O (M)	
Lincoln's Sparrow - Melospiza lincolnii	O(M)	
Swamp Sparrow - Melospiza georgiana	O	B
Song Sparrow - Melospiza melodia	O	B
McCown's Longspur - Calcarus mccownii	P	
Chestnut-collared Longspur - Calcarius ornatus	O	*
Lapland Longspur - Calcarius lapponicus	O (M)	
Smith's Longspur - Calcarius pictus	O (M)	
Snow Bunting - Plectrophenax nivalis	O(M)	

APPENDIX V

MAMMAL LIST - SOURIS RIVER BASIN

PROBABLE OCCURRENCE	SUBSTANTIATED OCCURRENCE
Masked shrew - Sorex cinereus	*
Water shrew - Sorex palustris	
Arctic shrew - Sorex arcticus	*
Pygmy shrew - Microsorex hoyi	*
Short-tailed shrew - Blarina brevicauda	*
Little brown myotis - Myotis lucifugus	
Keen's myotis - Myotis keenii	
Silver-haired bat - Lasionycteris noctivagans	
Big brown bat - Eptesicus fuscus	
Red bat - Lasiurus borealis	
Hoary bat - Lasiurus cinereus	
Eastern cottontail - Sylvilagus floridanus	*
Snowshoe hare - Lepus americanus	*
White-tailed jack rabbit - Lepus townsendii	*
Eastern chipmunk - Tamias striatus	
Least chipmunk - Eutamias minimus	*
Woodchuck - Marmota monax	*
Richardson's ground squirrel - Spermophilus richardsonii	*
Thirteen-lined ground squirrel - Spermophilus tridecemlineatus	*
Franklin's ground squirrel - Spermophilus franklinii	*
Gray squirrel - Sciurus carolinensis	*
Red squirrel - Tamiasciurus hudsonicus	*
Northern flying squirrel - Glaucomys sabrinus	
Northern pocket gopher - Thomomys talpoides	*
Olive-backed pocket mouse - Perognathus fasciatus	*
American beaver - Castor canadensis	*
Deer mouse - Peromyscus maniculatus	*
Northern grasshopper mouse - Onychomys leucogaster	*
Southern red-backed vole - Clethrionomys gapperi	*
Little upland vole - Pedomys ochrogaster	*
Muskrat - Ondatra zibethicus	*
Prairie vole - Microtus ochrogaster	*
Meadow vole - Microtus pennsylvanicus	*
Norway rat - Rattus norvegicus	
House mouse - Mus musculus	
Western jumping mouse - Zapus princeps	*

PROBABLE OCCURRENCE	SUBSTANTIATED OCCURRENCE
Meadow jumping mouse - Zapus hudsonius	*
American porcupine - Erethizon dorsatum	*
Coyote - Canis latrans	*
Red fox - Vulpes vulpes	*
Gray fox - Urocyon cinereoargenteus	*
Raccoon - Procyon lotor	*
Ermine - Mustela erminea	*
Long-tailed weasel - Mustela frenata	*
Least weasel - Mustela nivalis	*
American mink - Mustela vison	*
American badger - Taxidea taxus	*
Striped skunk - Mephitis mephitis	*
Mountain lion - Felis concolor	
Lynx - Felis lynx	
Bobcat - Felis rufus	
Mule deer - Odocoileus hemionus	*
White-tailed deer - Odocoileus virginianus	*
Moose - Alces alces	

APPENDIX VI

REPTILE AND AMPHIBIAN LIST -
SOURIS RIVER BASIN

PROBABLE OCCURRENCE	SUBSTANTIATED OCCURRENCE
Common snapping turtle - Chelydra serpentina serpentina	*
Western painted turtle - Chrysemys picta belli	*
Northern prairie skink - Eumeces septentrionalis septentrionalis	*
Northern red-bellied snake - Storeria occipitomaculata occipitomaculata	*
Red-sided garter snake - Thamnophis sirtalis parietalis	
Western plains garter snake - Thamnophis radix haydeni	*
Plains hognose snake - Heterodon nasicus	
Western smooth green snake - Opheodrys vernalis blanchardi	
Mudpuppy - Necturus maculosus maculosus	
Gray tiger salamander - Ambystoma tigrinum diaboli	*
Plains spadefoot - Scaphiopus bombifrons	*
Dakota toad - Bufo hemiophrys	
Great plains toad - Bufo cognatus	
Boreal chorus frog - Pseudacris triseriata maculata	
Northern leopard frog - Rana pipiens pipiens	*
Wood frog - Rana sylvatica	*