

WATER USES
IN THE
SASKATCHEWAN - NELSON BASIN
1951-1986

AUGUST 1990
PPWB REPORT NO. 108

TABLE OF CONTENTS

	<u>Page</u>
Table of Contents	i
List of Figures	iii
List of Tables	v
 <u>CHAPTERS</u>	
1 Introduction	1
2 Population Trends	5
3 Municipal and Industrial Water Use	21
4 Power Generation	33
5 Agriculture	41
6 Summary	53
 Appendix	 57

LIST OF FIGURES

<u>FIGURES</u>	Page
1 Population in the Saskatchewan-Nelson Basin and the Prairie Provinces	9
2 Population of the Prairie Provinces by Sub-Basin	14
3 Urban Population in the Saskatchewan-Nelson Basin and the Prairie Provinces	15
4 Rural Population in the Saskatchewan-Nelson Basin and the Prairie Provinces	16
5 Large Community Water Use	24
6 Large Community Water Use by Sub-Basin	25
7 Small Community Water Use	28
8 Industrial Water Use in the Prairie Province (Total Intake)	30
9 Electrical Energy Generation of Power Plants in the Prairie Provinces	36
10 Gross Water Use at Hydro Power Plants in the Sask.-Nelson Basin	38
11 Gross Water Use at Thermal Power Plants in the Sask.-Nelson Basin	39
12 Private and District Irrigation Water Use in the Prairie Provinces	45
13 Private and District Irrigation Water Use in Alberta	46
14 Private and District Irrigation Water Use in Saskatchewan	47
15 Irrigation Area in the Prairie Provinces	48

Water Demand Study Area

inside backcover

LIST OF TABLES

<u>TABLES</u>	Page
1 Total Prairie Region Population By Province and Basin, 1951-1986	10
2 Population Change By Province and Basin, 1976-1986	11
3 Population by Sub-Basin, 1951-1986	12
4 Population by Sub-Basin 1976-1986	13
5 Urban/Rural Population by Province and Basin, 1951-1986	17
6 Trends in Urbanization, 1951-1986	18
7 Urban/Rural Population by Sub-Basin and Province, 1951-1986	19
8 Urban/Rural Population by Sub-Basin and Province, 1976-1986	20
9 Large Community Water Use (Pumpage) by Sub-Basin	26
10 Water Use (Pumpage) in Small Serviced Communities and Unserviced Areas By Sub-Basin	29
11 Industrial Water Use by Sub-Basin 1986	31
12 Electric Energy Generation of Power Plants	37
13 Water Use at Power Plants	40
14 District Irrigation, Area and Net Water Use	49
15 Private Irrigation, Area and Gross Water Use	50
16 Water Use by Livestock	51

CHAPTER 1

INTRODUCTION

INTRODUCTION

The Prairie Provinces Water Board published the results of a study on the historic and current water uses in the Saskatchewan - Nelson Basin in 1982. This study provided detailed information on water used for municipal, industrial, agricultural and power generating purposes and instream requirements for recreation and fish and wildlife habitat. Information, including population trends, on the regional economic base was also included in the report. The report documented information for the period 1951 to 1978.

In 1987 the Board decided that the 1982 Water Demand Study should be updated to 1986. The results of that update are contained in this report. A map of the study area is located at the back of the report.

The reader should refer to the 1982 Water Demand Study report for a complete discussion of methodologies, assumptions and definitions used in the study.

In addition to this introductory chapter, this report consists of five other chapters: Population Trends; Municipal and Industrial Water Use; Power Generation; Agriculture; and Summary. Each chapter contains a summary of the highlights of the data. Several of the tables that were in the 1982 Water Demand Study have been updated and included in this summary report. Additional tables and figures have been included where it was deemed useful. Further information may also be obtained from the provincial and federal water management agencies listed in the appendix of this report.

CHAPTER 2

POPULATION TRENDS

POPULATION TRENDS

This chapter provides a summary of population changes from 1951 to 1986 and 1976 to 1986, the later representing the period since the publication of the PPWB Water Demand Study in 1982. Population trends have been divided into three categories: total population, basin population and urban/rural population.

A. Total Population (see Figure 1; Tables 1, and 2)

- Population of the three prairie provinces has increased 74% from 2.5 million in 1951 to 4.4 million in 1986
- Alberta has been and continues to be the largest and fastest growing prairie province with a population increase of over 150% since 1951.
- Since 1951 the Saskatchewan-Nelson River Basin has remained at about 92.5% of the total prairie population.
- Between 1976 and 1986 the population of both the prairie region and the Saskatchewan-Nelson Basin have increased by just over 17%.

B. Sub-Basin Population (see Figure 2; Tables 3 and 4)

- Between 1951 and 1986, the Nelson River and Bow River Basins have had the largest percentage gains with 367% and 310% respectively.
- The North Saskatchewan River Basin had the third largest percentage growth rate since 1951 with a population increase of 113%.
- Between 1951 and 1986, the largest decrease has been in the Old Wives Lake Basin which experienced a 25% decrease in population.
- Since 1976, the Bow River and Red Deer River Basins have increased 38% and 30% respectively. The Winnipeg River Basin with a decrease of 20% had the largest percentage population loss in this same period.

C. Urban/Rural Population (see Figure 3, and 4; Tables 2,5,6,7, and 8)

- "Urban" population includes all communities having a population of 1000 or more in any census year since 1951. The remaining population is "rural".

- The entire prairie region experienced a trend in urbanization between 1951 - 1986. The Prairie Region went from having 47% of the population living in urban centres in 1951 to 73% in 1986, a 55% increase.
- Saskatchewan had the greatest increase in urbanization since 1951 when the province had only 33% of its population living in towns and cities. By 1986, 62% of the provincial population lived in urban centres, an 88% increase.
- The Nelson River Basin had the largest percentage increase in urban population of all the sub-basins with 1700% gain from 1951 to 1986. However, in total numbers, urban population in this basin only increased from about 1000 in 1951 to 18 000 in 1986.
- Of the more developed basins, the Bow River Basin with an increase of 373% between 1951 and 1986 had the largest percentage growth in urban population.
- Since 1976, the Pembina River and Red Deer River Basins, with population growth rates of 100% and 59% respectively, have had the largest percentage increase of the sub-basins in the prairie region.

CHAPTER 3

MUNICIPAL AND INDUSTRIAL WATER USE

MUNICIPAL AND INDUSTRIAL WATER USE

This chapter summarizes municipal and industrial water use in the three prairie provinces between 1951 and 1986. Municipal water use which includes water supplied to industrial users through municipal supply systems is divided into two categories: large community use and small community use. A large community is defined as one with a water distribution system and having a population of at least 1000 sometime between 1951 and 1986. Industrial water use is also divided into two categories: private and municipal. Private industrial is defined as water used by all firms with private water supplies including distribution systems. Municipal or public industrial is water used by all firms that are supplied from a municipal source.

For purposes of this update it should be noted that:

- No attempt was made to obtain a breakdown of large community municipal water use into its various components (e.g. residential, industrial, commercial, and unaccounted for) as was done for the 1982 PPWB Water Demand Study.
- Small community water use includes centres having a population of under 1000 and a municipal water distribution system. Estimates of water use have been made where data was unavailable.
- Saskatchewan and Manitoba industrial water use data was obtained from the Environment Canada Industrial Water Use Survey. Data provided by Alberta Environment was used for Alberta's industrial water use figures.

A. Large Community Water Use (see Figure 5, and 6; Table 9)

- Total annual pumpage for all large communities increased from 171 753 dam³ in 1951 to 591 980 dam³ in 1986, an increase of 245%.
- Between 1951 and 1986, per capita water use increased 35% from 408 L/d to 552 L/d.
- Alberta continued to have the highest per capita use with 597 L/d compared to 539 L/d for Saskatchewan and 469 L/d for Manitoba.
- Saskatchewan's per capita water use has increased to 539 L/d, a 71% increase since 1951.

B. Small Community Water Use (see Figure 7; Table 10)

- Per capita consumption for the three provinces was 362 L/d in 1986 compared to 139 L/d in 1951, an increase of 160%.
- Alberta with a per capita use of 443 L/d was 23% higher than Saskatchewan and 76% higher than Manitoba.

C. Industrial Water Use (see Figure 8; Table 11)

- Industrial water use in Alberta decreased from 198 000 dam³ in 1976 to 184 000 dam³ in 1986.
- Saskatchewan's industrial water use has slightly decreased from 72 171 dam³ in 1976 to approximately 60 000 in 1986. Manitoba also experienced a small decrease in industrial water use for the same period, with water use going from 126 800 dam³ to 119 200 dam³.
- In 1976, 348 000 dam³ or 88% of total industrial water was supplied by private systems. Ten years later private systems with 324 000 dam³ still continued to provide about the same percentage (89%) of water used for industrial purpose.
- The North Saskatchewan River Basin with approximately 106 000 dam³ had the highest industrial water use of all river basins. This basin accounted for 29% of the reported industrial water use in 1986.

CHAPTER 4

POWER GENERATION

POWER GENERATION

This chapter summarizes power generation water uses for the period 1951 - 1986. Water use in thermal electric plants includes boiler feed and coolant. Another use, although it is indirect, is forced evaporation. Estimates of forced evaporation for 1981 and 1986 were unavailable for this update.

A. Electrical Energy Generation (see Figure 9; Table 12)

- Generating capability in the Saskatchewan-Nelson Basin has increased over 1500% since 1951 when there was 3941 Gigawatt-hours (G.H.) of energy produced in 26 power plants. In 1986, 65 854 G.H. were produced in 40 plants.
- Hydro power since 1951 increased from 2997 G.H. to 30 386 G.H. in 1986. Most of this increase has been in Manitoba where 23 765 G.H. or 78% of the total hydro power is generated.
- Thermal power production is highest in Alberta where 31 336 G.H. of energy were produced in 1986.

B. Water Use (see Figure 10, and 11; Table 13)

- while water used to generate hydro power was significantly higher in 1986 (260 000 dam³) than in 1951 (92 000 dam³), it is less than in 1976 (295 000 dam³).
- gross water used in Alberta for thermal power has increased from 106 000 dam³ in 1951 to 1 142 000 dam³ in 1986, a 977% increase.
- Manitoba continues to dominate water used for hydro production. In 1986, Manitoba used over 212 million dam³ or 82% of the water used for hydro production in the prairies.

CHAPTER 5

AGRICULTURE

AGRICULTURE

This chapter summarizes irrigation water uses for the periods 1951 to 1986. Irrigation water use is separated into two parts: irrigation in organized districts using a common water supply is referred to as district irrigation; and irrigation using privately developed supplies is referred to as private irrigation. Water use for livestock is also provided.

A. District Irrigation (see Figures 12, 13, 14 and 15; Table 14)

- Total amount of land being irrigated in district irrigation projects has increased from 115 905 ha. in 1951 to 447 307 ha. in 1986, an increase 285%. For the same period water used for district irrigation increased 1533% to 1 907 368 dam³.
- Alberta with 424 000 ha. had 95% of the district irrigation land in 1986.
- Saskatchewan's district irrigation has increased from 75 ha. in 1951 to 23 317 ha. in 1986.
- Since 1976, Saskatchewan's district irrigation area has increased by 63% while Alberta's irrigation has increased by 32%.
- Since 1976, water use in Alberta and Saskatchewan for district irrigation has increased 116%.
- Manitoba has no district irrigation.

B. Private Irrigation (see Figures 12, 13, 14 and 15; Table 15)

- Lands under private irrigation totalled 177 487 ha. in 1986. This represented an increase of 125% since 1978 and 782% since 1951.
- Water use for private irrigation increased 72% since 1978 to 548 942 dam³.
- Saskatchewan and Alberta have about the same amount of land under private irrigation, 83 122 ha. and 82 224 ha. respectively.
- Total private irrigation in Manitoba was estimated to be just over 12 000 ha. in 1986.

C. Livestock Water Use (Tables 16 and 17)

- In 1986, the North Saskatchewan River Basin had the most livestock in all categories except sheep where the Oldman Basin had the largest population.
- Water use for livestock continues to be by far the greatest in the North Saskatchewan River with 29% of the total livestock water use in 1986.
- Water use in the Saskatchewan-Nelson Basin has increased from 105 892 dam³ in 1951 to 200 078 dam³ in 1986; an increase of 89%.

CHAPTER 6

SUMMARY

SUMMARY

The 1982 PPWB Water Demand Study which contained water use information to 1978 and regional economic data to 1976 has been updated to 1986. The update was restricted to major water use and population parameters which were easily obtainable.

Population in the prairies was found to have increased 74% since 1951 and 17% during the 10 year period since the 1976 census. Water use, however, has grown at an even faster rate. Since 1951 total municipal use has increased 224%, water use for district and private irrigation 1533% and 540% respectively, and hydro power water use 183%. As expected, there were significant regional variations in the growth rates of both population and water use.

APPENDIX

SOURCES OF ADDITIONAL WATER USE INFORMATION

INFORMATION SOURCES FOR WATER USE DATA

Additional information on provincial water use data can be obtained at the addresses shown below:

1. Resource Management Division
Saskatchewan Water Corporation
3rd Floor, Victoria Place
111 Fairford Street E.
Moose Jaw, Saskatchewan
S6H 7X9

2. Water Control & Conservation
Water Resources Branch
Manitoba Department of
Natural Resources
1577 Dublin Avenue, Dublin Bldg.
Winnipeg, Manitoba
R3E 3J5

3. Planning Division
Alberta Environment
9th Floor, Oxbridge Place
9820 - 106th Street
Edmonton, Alberta
T5K 2J6

Information on industrial water use, population and related statistics may be obtained from:

Socio-Economics Division
Water Planning & Management Branch
Inland Waters Directorate
Environment Canada
9th Floor, Place Vincent Massey
351 St. Joseph Blvd.
Ottawa, Ontario K1A 0H3