PRAIRIE PROVINCES WATER BOARD

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Battle River
At Saskatchewan – Alberta Boundary
Natural Flow Update
1980 To 2004

Prepared for
PPWB Committee on Hydrology
by the Saskatchewan Watershed Authority

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Operations Division

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Recommended By: Committee on Hydrology

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Executive Summary

Alberta Environment, in 1982, under contract with PPWB, prepared a report entitled Battle River at Alberta-Saskatchewan Boundary Natural Flow. The study estimated the Battle River mean monthly natural flow at the Alberta-Saskatchewan boundary for the period 1912 to 1979.

In October 2004, the PPWB Committee on Hydrology (COH) noted significant water use changes in the Battle River Basin since 1982 and recommended the natural flow study be updated to 2004. The Saskatchewan Watershed Authority (Authority) agreed to complete the study under contract with the PPWB.

The average annual natural flow of the Battle River at the Alberta-Saskatchewan boundary from 1980 to 2004 was 224,234 dam^3. Average annual water use was 29,778 dam^3 or 13% of the average annual natural flow. The inter-provincial apportionment agreement obligates Alberta to pass 50% of the Battle River annual natural flow volume to Saskatchewan. From 1980 to 2004 Alberta passed on average 87% of the natural flow to Saskatchewan or 82,339 dam^3 more than required by the apportionment agreement. The estimated consumptive uses in the Alberta portion of the Battle River Basin did not exceed Alberta's 50% share of the Battle River natural flow from 1980 to 2004.

Within the last five years from 2000 to 2004, the average annual surplus passed to Saskatchewan dropped to 23,537 dam^3. The minimum occurred in 2002 when Alberta passed 54% of the natural flow into Saskatchewan.

It should be noted that there was a significant reduction in the annual water use for the Battle River in Alberta in 2004. In order to assess the future risk of potential shortfalls in the delivery of the Saskatchewan entitlements, the 5-year average use (2000 to 2004) was applied to the historical natural flow calculations (1980-2004). The assessment indicates that Alberta would not have met its apportionment obligations in only one year and that the shortfall would have been relatively minor.

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1.0 Introduction

1.1. Study Purpose

The objective of this study is to determine the Battle River natural flow at the Saskatchewan-Alberta border from 1980 to 2004 and the current level of water use in Alberta. This will assist the Prairie Provinces Water Board (PPWB) in assessing if apportionment monitoring is required for the Battle River at the Saskatchewan-Alberta border.

1.2. Background

The Battle River Basin, shown in Figure 1.1, is situated in east-central Alberta and west-central Saskatchewan. The Battle River headwater originates at Battle and Pigeon Lakes in central Alberta and flows in an easterly direction for about 800 km before crossing into Saskatchewan. The Battle River at the Saskatchewan-Alberta boundary has a Gross Drainage Area (GDA) of 25,100 km^2 and an Effective Drainage Area (EDA) of 9,900 km^2. In Saskatchewan, the Battle River flows another 240 km to its confluence with the North Saskatchewan River near Battleford.

The headwaters of the Battle River Basin lie within the eastern limits of the Western Alberta Plains, approximately 160 km east of the Rocky Mountains. From Battle Lake, the river flows in a south-east direction meandering 100 km within a low well-defined valley. At Ponoka, the river flows east for 48 km into a low flat area near Samson Lake. Passing through Samson Lake, the river continues north through 64 km of gradually steepening valley as it approaches its confluence with Pipestone Creek.

Downstream of Pipestone Creek, the river flows through a larger more rugged valley carved by the outflow from glacial Lake Edmonton during the last glaciation some 10,000 years ago. The Battle River continues to flow through this larger valley in an easterly direction through the Eastern Alberta Plains and into Saskatchewan. The downstream reaches are characterized by gently undulating terrain with surficial deposits of till and moraine formations.

Water supply within the Battle River is partially controlled by three reservoirs located within the Basin; Coal Lake, Driedmeat Lake and Alberta Power Reservoir. Coal Lake, located on Pipestone Creek, is occasionally operated for low flow augmentation. Releases from Coal Lake were recorded from 1982 to 1983 and in 2004. Riparian flow downstream of Driedmeat Lake is provided by a 2-metre wide fish ladder. The Alberta Power Reservoir is used to provide cooling water for a thermal electric generating station and passes water out of the reservoir by means of a syphon fitted with various size orifice plates. All three structures have substantial spillways for the passage of larger flows.

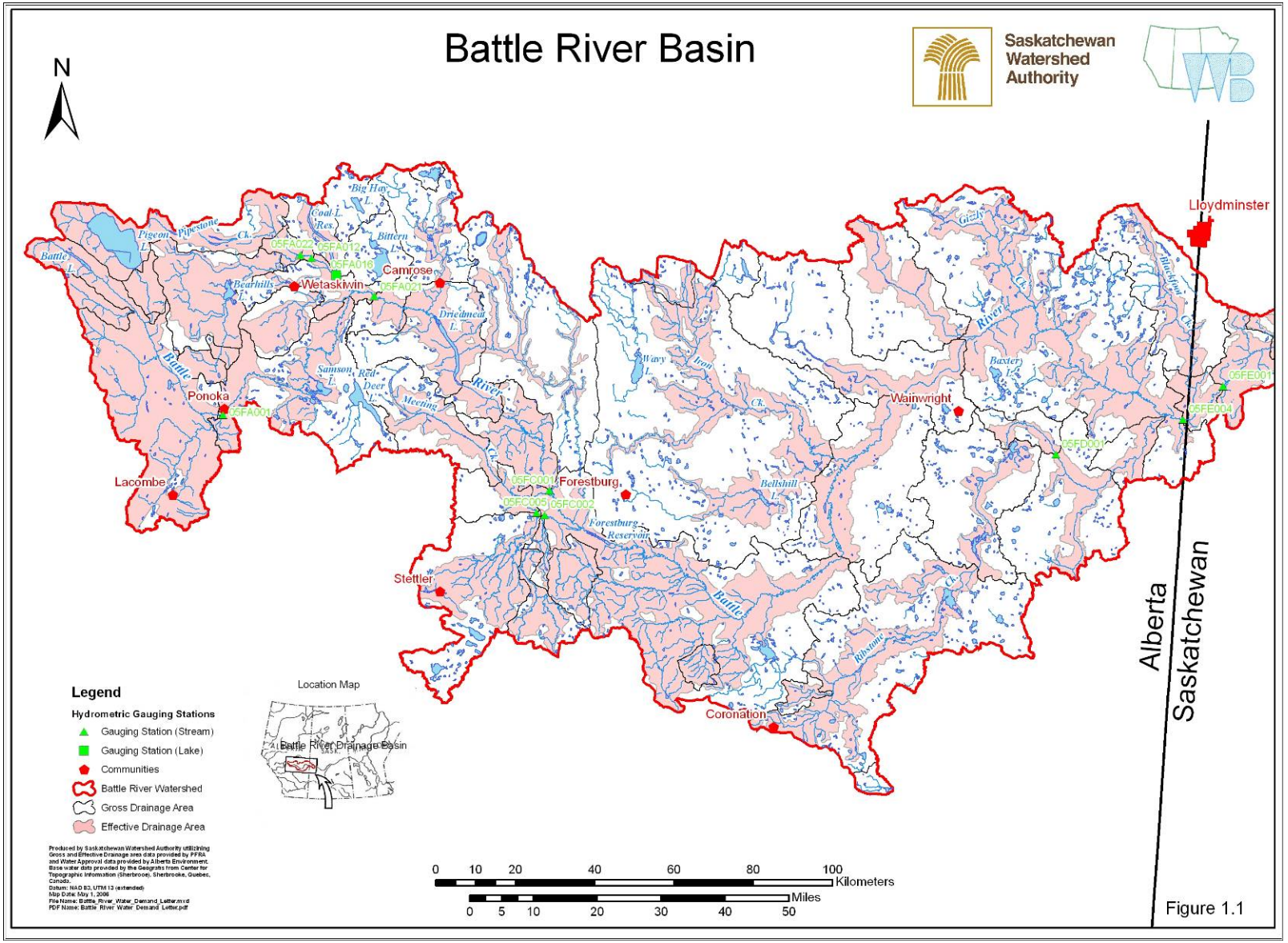


Figure 1.1: Battle River Basin

1.3. Previous Studies

In 1982, the Hydrology Branch, Alberta Environment (AENV) developed monthly natural flow estimates for the 1912 to 1979 period at nine locations in the Battle River Basin[1]. The study was conducted for the Prairie Provinces Water Board (PPWB). In 1986 AENV updated the natural flow estimates to include the 1979 to 1983 period using the same methodology as in the 1982 study[2]. Both studies naturalized flows using project depletions within the Battle River EDA.

In 2003, MPE Engineering were contracted by AENV to update the Battle River natural flows to include the 1984 to 2001 period. The objective was to extend the monthly natural flow database to 2001 in a manner consistent with the methodology used in the AENV 1986 study. A notable exception was that MPE Engineering included all surface water projects within the Battle River Basin GDA to naturalize flows. This would have resulted in conservatively higher natural flow and consumptive use estimates at the Saskatchewan-Alberta boundary relative to the methodology used by AENV in the two previous studies.

1.4. Study Objectives

This study updates the Battle River natural flow estimates to include the 1980 to 2004 period in a fashion that is consistent with the 1982 study. This will enable the PPWB to assess the available annual flow for the Battle River as it relates to the 1969 inter-provincial water sharing agreement. Natural flow is that quantity of water that would have been recorded under natural conditions prior to the impacts of human interference.

The analysis methodology is as follows:

i. Determine the historical level of monthly water use within the Alberta portion of the Battle River Basin EDA.

ii. Determine the monthly natural flows from 1980 to 2004 for the Battle River at the Saskatchewan-Alberta border by adding item i) to the recorded flows.

iii. Subtract the current (2004) level of water use within item i) from ii) to determine if any apportionment deficits would have occurred during the 1980 to 2004 period for the current level of use.

The Battle River apportionment requirement is outlined in the 1969 Master Agreement on Apportionment. Schedule A of the agreement states "Alberta shall permit a quantity of water equal to one-half of the natural flow of each watercourse to flow into the province of Saskatchewan, and the actual flow shall be adjusted from time to time on an equitable basis during each calendar year".

[1] Figliuzzi, S.; River at Alberta – Saskatchewan Boundary Natural Flow, Prairie Provinces Water Board (PPWB), June 1982

[2] DeBoer, A.;, Battle River Basin Historical Natural Flows 1912 to 1983, Alberta Environment, January, 1986.

Recorded monthly flows were available at the Saskatchewan-Alberta boundary for the 1980 to 2004 study period at hydrometric station 05FE004, Battle River near the Saskatchewan Boundary. Before natural flows at the Saskatchewan-Alberta boundary could be developed, natural flows had to be computed for hydrometric stations Battle River near Ponoka (05FA001), Pipestone Creek near Wetaskiwin (05FA012), and Ribstone Creek near Edgerton (05FD001). Additional gauged and project locations used to assess basin water demands and natural flows at the Saskatchewan-Alberta border are shown in Table 1.1.

Table 1.1: Battle River Gauged and Project Sites

Description	Station	Drainage Area (km^2)		Type	Status	Records	
Gauged Sites		**Effective**	**Gross**			**From**	**To**
Battle R. near Ponoka	05FA001	1550	1820	Natural	Active	1913	2004
Battle R. below Pipestone Cr.	05FA021	2870	4550	Natural	Discontinued	1978	1978
Battle R. near Forestburg	05FC001	3610	7670	Regulated	Active	1966	2004
Battle R. near the Sask Boundary	05FE004	9860	25100	Regulated	Active	1978	2004
Coal Lake Reservoir near Wetaskiwan	05FA016	816	1240	Regulated	Active	1973	2004
Pipestone Cr. below Bigstone Cr.	05FA022	724	1020	Natural	Discontinued	1979	1990
Pipestone Cr. near Wetaskiwan	05FA012	733	1030		Active	1972	2004
Ribstone Cr. near Edgerton	05FD001	987	2790	Regulated	Active	1924	2004
Project Sites							
Pipestone Cr. at Coal Lake		751	1064				
Coal Lake Natural Outlet		65	176				
Atco Power Reservoir on the Battle River		n/a	n/a				

2.0 Water Use

Historical basin water use is defined as the monthly flow adjustments which must be added to the recorded flows at a gauging station in order to reconstruct the monthly natural flows at that site.

The Battle River supplies a diversity of licensed water users. Many users withdraw water from or discharge water to areas which, during a year of average flow, do not contribute flow to the Battle River. In this regard, a basin water use has been defined as consisting solely of licensed and/or authorized projects which are located within the EDA of the basin, and which consume or modify the flow which would have been experienced in the Battle River. While it is realized that drainage projects, land use changes, unlicensed withdrawals and withdrawals from non-effective drainage areas may have some modifying effects on flows in the Battle River, it was assumed that these effects will be negligible.

In order to create a table of historical basin water uses it was necessary to identify the following items:

a) Which projects constitute a water use?
b) What is the quantity of water being used by each project?
c) What was the period of operation for each project?
d) What is the time distribution of water diversions?
e) How are time of travel adjustments to be taken into account?

Only licensed allocations within the Alberta portion of the Battle River EDA were evaluated. The surface water projects dataset was provided by Alberta Environment (AENV) in spreadsheet format. The dataset lists 996 water projects in the Battle River Basin GDA.

Within the list provided by AENV licence locations are referenced using the Dominion Land Survey (DLS) system. The location of each licence was mapped in ArcGIS based on the quarter section centroid using a DLS to latitude and longitude look-up table developed by Prairie Farm Rehabilitation Administration (PFRA). ArcGIS was then used to geo-reference licence locations into gross and effective drainage areas.

Of the 996 surface water projects listed in the dataset, 575 mapped within the EDA and 206 mapped within the GDA but outside the EDA. Of the remaining projects, 182 were projects that had no diversion quantity listed and were not considered further. Another 17 projects mapped outside the Battle River Basin and 15 projects were duplicate entries representing changes in conditions to an existing licence. One project had no land location and could not be used in this study.

The ArcGIS mapping results are tabled in Appendix A, Table A1. The project demands are mapped in Appendix K. AENV licensed surface water right allocations are presented in Appendix A, Table A3. Surface water project licenses with more than one listings in the dataset are presented in Appendix A, Table A4. A project use had only one project licence for the natural flow calculation.

Of the 182 projects licensed with no quantity, 177 were for flood control and have no consumptive use. Refer to Section 2.1.8. The 5 remaining projects licensed with no quantity are listed in Appendix A, Table A10.

Surface water allocations are licensed for a maximum quantity of annual diversion (allocation) and a maximum rate of diversion. Other information on each licence includes an estimated consumption, loss and return flow. The allocated quantity is the maximum allowed gross diversion, which includes the total consumption, loss and return flow. However, during any specific year a licensee may use all or part of the allocation, depending on operations and climate conditions. Water use is the actual quantity of water consumed by a licence in a specific year. Water use represents the actual water diverted and not returned to the Battle River system or the net depletion from the system. Water use may also be estimated as the actual quantity diverted less the return flow.

As the actual water use has not been recorded, the quantity of use was estimated for the following categories:

1. Minor licensed allocations located within the Battle River Basin EDA upstream of the Saskatchewan-Alberta border;
2. Reservoirs with regulated outflow that would normally contribute to the Battle River main stem (evaporation and storage losses) and
3. Municipal water use.

2.1. Minor Licensed Allocations

There are 575 minor licensed allocations within the Alberta portion of the Battle River Basin EDA. In the 1982 PPWB study each licensed allocation was designated as having a "purpose", which identified the activity associated with each allocation and which was used to evaluate the quantity and the temporal distribution of the water use. The recent list of licensed allocations provided by AENV indicates a "Specific Activity". The "Specific Activity" is a further subdivision of the "Purpose" used in the 1982 PPWB Study. The current specific categories, the equivalent purpose designation used in the 1982 PPWB study and industry activity are listed in Table 2.1. Over the years, the specific purpose terminology has changed. Appendix A, Table A2 relates the current specific purpose categories with terminology used in past studies.

Table 2.1: Project Licence Specific Categories

Number	Description	2004 Specific	1982 Purpose	Industry Activity
1	Aggregate Washing	AGGWSH	Wash	Commercial
2	Construction	CNSTRCT		Commercial
3	Cooling	COOLING	COOL, PROC	Commercial
4	Cooperative	COOPD		Municipal
5	Crop	CROP	AGR	Irrigation
6	Feedlot	FEEDLT		Agricultural
7	Fish Management	FISHERY	F.P.	Fish Management
8	Flood Control	FLOODCNT	F.C.	Dewatering
9	Gardening	GRDN		Commercial
10	Golf Courses	GLFCRS		Commercial
11	Oilfield Injection	INJECTN	INJ, MISC	Industrial
12	Other	OTHR		Commercial
13	Parks	PRK		Commercial
14	Recreation	RCRTN	REC	Recreation
15	Snow/Ice Making	SNOW/ICE		Commercial
16	Stabilization	STBLZTN	WF. PR.	Water Management
17	Stockwatering	STCKWT	STOCK	Agricultural
18	Urban	URBAN	MUN	Municipal
19	Wetlands	WTLNDS	DU	Habitat Enhancement
20	Wildlife	SRWILD		Wildlife Management

The procedure used to estimate actual water use within each specified activity are based on the assumptions in the 1982 PPWB report unless otherwise noted. A description of the assumed quantity temporal distribution of water use for each specified activity is summarized below.

2.1.1. Aggregate Washing

Aggregate Washing consumptive uses assumed at 30% of the licensed allocation. The 30% consumptive use was assumed equally distributed from May to October.

2.1.2. Construction

There is one licensed allocation to a construction project in the Battle River Basin EDA. This project is a sand and gravel operation (Approval ID 184773). Consumptive use for this project was assumed at 30% of the licensed quantity, similar to Aggregate Washing.

2.1.3. Cooling

Cooling identifies water diverted out of the Atco Power Reservoir by Atco Power to cool their thermal electric power facility. This project has three licenses having a total allocation of 691,737 dam^3, which represents 94% of the 738,286 dam^3 licensed allocations in the Battle River Basin. However, as the licensed allocation is for the total water entering the plant, most of which is recirculated through the reservoir, the total Atco Power licensed consumption and losses are estimated at 432 dam^3 and 13,309 dam^3 respectively. Atco Power's actual water use, taken as the sum of the consumption and loss, is 13,741 dam^3, or about 2% (13,741 dam^3 / 691,737 dam^3) of the licensed allocation. Atco Power uses are presented in Section 2.2.1.

2.1.4. Cooperatives

Cooperatives represent a municipal use for farmsteads, single-multi homes and colonies. Cooperative uses were included in the municipal use estimates in Section 2.3.

2.1.5. Crop

The mean annual irrigation requirement for Crop is 600 mm (24 inches) distributed from May to September as shown in Table 2.2.

Table 2.2: Monthly Irrigation Crop Requirement

Month	Duty	Percent
May	66 mm	11%
June	156 mm	26%
July	192 mm	32%
August	126 mm	21%
Sept	60 mm	10%
Total	600 mm	100%

Diversion and consumptive use for irrigation was assumed to occur during months for which the crop requirements exceeded the monthly precipitation. The quantity diverted each month equals the irrigated area multiplied by the difference between the crop requirement and precipitation. Since information on crop type is unavailable, the use is calculated the same for each crop licence. The estimated monthly crop use is represented by the following equation:

Eq. No. 1 $\sum_{m=1}^{12} Um = \left((Dm\text{-}Pm) \geq 0\right) A \bullet 10$	Where: U_m – Estimated Monthly Use (m^3) D_m – Monthly duty (mm) P_m – Monthly recorded precipitation (mm) A – Irrigable Area (ha)

Monthly precipitation for areas upstream of Forestburg were assumed equal the monthly precipitation at Wetaskiwin while monthly precipitation for Stettler was assumed representative of areas downstream of Forestburg.

Uses for Crop licenses with no irrigable area, shown in Table 2.3, were calculated using the following equation:

Eq. No. 2	Where:
$\sum_{m=1}^{12} U_m = Q \bullet M\% \left[\frac{(D_m - P_m) \geq 0}{D_m} \right]$	U_m – Estimated Monthly Use (m^3) Q – Annual Licensed Quantity (m^3) M% - Monthly Quantity expressed as a percent of Q (Refer to Table 2.2) D_m – Monthly duty (mm) P_m – Recorded monthly precipitation (mm)

Table 2.3: Licensed Irrigation Projects (CROP) with no Irrigable Area

Approval ID	File No.	Priority	Specific	Quantity (m^3)	Consumption (m^3)	Losses (m^3)	Return Flow (m^3)	Irrigated Area (ha)
74160	74160	1999-05-25	CROP	3000	3000	0	0	0
74160	74160.01	1999-05-25	CROP	3000	3000	0	0	0
76717	76717	1999-06-21	CROP	12000	11000	1000	0	0
193274	193274	1984-01-10	CROP	37000	37000	0	0	0
195751	195751	1987-02-24	CROP	18500	18500	0	0	0
195755	195755	1987-02-24	CROP	12340	12340	0	0	0

2.1.6. Feedlot

Feedlot uses were assumed similar to stock watering. Water uses for the two feedlot licences within the Battle River EDA were assumed at 100% of the licensed allocation with the full quantity being diverted and lost from the system during the month of April.

2.1.7. Fish Management

The licensed quantity is assumed diverted and held in dead storage in the first year of operation during the spring runoff. In subsequent years, only annual net evaporation losses are replenished. The annual net evaporation loss is the licensed quantity prorated by the annual net evaporation up to a maximum 305 mm. The formulae used to calculate Fish Management uses is shown in Table 2.4.

Monthly net evaporation for areas upstream of Forestburg was assumed equal to monthly net evaporation for Wetaskiwin while monthly net evaporation for Stettler was assumed representative of areas downstream of Forestburg.

Table 2.4: Pond Monthly Use Equations

First Year	Total Use withdrawn in April: $U = Q$
Thereafter	Total Use withdrawn in April: $U = L \bullet \frac{[E \le 305]}{305}$
E – Annual net evaporation (mm) L – Estimated annual loss listed in project licence (m^3) Q – Licensed quantity (m^3) U – Annual use volume (m^3) 305 – Estimated annual pond net evaporation used in 1982 PPWB study (mm)	

2.1.8. Flood Control

In previous studies, consumptive uses for this category were assumed negligible since losses were essentially the same as for normal river flow. There are 177 licensed flood control projects in the Battle River Basin assumed to have no consumptive use.

2.1.9. Gardening

Gardening includes market gardens, greenhouses, sod and tree farm commercial ventures. There are four Gardening projects within the Battle River EDA as shown in Table 2.5. Three of the Gardening projects withdraw water from reservoirs located adjacent to tributary streams. Gardening use was assumed to be similar to stock watering with the annual quantity withdrawn in April and then held in storage.

Table 2.5: Gardening Project Licenses

Apv Id	Txt File No.	Specific	Source	Priority	Quantity (m^3)	Cons (m^3)	Losses (m^3)	Return (m^3)	Irr Area (ha)	Capacity at FSL (dam^3)
00136070	00078268	GRDN	Wolf Cr.	19991022002	1300	1000	300	0	0	
00023969	27315	GRDN	Lake	19950609001	2460	2460	0	0	0	2.71
00022462	48929	GRDN	Brook	19960130002	5970	4310	1660	0	0	4.31
00026496	25026	GRDN	Creek	19900115005	7400	7400	0	0	9.19	2.1

2.1.10. Golf Courses

Golf course uses match irrigation practices with the bulk of the water taken during the summer depending on the amount of natural precipitation[3]. The maximum annual irrigation requirement for Golf Courses was assumed 600 mm (24 inches). The Golf Course licence does not specify an irrigable area. Golf Course uses were assumed similar to Crop and were calculated using Equation No. 2 in Section 2.1.5.

2.1.11. Oilfield Injection

Water use for oilfield injection projects were computed on the basis of monthly water use returns submitted by the licensee to the Energy Resources Conservation Board and filed in the Oil and Gas Water Use Drainage Area Codes (OGWU DAC).

Nine licensed surface water allocations for injection projects were identified within the Battle River EDA as shown in Appendix A, Table A8. A review of the file reveals that:

- Approval ID 189216, although located within the Battle River EDA, uses water from the North Saskatchewan River and is not included.
- Approval ID's 36515 and 37819 are not for oilfield injection and so were removed from consideration in this category.
- Approval ID 31721 was issued in late 1988 and expired January 1, 1991, with no recorded usage, so was deleted from further consideration.
- There was no recorded usage data available for approval ID 40031 so this project was removed from further consideration.
- Data from Approval ID's 37170, 37171 and 37172 were reported in aggregate and are from the same source, so the data are presented as one licence.

This leaves a total of 5 Approval IDs, the data of which are presented in Table 2.6.

Watrecon Consulting previously provided recorded annual withdrawals for 6 of the injection projects licensed to take water from the Battle River EDA. Projects were referenced by land location rather than Approval ID. In order to determine an Approval ID for each recorded use, the land locations were used to cross-reference the surface water projects dataset as shown in Appendix A, Table A9.

The Watrecon report indicates 2004 recorded injection withdrawals were only 2% of the licensed allocation. Therefore, the actual consumption is considerably less than the licensed quantity. As a result consumptive uses for Oilfield Injection is based on recorded uses and not the licensed quantity.

Most injection projects have access to a year round water supply. Withdrawals were distributed equally throughout the year as assumed in the 2003 MPE Engineering Battle River natural flow study update.

[3] Watrecon, *Battle River Basin Water Use Assessment and Projections* (2005). p. 88.

Table 2.6: Oilfield Injection Recorded Consumptive Uses (m^3)

Approval ID's	37936	31722	37170 37171 37172	Total Consumption (m^3)	Ratio of Consumption to Allocation (%)
Priority Date	1965-11-22	1979-11-16	1969-08-19		
Group	3	4	7		
YEAR	Consumption (m^3)	Consumption (m^3)	Consumption (m^3)		
1980	353825	0	1059250	1413075	20.7
1981	184696	301541	551293	1037530	15.2
1982	93658	630281	514038	1237976	18.1
1983	48831	593524	447358	1089713	16.0
1984	0	364765	500028	864793	12.7
1985	0	286911	430477	717387	10.5
1986	0	573669	199939	773608	11.3
1987	0	591073	154523	745596	10.9
1988	0	768661	169307	937968	13.7
1989	0	1237524	158511	1396035	20.5
1990	0	676823	141097	817920	12.0
1991	0	622780	127209	749989	11.0
1992	0	694296	130922	825218	12.1
1993	0	849809	59311	909120	13.3
1994	0	917055	0	917055	13.4
1995	0	745674	3510	749184	11.0
1996	0	496144	17891	514035	7.5
1997	0	229716	14199	243915	3.6
1998	0	303868	0	303868	4.5
1999	0	699021	0	699021	10.2
2000	0	910956	0	910956	13.3
2001	0	641608	0	641608	9.4
2002	0	555315	0	555315	8.1
2003	0	565440	0	565440	8.3
2004	0	152793	0	152793	2.2
Allocation (m^3)	616,740	1,275,420	4,933,930	6,826,090	

Note:

- Approval ID 31722: withdrawals began in 1981.
- Approval ID 37936: withdrawals ended in 1983.
- Approval IDs 37170-37172: withdrawals ended in 1997. Because withdrawal records were not found for 1994, consumption is assumed to be zero.

2.1.12. Other

Other represents a commercial activity which includes abattoirs, dust control, bridge washing and hydroseeding. Water use within this specific activity are assumed to be the licensed quantity less the return flow indicated in the licence with the use being equally distributed from May to October inclusive.

2.1.13. Park

The annual irrigation requirement for Park was assumed 600 mm (24 inches). The Park licence includes an irrigable area. Park uses were assumed similar to the Crop calculated using Equation No. 1 in Section 2.1.5.

2.1.14. Recreation

Recreation includes fairgrounds, entertainment centres, sporting complexes, halls, zoos, restaurants, cafes, clubhouses and stables. The Watrecon report indicates seasonal water use for recreation would match irrigation practices with the bulk of the water used during the summer depending on the amounts of natural precipitation. The annual irrigation requirement for Recreation was assumed 600 mm (24 inches). As the Recreation licenses do not specify an irrigable area water uses were assumed similar to Crop and were calculated using Equation No. 2 in Section 2.1.5.

2.1.15. Snow/Ice Making

The one Snow/Ice Making project licence in the Battle River Basin EDA diverts water from the Battle River in winter to make snow. In the spring the melt water returns back into the main stem. The return flow is taken as the licensed quantity less loss estimated at 1,000 m^3. The licensed 51,000 m^3 diversion is equally distributed from November to February with a 98% return flow (50,000 m^3) in April. The water use is based on the information provided in the project licence.

2.1.16. Stabilization

Stabilization projects are primarily licensed to Ducks Unlimited Canada and are essentially the same projects which were categorized as Wildfowl Propagation in the 1982 report. Stabilization uses are estimated as the licensed annual allocation diverted and lost from the system during the month of April.

2.1.17. Stock Watering

Stock Watering use was assumed to be 100% of the licensed allocation with the entire quantity being diverted and effectively lost from the system during the month of April.

2.1.18. Urban

Urban uses were included in the municipal use estimates in Section 2.3.

2.1.19. Wetlands

Wetlands comprise largely of Ducks Unlimited Canada back flood irrigation projects located within the Ribstone Creek Basin. Individual project uses were unavailable. General operation consists of storing water during the spring runoff from March to April and then releasing all the storage in June less net evaporation and infiltration losses. The number of structures operated during any one year is not constant but rather, is directly related to the spring runoff during that year.

Wetland projects uses are assumed to divert 50% of their licensed quantity in March, 50% in April, with 100% return flow in June less evaporation and infiltration losses.

Wetland evaporation and infiltration losses were estimated at 654 dam^3 (530 ac.ft) in the 1982 PPWB study; however the losses were not included as a use. The 2003 MPE Engineering study assumed the same use as in the 1982 PPWB study but includes March, April and May net evaporation loss plus 150 mm infiltration (irrigation) taken over 75% of the flooded area at the Full Supply Level (FSL)[4]. The 75% factor was intended to account for the reduced surface area as the water level dropped. The method used by MPE Engineering was adopted for the current study.

The surface water licence dataset provided by AENV lists the wetland FSL storage volume but not the FSL area required to calculate the evaporation loss over 75% of the FSL flooded area. The Upper Assiniboine River Basin Study Main Report documents a relationship between wetland storage volume and surface area[5] as shown in Appendix I, Figure I1. From this relationship, the Wetland FSL area may be estimated using the equations in Table 2.7.

The wetland FSL storage volume, required to estimate the pond evaporation, was not listed for several projects. A correlation was developed between the wetland licence quantity and FSL storage volume shown in Appendix I, Figure I2. The licensed and estimated wetland project FSL storage volume and FSL area are tabled in Appendix I, Table I1. From this data, pond evaporation was calculated.

[4] MPE Engineering Ltd, Alberta Environment Battle River Basin in Alberta Extension of Historical Natural Flow Database 1984 to 2001, October 2003

[5] Environment Canada, Sask Water and Manitoba Conservation, Upper Assiniboine River Basin Study Main Report. November 2000. http://www.swa.ca/publications/documents/uarb_report.pdf

Table 2.7: Pond Monthly Use Equations

Area if FSL Volume is less than 50 dam^3	$A = \left[\frac{V}{2.85}\right]^{0.81967}$
Area if FSL Volume is greater than 50 dam^3	$A = \frac{V - 9.97}{7.1}$
A – FSL Pond Area (ha) V – FSL Pond Volume (dam^3)	

2.1.20. Wildlife Storage Reservoirs

There is one Wildlife Storage project (Approval ID 146266) listed in the surface water licence dataset provided by AENV. Water uses for Wildlife Storage are estimated as the licensed quantity less return flow estimated in the approval. Water uses are assumed to be diverted and lost from the system during the month of April.

2.2. Regulated Lake and Reservoir Evaporation and Storage Losses

Driedmeat and Ribstone Lakes lie on the main stems of the Battle River and Ribstone Creek and have outlet controls. Driedmeat Lake has a controlled outlet comprised of a steel sheet-pile weir with a fixed elevation of 684.58 m and a stop log fish ladder allowing the elevation to be lowered to 682.75 m[6]. The weir was licensed in 1980 (Approval ID 42285) for lake stabilization and to provide a stable water supply for the City of Camrose. In past studies, it was assumed that water use and the outlet have not significantly changed from natural conditions[7].
Ribstone Lake on Ribstone Creek has an outlet control box weir with 2 – 1400 mm CSPs and stop log bay. The structure is licensed for flood control by AENV and is assumed to have no consumptive uses.

Pigeon Lake discharges into the Battle River. While the outlet from Pigeon Lake has a control, the structure is only used to increase outflow during the period of high lake levels. Furthermore, as the control structure has not had any noticible impact on the surface area of the lake and therefore evaporation losses, the effect of this operation on natural flow is deemed to be minor and has not been considered in previous studies[8].

[6] Alberta Environment (AENV), Red Deer Region, Fax Transmittal
[7] MPE Engineering Limited (MPE),"Driedmeat Lake Reservoir", p 18
[8] MPE, "Accuracy of Natural Flow Estimates", p 24

Evaporation and storage losses were considered for the Atco Power Reservoir and Coal Lake. The procedures used to estimate these water uses are described in Sections 2.2.1 and 2.2.2 respectively.

2.2.1. Atco Power Reservoir Cooling

The Atco Power Reservoir is located on the Battle River near the Town of Forestburg as shown in Figure 2.1. The Atco Power Reservoir is also known as the Battle River Reservoir by Atco Power and as the Forestburg Reservoir in the Watrecon report.

Figure 2.1: Atco Power (Forestburg) Reservoir

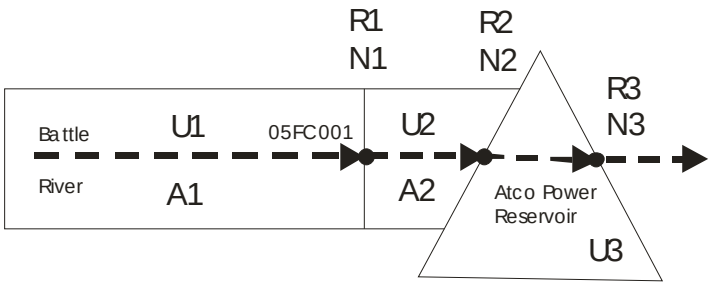
Water use by Atco Power Reservoir (U) is estimated as the inflow (I) less discharge (D) shown in Equation No. 1, Table 2.8 and is represented by R2-R3 in the schematic in Figure 2.2. Atco Power use may also be derived from the continuity equation as the change in storage (ΔS) plus loss due to forced and natural evaporation (E) shown in Equation No. 2.

Table 2.8: Atco Power Reservoir Uses

$U = I - D$ Eq. 1 $\Delta S = I - O$ $O = E + S + C + D$ $E = En + Ei + Ec$ $D = Dw + Ds$ $\Delta S = I - [E + D]$ $I - D = \Delta S + E$ $\therefore U = \Delta S + E$ Eq. 2	Where: U - Use I - Inflow D - Discharge Dw - Weir Discharge Ds - Syphon Discharge ΔS - Change in Storage O - Outflow E - Evaporation Loss E_n - Natural Evaporation E_i - Induced Evaporation Ec - Cooling Tower Evaporation S - Seepage Loss (assumed 0) C - Plant Consumption (assumed 0)

The equation used depends on the quantity and quality of available data which includes:

1. Atco Power Reservoir monthly discharge and inflow (1984 to 2004)
2. Atco Power Reservoir monthly forced and cooling tower evaporation estimates (1984 to 2004)
3. Estimated rates and quantities diverted from the Battle River Reservoir (1984 to 2004)
4. Atco Power Reservoir daily water levels (1980 to 2004)
5. Precipitation data for Forestburg Plant Site (Climate Station 3012652) from 1980 to 2004
6. Morton's Monthly Gross Evaporation for Lacombe (1980 to 2001)
7. Myers Monthly Gross Evaporation for Red Deer (2002 to 2004)



U - Sub-Basin Water Demands
A - Sub-basin Area
R - Recorded Flow
N - Natural Flow (total)

$N2 = N1 \times (A1 + A2) / A1$
$R2 = R1 \times (A1 + A2) / A1$
$U3 = R2 - R3$

Figure 2.2: Atco Power Total Use Estimate Schematic

Atco Power have expressed concerns regarding the accuracy of their forced evaporation estimates in which case Equation No. 1 would be preferred. However, there is a discrepancy with the recorded discharge (R3) outlined in Appendices H7-H8. Therefore, it was assumed that Equation No. 2 would provide the best estimate of Atco Power uses from 1980 to 2004.

Morton gross evaporation data for Lacombe from 1980 to 2001 was obtained from the AENV[9] and MPE Engineering[10] reports. Monthly net natural evaporation was developed by applying recorded precipitation at the Forestburg Plant Site to the Morton's gross evaporation.

As Morton estimates of evaporation were not available for the 2002 to 2004 period, Meyer monthly gross evaporation data was used to estimate gross evaporation. Refer to Section 3.0 for the Meyer and Morton gross evaporation correlation.

Atco Power Reservoir recorded water levels, combined with the elevation-storage table in Appendix H, Table H1, were used to compute the change in storage volume for each month. The monthly net natural evaporation loss was applied 50% at the start of the month and 50% at the end of the month. Monthly net natural evaporation for the Atco Power Reservoir is summarized in Appendix H, Tables H2 and H3.

The forced and cooling tower evaporation estimates, provided by Atco Power, were added to the change in storage and net natural evaporation estimates. Missing forced evaporation data from 1980 to 1983 was filled using the monthly median from 1984 to 2004. Atco Power forced and cooling tower evaporation estimates are summarized in Appendix H, Table H4. The monthly

[9] AENV, *Battle River Basin Historical Natural Flows 1912 to 1983*, 1986. Table B-1
[10] MPE Engineering Ltd., *Alberta Environment Battle River Basin in Alberta Extension of Historical Natural Flow Database 1984 to 2001*, 2003. Table C-3.

change in reservoir storage volume is summarized in Appendix H, Table H5. Total Atco Power Reservoir estimated uses are presented in Appendix H, Table H6.

2.2.2. Coal Lake

Pipestone Creek flows into Coal Lake as shown in Figure 2.3. The flow in Pipestone Creek is impacted by the Coal Lake control structure.

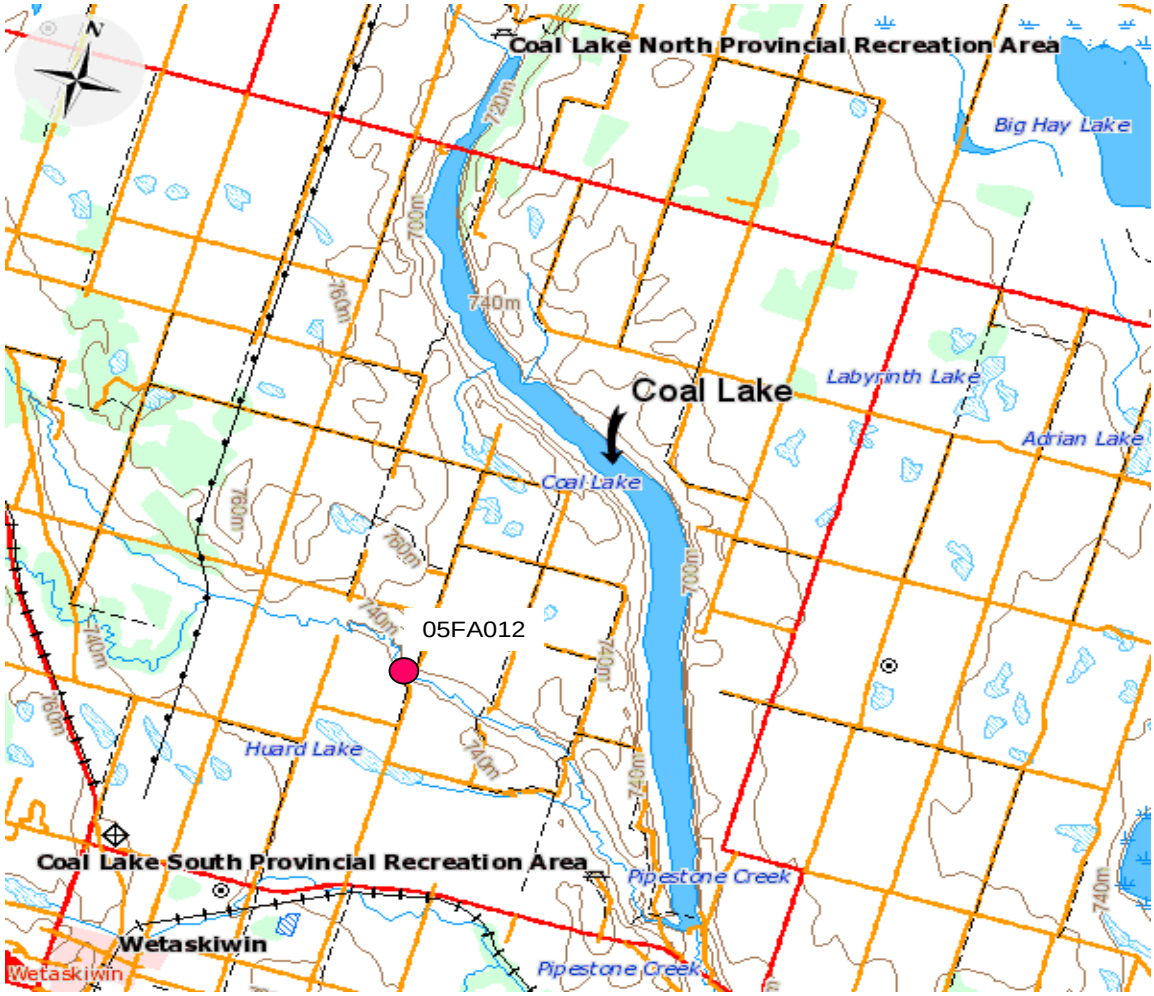


Figure 2.3: Pipestone Creek at Coal Lake

In the 1982 PPWB study, consumptive uses for Coal Lake Reservoir were assumed equal to the recorded flows for Pipestone Creek near Wetaskiwin (05FA012) adjusted by the ratio of effective drainage area of Pipestone Creek at its confluence with Coal Lake minus releases from Coal Lake. The drainage area ratio did not include Coal Lake local inflow which prior to the

construction of the Coal Lake control structure, did not contribute flow to the Battle River main stem[11].

Coal Lake uses out of Pipestone Creek (U3), which include the Wetaskiwin urban water supply and Coal Lake net evaporation, equals the recorded inflow (R2) less the recorded outflow (R3) as shown by the schematic diagram in Figure 2.4. Alternatively, the Pipestone Creek total uses at Coal Lake outlet (U1+U2+U3) could be determined by extending the Pipestone Creek near Wetaskiwin (05FA012) natural flow to Coal Lake and then subtracting the calculated outflow such that U1+U2+U3 = N2-R3. The latter method was adopted to calculate total Pipestone Creek uses at Coal Lake.

The Coal Lake natural inflow (N2) was estimated by extending the naturalized flow at Pipestone Creek near Wetaskiwin (05JA012) to Coal Lake using the effective drainage area ratio of the two locations.

Coal Lake daily recorded water levels were provided from 1980 to 2004. Missing data was filled by interpolating between daily recorded values. The daily discharge was interpolated from the stage discharge table in Appendix G, Table G3. The Coal Lake monthly mean outflow was calculated from the daily discharge estimates.

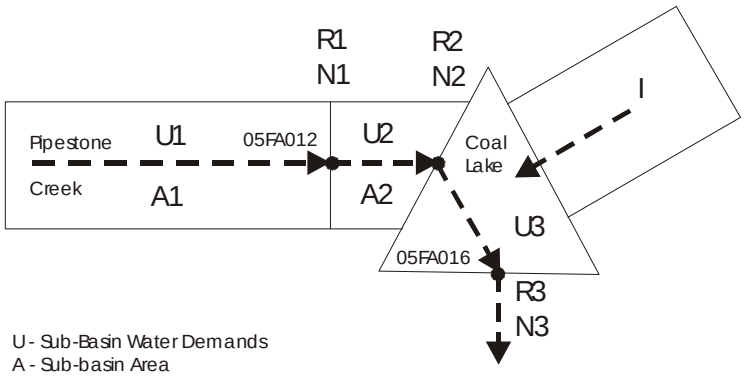


Figure 2.4: Coal Lake Total Use Estimate Schematic

[11] PPWB, "Calculation of Uses", p 24-25

There have been two controlled releases out of Coal Lake during the study period. The first was a 150-day 0.28 m^3/s (10 cfs) release from October 1982 to February 1983 totalling 3670 dam^3 (2975 ac.ft). The second was a 4500 dam^3 (3648 ac.ft) release to augment low water levels in the Atco Power Reservoir which occurred from July to August 2004. The Coal Lake discharge is presented in Appendix G, Table G5. Pipestone Creek total uses at Coal Lake (U1+U2+U3) is presented in Appendix G, Table G6.

2.3. Municipal Water Use

The Urban and Cooperative specifics were combined into a single municipal use. Municipal use is the water diverted but not returned to the Battle River main stem and is calculated as the total diversion less the return flow or the sum of the consumption and loss. Municipal use may be derived from recorded data, the Approval ID or a combination of both.

Municipal uses and return flows were considered for communities within the Battle River Basin EDA and communities within the GDA that withdraw water from the Battle River main stem such as CFB Wainwright.

The Watrecon report on water use in the Battle River Basin concluded that municipal withdrawals were considerably less than the licensed quantity[12]. Recorded withdrawals would provide a more realistic estimate of the historic natural flows. Recorded municipal uses were obtained whenever possible. Sources include the Watrecon report for 2004 data, AENV Red Deer and by contacting urban communities directly. AENV identified 11 communities with a significant return flow. These communities are listed in Item No. 8, Appendix F, Figure F1.

The communities identified in the Watreon report[13] and listed in Appendix F, Table F1 were mapped into EDA and GDA locations. The community latitude and longitude were obtained using Google Earth and georeferenced in ArcInfo. Urban surface water licensed volumes within the Battle River Basin EDA are tabled in Appendix F, Table F2. The licence dataset lists the water source for the Town of Stettler as the Battle River, however, the town draws water from the Red Deer River and supplies water to the communities of Botha and Gadsby.

2.3.1. Town of Wainwright and CFB Wainwright

CFB Wainwright supplies treated water to the Town of Wainwright. Water is diverted from the Battle River. The raw water storage at Wainwright is filled from the Battle River from May through October[14] and water is drawn from storage for treatment on a monthly basis as required. The Watrecon report indicates Wainwright return flows exceed diversions[15]. As a result, only the recorded uses, or the water not returned to the Battle River, were considered. Annual uses were applied during the diversion period from May through October.

[12] Watrecon, Summary, pg. 38.
[13] Watrecon, Water Licence Information, Table 3.3, pg. 31-32.
[14] Watrecon, Water Use Estimates, pg 36.
[15] Watrecon, Water Use Estimates, pg 35.

Recorded daily uses were provided by CFB Wainwright from 1999 to 2004. The average recorded total water use from 1999 to 2004 for CFB Wainwright and the Town of Wainwright was 83% of the licensed consumption and loss shown in Appendix F, Tables F18 and F19. Water uses from 1980 to 1998 were assumed to be 83% of the Approval ID licensed consumption and loss.

2.3.2. City of Camrose

Camrose has three Urban and one COOPD licence. The City of Camrose provided monthly recorded diversions from 1987 to 2004. Diversions from 1980 to 1986 were filled in using the recorded monthly average flow.

The City of Camrose reported returning more water than they withdrew[16]. Alternatively MPE Engineering assumed Camrose return flows were 80% of the withdrawal distributed equally from May to October[17]. The Approval ID ratio of total return flow to allocation for the three surface water licenses for the City of Camrose is 78% as shown in Appendix F, Table F4. Lacking other data it is assumed that the City of Camrose return flow is 78% of the diversion equally distributed from May to October as assumed by MPE Engineering. Uses for the City of Camrose are summarized in Appendix F, Table F5.

2.3.3. City of Wetaskiwin

City of Wetaskiwin urban withdrawals were included with the total uses for Coal Lake computed as the inflow from Pipestone Creek less the reservoir outflow. Recorded return flows for Wetaskiwin were provided by the City of Wetaskiwin from 1983 to 1987, 1989 to 1993 and 1995. Return flows from 1980 to 1982, 1988 and from 1996 to 2004 were filled using the recorded monthly mean. The city of Wetaskiwin returns flow continuously throughout the year. Estimated return flows were applied using the same monthly distribution as the recorded values. The recorded and estimated return flow volumes are summarized in Appendix F, Table F20. The monthly return flows, represented as a negative use, are summarized in Appendix F, Table F21.

2.3.4. Town of Stettler

Town of Stettler has a 1,700 dam^3 inter-basin surface water licence from the Red Deer River. Stettler supplies water to the communities of Gadsby and Botha. Stettler reportedly withdraws 1,008 dam^3 from the Red Deer River with 800 dam^3 returned to the Stettler wetlands[18].

AENV reports Stettler annually withdraws 1,110,134 m^3 (900 ac/ft) from the Red Deer River with an estimated 616,741 m^3 (500 ac/ft) return flow back into the Battle River [19]. The AENV

[16] Watrecon, Water Licence Information, pg. 35-36.
[17] MPE, Urban Water Supply, pg. 17.
[18] Watrecon, Water Licence Information, pg. 37.
[19] AENV, E-mail, Douglas Thrussell to Terry Chamulak, February 9, 2006.

estimate was used to determine the Stettler return flow. Although some losses may be attributed to the Stettler wetland it was assumed that 100% of return flow which enters the Stettler wetland is returned back into the Battle River. Return flows only occurred in April and October and the return flow volumes were equally distributed between April and October. Stettler return flows are summarized in Appendix F, Table F17.

2.3.5. Small Urban Surface Water Supply

There were five smaller communities within the Battle River Basin EDA that diverted water from the Battle River main stem. Surface water was supplied to the communities of Alliance, Castor, and Ferintosh, and the Lacombe County and Spady cooperatives. Alliance and Ferintosh switched to groundwater in 2002 and 2000 respectively as shown in Appendix F, Table F2. The Town of Castor had the most complete set of recorded withdrawals.

Recorded diversions for the Town of Castor were used to estimate the withdrawals for the other four communities. Monthly diversions were recorded from 1980 to 1982, 1984 to 1992 and 2001 to 2004. Missing data for the Town of Castor was filled using the average recorded monthly withdrawals.

Recorded diversions for the Town of Castor averaged 62% of the licensed quantity as shown in Appendix F, Table F7. It was assumed that surface water diversions for small communities were 62% of licensed quantity with the same monthly distribution as the Town of Castor.

AENV identified several communities with a significant return flow that would have a high likelihood of being recorded at a Water Survey Canada (WSC) gauging station on the Battle River as shown in Item No. 8, Appendix F, Figure F1. The list includes communities with both surface and groundwater supply. Castor was the only community on the list with a surface water supply that had a significant return flow.

The Town of Castor reported return flow exceeds withdrawals. The same observation was made for other communities in the Battle River Basin[20]. As a result the return flow was estimated using a ratio of the Approval ID return flow to licensed quantity.

The Approval ID licensed return flow for the Town of Castor is 166,520 m^3 which is 68% of the 246,690 m^3 licensed quantity as shown in Appendix F, Table F6. Therefore, the return flow for Castor is assumed to be 68% of the estimated withdrawal prorated using the recorded return flow monthly distribution. The estimated withdrawal is assumed to be 62% of the licensed quantity.

Monthly uses for the Town of Castor are summarized in Appendix F, Table F8. Uses for the communities of Alliance, Ferintosh, Lacombe County and Spady are summarized in Appendix F, Tables F3, F10, F14 and F16 respectively.

[20] Watrecon, Water Licence Information, pg. 35.

2.3.6. Urban Groundwater Supply with Significant Return Flow

Of the 11 communities AENV identified with a significant return flow, five had a groundwater supply within the EDA. Return flows from these locations were considered a net import of water into the Basin and constitute a negative use. They include Coronation, Hardisty, Killam, Lacombe and Ponoka. The average municipal withdrawal from a groundwater source is 56% of the allocation and consumption is 25% of withdrawal[21].

Assuming a 25% consumption and loss, the return flow is 75% of the withdrawal volume. Lacking additional records, groundwater withdrawals were assumed to be 56% of the licensed quantity with a 75% return flow of the withdrawal volume. The return flow volume is limited April and October but the return volumes are the same for April and October[22].

Return flows for Lacombe were reduced to 50% of the estimated withdrawal volume to ensure naturalized flows on the Battle River near Ponoka (05FA001) were positive in October (refer to Section 4.1.1). Return flow at Coronation was set to zero. This was necessary to ensure natural flows on Ribstone Creek near Edgerton (05FD001) remained positive in October (refer to Section 4.1.3).

Monthly return flows (or negative uses) for Coronation, Hardisty, Killam, Lacombe and Ponoka are summarized in Appendix F, Tables F9, F11, F12, F13 and F15 respectively. The Town of Blackfalds, located between Lacombe and Red Deer, was reported to have a significant return flow into the Battle River (Appendix F, Figure F1). However, Ray Kerber, Director of Operations for the Town of Blackfalds, advised that the town continuously discharges directly into the Red Deer River. As such the Town of Blackfalds return flow had no impact on natural flows in the Battle River.

2.4. Project Licence Summary

The 571 surface water licenses within the Battle River EDA have a total licensed allocation of 738,989,834 m^3. These are summarized by specific category in Table 2.9.

Table 2.9 differs from the AENV list of licensed surface water allocation projects listed in Appendix A, table A3 because of the four oil injection projects removed from consideration. The explanation of the oil injection projects is in Section 2.1.11.

[21] Watrecon, Water Licence Information, Table 3.7, pg. 38.
[22] Ibid, p. 37.

Table 2.9: Licensed Project Water Demand Summary

Number	Specific Category	Licensed Quantity		Number of Licenses
		(Cubic metres)	(dam^3)	
1	AGGWSH	111,010	111	3
2	CONSTRCT	18,950	19	1
3	COOLING	691,736,660	691,737	3
4	COOPD	5,950,310	5,950	4
5	CROP	10,045,320	10,045	130
6	FEEDLT	137,269	137	2
7	FISHERY	184,550	185	8
8	FLOODCNT	1,100,430	1,100	9
9	GLFCRS	51,238	51	2
10	GRDN	17,130	17	4
11	INJECTN	7,529,170	7,529	5
12	OTHR	395,940	396	4
13	PRK	913,970	914	8
14	RDRTN	88,770	89	3
15	SNOW/ICE	51,000	51	1
16	SRWILD	2,000	2	1
17	STBLZTN	4,306,070	4,306	11
18	STCKWT	1,802,137	18,02	311
19	URBAN	8,145,940	8,146	10
20	WTLNDS	6,401,970	6,402	51
Totals		738,989,834	738,990	571

Project Specifics were grouped into 12 categories. Specifics within each category have the same type of use and duration. Specifics within each group are listed in Appendix A, Tables A5 and A6.

ArcGIS was used to geo-reference project uses into 8 nodes along the Battle River shown in Table 2.10. Specific Uses were grouped into nodes for natural flow calculations and travel time estimates summarized in Appendix A, Table A7.

Table 2.10: Water Use Node Locations

Node	Location	Hydrometric Station Number
1	Battle River near Panoka	05FA001
2	Pipestone Cr. near Wetaskiwan	05FA012
3	Battle R. below Pipestone Cr.	05FA021
4	Battle R. near Forestburg	05FC001
5	Battle R. at ATCO Power Reservoir	
6	Ribstone Cr. near Edgerton	05FD001
7	Battle R. near the Sask Boundary	05FE004
8	Battle R. near Unwin	05FE001

The 1982 PPWB study lists 362 project licenses authorized from 1917 to 1979. The total project licence quantity as of 1979 was 481,623 dam^3. The Atco Power and CFB Wainwright licenses totalled 461,407 dam^3. The balance of the project licenses totalled 20,216 dam^3.

The 2005 AENV list of licensed projects from 1917 to 1979, less the Atco Power and CFB Wainwright licenses, totalled 23,452 dam^3. The licensed allocations provided by the 2005 AENV dataset exceed the total allocations in the 1982 PPWB study by 3,236 dam^3 for the same period of record (1912 to 1979). The results are shown in Appendix A, Figure A1. The implication is that the 1980 uses will increase by 3,236 dam^3 from the 1979 PPWB study to account for the difference between the 1982 PPWB study and current dataset (Battle.xls). The 3,236 dam^3 increase is in addition to any new project licenses approved in 1980.

Based on the current dataset, surface water licenses within the Battle River EDA have increased from 330 in 1979 to 575 by 2002. The non-compounded average annual increase is 3%. The rate at which project licenses were issued within the Battle River Basin from 1936 to 2002 follows a trend ($R^2 = 0.98$) shown in Appendix A, Figure A2. The current dataset contains no new project licenses with priority dates issued after 2002.

There have been no new surface water licenses or cancellations since October 30, 2002. As result surface water uses did not change in the Battle River Basin EDA from 2002 to 2004.

2.5. Period of Operation

The surface water licence Priority field, a date and number composite, defines the project commencement date. Late commencement dates were not applied until the following year. For example, if an irrigation project Priority was issued in November, the irrigation demand would not apply until the summer of the following year.

2.6. Time of Travel Adjustments

In order to naturalize flows at the Saskatchewan/Alberta border, the effect of water demands from the upper reaches of the basin must be carried downstream and added to the recorded flows at the border. These uses were then transferred to the Alberta/Sask border using a time-of-travel component.

Due to the relative lack of hydrometric data for the Battle River and its tributaries, travel times were computed for specific points along the main stem of the Battle River. The Battle River was assumed to consist of four nodes. All water uses between any two nodes were assumed to take place at the downstream node. Travel time between nodes was assumed constant for all levels of flow.

The four nodes and the travel time between each node are shown in Table 2.11.

Table 2.11: Battle River Travel Time

Node	Location	Hydrometric Station	Travel Time (days)
1	Battle River near Ponoka	05FA001	
			6
2	Battle River below Pipestone Creek	05FA021	
			6
3	Battle River near Forestburg	05FC001	
			7
4	Battle River near the Sask Boundary	05FE004	

Historical monthly water use adjustments for the various monitoring locations along the Battle River system (J-File) were computed using the following equation:

$$J(i,t) = U(i,t) + [uU(i-l, t-l) + (l-u)U(i-l,t)] + u1U(i-2,t-1) + (l-u1)U(i-2,t) + \ldots$$

Where J(i,t) = The monthly adjustment which must be added to the recorded flow at node 'i' for month 't' to reconstruct the natural flow at node 'i'.

U(i,t) = The adjustment due to water uses between nodes 'i' and 'i-l' for time 't'.

u = A travel time adjustment as a fraction of a month. Travel time from the upstream node to node 'i' divided by the number of days in month 't'.

3.0 Meteorologic Data

Meteorological data was used to estimate irrigation uses and reservoir net evaporation losses.

3.1. Precipitation

As noted in Section 2.1.5, precipitation for irrigation upstream of Forestburg was assumed equal to monthly precipitation for Wetaskiwin while monthly precipitation for Stettler was assumed representative of areas downstream of Forestburg. The same assumptions were applied in the 1982 PPWB study[23].

The monthly precipitation array for the Atco Power Reservoir (302652) is provided in Appendix B, Table B1. Missing data was filled using the Brownfield (3010890) climate station. The monthly precipitation array for Wetaskiwin is in Appendix B, Table B2. Missing data was filled using the Brightview (3010830) and Ponoka South (3015283) climate stations. The monthly precipitation array for Stettler is in Appendix B, Table B3. Missing data was filled using the Red Willow (301NDR1) and Hackett (3012992) climate stations.

3.2. Gross Evaporation

An underlying assumption of the current study is to maintain the methodology used in the original 1982 PPWB report. In the original study, natural evaporation was computed using Morton's estimates. However, sunlight data is no longer collected by Environment Canada (EC). PFRA regularly updates Meyer's gross evaporation tables for the Canadian prairies. PFRA does not calculate Morton's gross evaporation nor have they correlated Meyer's to Morton's gross evaporation (Appendix J, Figure J1).

A study was undertaken to develop a way to convert Meyer's to Morton's gross evaporation. Two nearby climate stations were selected; Morton method at Lacombe and Meyer's method at Red Deer. There was no direct correlation of annual gross evaporation between the two methods as shown in Appendix J, Figure J2. A correlation was found by comparing the historic cumulative monthly total gross evaporation for the two stations. The correlation results are presented in Appendix J. The annual and monthly correlations were developed from March to October. The November to February Morton gross evaporation estimates, not used in Meyer's method, were filled using the annual correlation less the sum of the March to October correlations.

The Meyer's to Morton's correlation was used to estimate Morton's gross evaporation from 2002 to 2004. For the period of 1980 to 2001, Morton's gross evaporation estimates were obtained from the AENV[24] and MPE Engineering[25] reports. Monthly Morton gross evaporation estimates for Lacombe are in Appendix B, Table B4.

[23] PPWB, "Agricultural Irrigation", p 12
[24] Alberta Environment, *Battle River Basin Historical Natural Flows 1912 to 1983* (1986) Table B-1

4.0 Natural Flow Calculations

Natural flows are derived by adding historic basin water use adjustments from within the EDA to the recorded flows, a procedure known as the project depletion method which required the creation of the following files:

- A-File – recorded monthly flow at specific gauging sites
- J-File – an array of monthly adjustment items added to the recorded flows in order to remove the effect of human activity (historical water use) in the basin.
- B-File – naturalized monthly flows taken as the sum of the A-File and J-file.

Monthly natural flow arrays covering the period from 1980 to 2004, were developed for four gauged and one project location shown in Table 4.1.

Table 4.1: Natural Flow Gauged and Project Locations

No.	Site	Hydrometric Station No.	Description
1	Gauged	05FA001	Battle River Near Ponoka
2	Gauged	05FA012	Pipestone Creek Near Wetaskiwin
3	Gauged	05FD001	Ribstone Creek Near Edgerton
4	Gauged	05FE004	Battle River Near the Sask Boundary
5	Project	05FA016	Pipestone Creek at Coal Lake

The natural flow assessment considers return flows from wetland and urban uses. Overestimating return flows resulted in negative natural flows. As a result return flows, which are considered a negative use, were adjusted where necessary to ensure positive natural flows.

4.1. Natural Flow Calculation Methodology

The natural flow calculation methodologies for the gauged and project sites listed in Table 4.1 are described below:

4.1.1. Battle River near Ponoka (05FA001)

Water use arrays upstream of the Battle River near Ponoka were added to the recorded value array to naturalize flows. Return flows for Lacombe were adjusted to 50% of the withdrawal volume to prevent negative natural flows in October. Return flows from wetlands were adjusted to 94% of the withdrawal volume to prevent negative natural flows in June. Ponoka is identified

[25] MPE Engineering Ltd., *Alberta Environment Battle River Basin in Alberta Extension of Historical Natural Flow Database 1984 to 2001* (2003) Table C-3

by AENV as having a significant return flow as shown in Appendix F, Figure F1. The gauging station Battle River near Ponoka (05FA001) is located upstream of the town as shown in Appendix F, Figure F2, therefore it was assumed that recorded flows did not include the Ponoka return flows.

4.1.2. Pipestone Creek near Wetaskiwin (05FA012)

Recorded flows for Pipestone Creek near Wetaskiwin (05FA012) were combined with recorded flows for Pipestone Creek below Bigstone Creek (05FA022) to form a continuous dataset for the entire 1980 to 2004 period. No adjustment was applied to the recorded flows due to the close proximity of the two hydrometric stations[26].

Monthly water use arrays upstream of Pipestone Creek near Wetaskiwin (05FA012) were added to the recorded value array to naturalize flows from March to October. November to February natural flows were estimated using a ratio of the September and October naturalized flow volume of Pipestone Creek near Wetaskiwin and the Battle River near Ponoka for common periods of record. The monthly ratios used to extend natural flows from the Battle River near Ponoka (05FA001) to the Pipestone Creek near Wetaskiwin (05FA012) are shown in Appendix G, Table G1.

The Westakiwin municipal return flow re-enters the Battle River downstream of Coal Lake near Gwynne as shown in Figure 4.1 and has no effect on the natural flow calculation for Pipestone Creek near Wetaskiwin.

[26] MPE, "Recorded Flows – A-Files", p 13

Figure 4.1: Wetaskiwin Return Flow Downstream of Coal Lake Outlet

4.1.3. Ribstone Creek Near Edgerton (05FD001)

Hydrometric station 05FD001 is a seasonal station operated from March to October. The addition of wetland return flows in June and municipal return flows in April and October, resulted in negative natural flows for June and October. Therefore, natural flows for Ribstone Creek near Edgerton (05FD001) were estimated in accordance with the negative natural flow procedure noted for this location in the MPE Engineering study[27].

Coronation is the only urban use within this sub-basin identified with a significant return flow (Appendix F, Figure F1). The estimated return flow for Coronation is 0.028 m^3/s and 0.027 m^3/s in April and October respectively. In years when no flow was recorded in October at the Ribstone Creek near Edgerton hydrometric station, adding the Coronation return flow resulted in negative natural flow. Therefore, it was necessary to remove the Coronation return flow from

[27] MPE, Waterfowl Conservation / Backflood Irrigation Projects, pg. 16.

the natural flow calculation to ensure natural flows were positive. If the Coronation return flow is subject to channel losses or is intercepted at Ribstone Lake it would not be recorded at hydrometric station 05FD001. Based on the above assessment it was assumed that although Coronation may have a significant return flow, the release does not augment flows in the Battle River main stem.

4.1.4. Battle River at the Saskatchewan/Alberta Boundary (05FE004)

A continuous flow record was available for hydrometric station 05FE004 from 1980 to 2004. Upstream water uses for the Battle River at the Saskatchewan/Alberta boundary were estimated by adjusting computed water uses for upstream nodes by the appropriate travel time to the Saskatchewan/Alberta border to develop an array of total monthly upstream water uses. The computed monthly upstream water uses were then added to the recorded flows to produce a continuous monthly natural flow data set.

4.1.5. Pipestone Creek at Confluence with Coal Lake

Pipestone Creek at the confluence with Coal Lake is a project location with no direct flow measurements. The Coal Lake local drainage area historically did not contribute to the Battle River system. Coal Lake Reservoir, constructed in 1973, captures the flow from Pipestone Creek and from the Coal Lake local drainage area. Natural flows at this site were calculated by applying the EDA ratio of 1.13 to the naturalized flows for Pipestone Creek near Wetaskiwin (05FA012) as shown in Appendix G, Table G2.

Water uses for Pipestone Creek downstream of Coal Lake were estimated by taking the Pipestone Creek previously computed natural flow downstream of Coal Lake less the calculated outflow which was computed based on recorded water levels and a stage discharge table for the outlet structure.

4.2. Natural Flow Results

Mean monthly recorded flows (A-Files) from 1980 to 2004 for the gauged sites are presented in Appendix C, Tables C1 to C4.

Historic uses (J-Files) for the gauged sites are presented in Appendix D, Tables D1-D4. Total historic uses for Pipestone Creek at Coal Lake are presented in Appendix G, Table G6. Total historic uses for the Atco Power Reservoir are presented in Appendix H, Table H6.

Total uses were tracked throughout the calculation process. From 1980 to 2004 the licensed allocations totalled 807,389 dam^3 while the average annual water use averaged 29,778 dam^3 as summarized in Table 4.2.

The results indicate that for municipal uses an assessment of consumption, return flows and return flow from groundwater sources, resulted in an overall net import, or a negative use, from the Battle River Basin. The largest water imports occurred due to Lacombe, Ponoka and Stettler as shown in Appendix F, Table F22.

The January 2005 consumptive uses at Battle River near the Saskatchewan Boundary (05FE004) reflect the upstream December 2004 uses adjusted for travel time. Total basin uses routed to the Battle River near the Saskatchewan Boundary (05FE004) are summarized in Appendix D, Table D5. A complete summary of uses by specific purpose and sub-basin is presented in Appendix D, Table D6.

Table 4.2: Summary of Average Uses at the Saskatchewan – Alberta Border

Type of Use	Average Annual Use, 1980 to 2004 (dam^3)
Pipestone Creek at Coal Lake (U1+U2+U3)	7,726
ATCO Power Reservoir	6,140
Municipal	-400
Balance of Project Uses	16,312
Average Annual Uses at Sask/AB Border	**29,778**

Naturalized flows (B-Files) for the gauged and project sites are presented in Appendix E, Tables E1 to E5. Flows in Ribstone Creek near Edgerton (05FD001) were naturalized for an 8-month period (March to October) to verify natural flows were positive in the months of April, June and October as a result of wetland and municipal return flows.

5.0 Summary

An analysis was made to determine if Alberta would have exceeded its 50% share of the natural flow of the Battle River at the inter-provincial boundary, under the 1969 Master Agreement on Apportionment, in the period 1980 to 2004 for both historic and present (2004) uses.

Natural flows were calculated using the project depletion method consistent with the procedures used by Alberta Environment in the natural flow study completed for the PPWB in 1982.

In the original Terms of Reference for the Study, the current (2004) water use was to be used in the study when assessing deficits or surpluses. The 2004 uses (27,453 dam^3) were significantly lower than the uses in 2003 (39,731 dam^3) and also lower than the mean of the uses for the period 1980 through 2004 (29,778 dam^3). This is interesting in that the basin allocations increased rapidly from 1980 to 1990 and then steadily from 1990 to 2004 (Figure A1, Appendix A). The annual changes in uses are more likely related to the water flow conditions in the basin than the allocations. As a further assessment, the average level of use over the 2000 to 2004 period (32,613 dam^3) was used compared to Natural Flows for the period 1980 to 2004.

The study shows that:

1. That actual water use within the Battle River Basin upstream of the Saskatchewan-Alberta boundary have increased by 90% from 17,145 dam^3 (13,900 ac.ft) [28] in 1979 to an average of 32,613 dam^3 in the period from 2000 to 2004.
2. Based on the historic level of development there would not have been any years within the 25-year study period from 1980 to 2004, in which less than 50% of the natural flow would have been passed into Saskatchewan.
3. The lowest percentages passed by Alberta to Saskatchewan were 54% of the natural flow in 2002 and 56% in 2004.
4. The mean ratio of annual recorded flow at the Alberta-Saskatchewan border versus the annual Natural flow during the study period was 82%. However, within the last five years, from 2000 to 2004, the surplus dropped to 66% resulting from increased water uses and lower flows during this period. It is interesting to note that the ratio is 87% if one compares the mean for recorded annual volumes (194,456 dam^3) versus the mean for the Natural flow volume (224,234 dam^3).
5. The average annual natural flow at the Alberta-Saskatchewan boundary during the 1980 to 2004 period was 82,339 dam^3 higher than the natural flow required under the 1969 Master Agreement on Apportionment. Within the last five years the average annual flow surplus has decreased to 23,538 dam^3. These results are shown in Table 5.1.
6. Based on the average level of use over the 2000 to 2004 period, when applied to the historic natural flow, 2004 was the only year with an apportionment deficit of 1,561dam^3 as shown in Table 5.2. This indicates a relatively low risk with only one year in twenty five where there was a minor shortfall.

[28] PPWB, Conclusions, pg. 27.

Table 5.1: Battle River Apportionment at Saskatchewan-Alberta Border

Year	Recorded Annual Volume (dam^3)	Uses (dam^3)	Natural Annual Volume (dam^3)	50 % of annual Nat. Volume (dam^3)	Recorded vs Natural Flow (%)	Surplus above 50% of Natural Flow (dam^3)
1980	232,568	22,662	255,230	127,615	91	104,953
1981	210,182	27,772	237,954	118,977	88	91,205
1982	391,092	17,724	408,816	204,408	96	186,684
1983	359,133	28,403	387,536	193,768	93	165,365
1984	104,332	28,702	133,033	66,517	78	37,815
1985	284,654	17,196	301,850	150,925	94	133,729
1986	262,034	24,397	286,431	143,216	91	118,818
1987	215,115	29,830	244,946	122,473	88	92,642
1988	63,862	26,719	90,582	45,291	71	18,571
1989	134,540	33,788	168,328	84,164	80	50,376
1990	431,196	28,243	459,439	229,720	94	201,476
1991	233,974	30,251	264,225	132,113	89	101,861
1992	159,686	31,630	191,315	95,658	83	64,028
1993	180,394	32,535	212,928	106,464	85	73,930
1994	146,484	31,115	177,599	88,800	82	57,684
1995	88,413	29,326	117,738	58,869	75	29,544
1996	252,573	30,300	282,873	141,437	89	111,136
1997	338,013	33,496	371,509	185,755	91	152,258
1998	79,777	39,174	118,951	59,476	67	20,301
1999	294,942	38,131	333,073	166,537	89	128,405
2000	147,583	30,016	177,599	88,800	83	58,783
2001	49,373	28,621	77,994	38,997	63	10,376
2002	43,675	37,244	80,919	40,460	54	3,215
2003	123,159	39,731	162,890	81,445	76	41,714
2004(1)	34,651	27,453	62,104	31,052	56	3,599
Minimum	34,651	17,196	62,104	31,052	54	3,215
Maximum	431,196	39,731	459,439	229,720	96	201,476
Mean	194,456	29,778	224,234	112,117	82	82,339
Average 2000 to 2004	79,688	32,613	112,301	56,151	66	23,538

(1) Injection uses decreased substantially by 2004 as shown in Table 2.6. As a result the present level of development showed lower total uses in some years than observed historically.

Table 5.2: Battle River Apportionment Surplus at Saskatchewan-Alberta Border, Uses based on the average from 2000 to 2004

Year	Annual Natural Flow Volume (ANFV) (dam^3)	50% of the ANFV (dam^3)	Average Uses (2000 to 2004) (dam^3)	Use versus 50% of ANFV (%)	Surplus of uses over 50% of ANFV (dam^3)
1980	255,230	127,615	32,613	25.6	95,002
1981	237,954	118,977	32,613	27.4	86,364
1982	408,816	204,408	32,613	16.0	171,795
1983	387,536	193,768	32,613	16.8	161,155
1984	133,033	66,517	32,613	49.0	33,904
1985	301,850	150,925	32,613	21.6	118,312
1986	286,431	143,216	32,613	22.8	110,603
1987	244,946	122,473	32,613	26.6	89,860
1988	90,582	45,291	32,613	72.0	12,678
1989	168,328	84,164	32,613	38.7	51,551
1990	459,439	229,720	32,613	14.2	197,107
1991	264,225	132,113	32,613	24.7	99,500
1992	191,315	95,658	32,613	34.1	63,045
1993	212,928	106,464	32,613	30.6	73,851
1994	177,599	88,800	32,613	36.7	56,187
1995	117,738	58,869	32,613	55.4	26,256
1996	282,873	141,437	32,613	23.1	108,824
1997	371,509	185,755	32,613	17.6	153,142
1998	118,951	59,476	32,613	54.8	26,863
1999	333,073	166,537	32,613	19.6	133,924
2000	177,599	88,800	32,613	36.7	56,187
2001	77,994	38,997	32,613	83.6	6,384
2002	80,919	40,460	32,613	80.6	7,847
2003	162,890	81,445	32,613	40.0	48,832
2004	62,104	31,052	32,613	105.0	-1,561

Appendix A

Summary of Licences

Appendix A: Summary of Licences

Table A1: Battle River Surface Water Project Licence Summary (Battle.xls Dataset)

		No. of Licenses	No. of Licenses	Note
BATTLE.XLS Worksheet Summary				
	Cancel.Dup.Alloc	1304	1304	
	Non.Cancel.Lst		**996**	
	Specific Worksheet Totals (19)	994		
	Total	2298	2300	1
GIS Mapping Summary				
	Q=0		182	
	OUTSIDE		17	2
	NA		1	3
	GDA		206	
	EDA		571	4
	Licensed Injection Projects no use		4	5
	Duplicate Water Use Licenses		15	6
	Total		**996**	
Note:				
1)	Discrepancy between the Non-Cancelled List and the Specific Category Sum			
	APR_ID 31241 is listed 3-times in the Non.Cancelled list and only once in the Type List			
2)	Originally 18 Apr_ID's mapped outside the basin			
	Todd Aasen requested one of the above Apr_IDs be moved into the basin			
3)	Approval ID 47618 (Battle.xls:Wetland) does not have a land location			
	and is missing from the non-cancelled list (Battle.xls:Non.Cancel.Lst)			
4)	590 Approval_ID's mapped within the EDA and were included in the Natural flow study			
	Some discussion required on whether or not all duplicate Approval_ID entries are valid			
5)	There are nine licensed injection projects within the Battle River Basin EDA however			
	4 projects reported no consumption (Peter Stevens, AENV)			
6)	15 Duplicate Water Use Licenses Were Removed From the Battle.xls:Non-Cancelled Dataset			
C:\Battle.River.Natural.Flow.(1980-2004)\Specific.Water.Demands\[Water.Demand.Categories.xls]GIS.Summary				

Table A2: Battle River Basin Surface Water Licence Allocation Purpose and Specific Activity Summary

BATTLE RIVER BASIN WATER USES WHICH INCLUDES LICENSED APPROVAL_IDS, COAL LAKE, FORESTBURG RESERVOIR AND DRIEDMEAT LAKE
APPROVAL IDS LIST INCLUDES THE SPECIFIC CATEGORY, NO OF LICENSES (DUPLICATES) AND QUANTITY WITHIN BATTLE RIVER EDA

	Battle.xls - May 2005				Study ->	PPWB - June 1982	AE - January 1986	mpe - October 2003
	No.	Worksheet	No.		Natural Flow Period ->	(1912 - 1979)	(1980 - 1983)	(1984 - 2001)
	Licenses	Name	Licenses	Specific	Quantity (cm)	Notes	Specific Purpose	Specific Purpose	Specific Purpose
1	3	aggrwsh	3	AGGWSH	111,010		j) Washing Operations	j) Washing Operations	5.2.8 Gravel Washing Projects
2	1	cnstr	1	CNSTRCT	18,950				
3	3	cooling	3	COOLING	691,736,660		i) Cooling: APL Reservoir	i) Alberta Power Reservoir	5.3.1 Forestburg Reservoir (ATCO Power)
4	4	coop	4	COOPD	5,950,310		h) Community Water Supply	h) Community Water Supply	
5	130	crop	130	CROP	10,045,320		b) Agriculture: Irrigation	b) Irrigation	5.2.2 Irrigation Projects
6	2	feedlot	2	FEEDLT	137,269	2			
7	8	fish	8	FISHERY	184,550		d) Fish Ponds	d) Fish Ponds	5.2.5 Fish Ponds
8	9	fldcontr	9	FLOODCNT	1,100,430		m) Flood Control	m) Flood Control	
9	2	golf	2	GLFCRS	51,238	2			
10	4	gard	4	GRDN	17,130	2			
11	5	inject	5	INJECTN	6,826,090	4, 5	f) Injection, l) Miscellaneous	f) Injection, l) Miscellaneous	5.2.7 Water Injection for Secondary Oil Recovery
12	4	other	4	OTHR	395,940	2			
13	8	park	8	PRK	913,970	2			
14	4	rec	3	RCRTN	88,770				
15			1	SNOW/ICE	51,000	2			
16	12	stabl	1	SRWILD	2,000	3	g) Wildfowl Propagation	g) Wildfowl Propagation	5.2.4 Waterfowl Conservation
17			11	STBLZTN	4,306,070	2			
18	311	stock	311	STCKWT	1,802,137		a) Stock Watering	a) Stock watering	5.2.1 Stock Water Projects
19	10	urban	10	URBAN	8,145,940		e) Urban Water Supply	e) Urban Water Supply	5.2.6 Urban Water Supply
20	51	wetland	51	WTLNDS	6,401,970	1	c) Agriculture: Ducks Unlimited Projects	c) Ducks Unlimited Projects	5.2.3 Waterfowl Conservation/Back flood Irrigation
	571		571		738,286,754				
							k) Flow Control: Coal Lake	k) Coal Lake Reservoir	5.2.9 Coal Lake Reservoir
									5.3.0 Driedmeat Lake Reservoir

Notes:

1. Mostly DUC projects with 100% Losses in Approval_ID records.
2. FEEDLT, GARD, GLFCRS, OTHR, PRK, SRWILD and SNOW/ICE are new specific purposes created after the 1982 PPWB Study
3. Mostly DUC projects - File No.s were assigned Wildfowl Propagation in previoius studides therefore assumed use for current study
4. Approval ID 37819 (File No. 12128) 1982 PPWB Study moved from Micellaneous to Injection
5. Appendix A, Table A8 shows 9 Injection licenses within the Battle River Basin however only 5 reported uses (Peter Sevens, AENV)

C:\Battle.River.Natural.Flow.(1980-2004)\Specific.Water.Demands\[Water.Demand.Categories.xls]Water.Demand.Categories

Table A3:
Battle River Basin – Alberta Licensed Surface Water Projects
Upstream of Battle River near Ponoka (05FA001) - Node 1

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	IRRIGATED RETURN (cm)	IRRIGATED AREA (ha)
24942	26299	19930226010	1995	NW36-42-26-4	AGGWSH	61670	61670	0	0	0
28773	22690	19870415003	1992	NW26-42-26-4	AGGWSH	24670	14800	9870	0	0
37875	12078-B	19700323001	1972	NE15-40-27-4	COOPD	740090	740090	0	0	0
29348	22081	19851223009	1987	NW07-42-27-4	CROP	37000	37000	0	0	32.38
31240	20148-4	19870603004	1994	NE10-43-28-4	CROP	646340	140620	0	505720	107.65
37568	12364	19680404002	1968	NW21-41-26-4	CROP	92510	92510	0	0	29.9
74160	00074160	19990525001	1999	NW20-40-27-4	CROP	3000	3000	0	0	0
74160	00074160	19990525002	1999	NW20-40-27-4	CROP	3000	3000	0	0	0
76717	00076717	19990621001	1999	NE04-42-28-4	CROP	12000	11000	1000	0	0
39145	10773	19620827001	1985	NW11-45-28-4	FISHERY	20970	0	20970	0	0
22462	48929	19960130002	1996	SW15-42-27-4	GRDN	5970	4310	1660	0	0
136070	00078268	19991022002	2000	SW33-40-26-4	GRDN	1300	1000	300	0	0
40292	09465	19560824001	1991	NW11-47-28-4	OTHR	333040	333040	0	0	0
25643	25711	19911230001	1996	SW07-41-26-4	PRK	151710	134450	17260	0	40.46
28582	22896	19871202001	1990	NW25-45-01-5	PRK	2460	2460	0	0	0.6
30997	20393	19820618003	1986	SE03-42-26-4	PRK	168990	166520	2470	0	36.37
83301	83301	20000307004	2002	NW36-42-26-4	RCRTN	53000	0	53000	0	0
27097	24494	19900316002	1991	NE04-40-27-4	STBLZTN	70310	0	70310	0	0
31178	20209	19820205001	1984	NW24-43-27-4	STBLZTN	350310	0	350310	0	0
35229	15588	19730710001	1983	NE26-41-26-4	STBLZTN	46870	0	46870	0	0
22118	52415	19950626003	1995	SE35-44-01-5	STCKWT	2460	1230	1230	0	0
22471	48765	19950215006	1996	NW14-43-28-4	STCKWT	4310	3700	610	0	0
26311	25186	19910311001	1991	NE07-45-01-5	STCKWT	2460	1230	1230	0	0
26998	24564	19900626005	1990	NE19-41-25-4	STCKWT	4930	1230	3700	0	0
27125	24469	19900228005	1991	NW29-46-01-5	STCKWT	2460	1230	1230	0	0
27746	23646	19890427006	1989	SW25-45-01-5	STCKWT	1240	620	620	0	0
28375	23094	19880408004	1988	SE23-45-02-5	STCKWT	2460	1230	1230	0	0
28476	22977	19880215002	1989	SE31-41-26-4	STCKWT	2460	1230	1230	0	0
28815	22647	19870312012	1987	SE14-44-28-4	STCKWT	3700	1230	2470	0	0
29021	22433	19860818003	1987	NE03-44-28-4	STCKWT	2460	1230	1230	0	0
29355	22073	19851223003	1988	SW22-44-28-4	STCKWT	3700	1230	2470	0	0
30517	20897	19831101004	1988	SW35-45-02-5	STCKWT	2460	1230	1230	0	0
31652	19623	19791220007	1980	NW17-44-01-5	STCKWT	2460	1230	1230	0	0
31659	19614	19791220012	1984	SE04-45-01-5	STCKWT	1240	620	620	0	0
32064	19249	19780824001	1979	NE14-46-01-5	STCKWT	2470	620	1850	0	0
32717	18624	19780602006	1978	SE11-45-28-4	STCKWT	4930	1230	3700	0	0
32718	18623	19780623001	1978	SW08-43-26-4	STCKWT	2460	1230	1230	0	0
32971	18385	19780103004	1981	NW36-44-01-5	STCKWT	2460	1230	1230	0	0
33076	18260	19770822003	1978	SW11-46-02-5	STCKWT	2460	1230	1230	0	0
33169	18163	19770607001	1980	NW28-45-01-5	STCKWT	2460	1230	1230	0	0

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Table A3 Continued:
Battle River Basin – Alberta Licensed Surface Water Projects
Upstream of Battle River near Ponoka (05FA001) - Node 1

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIV DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	IRRIGATED RETURN (cm)	IRRIGATED AREA (ha)
34404	16701	19740821004	1975	SW16-44-01-5	STCKWT	2460	1230	1230	0	0
34405	16700	19740909003	1983	NE01-44-01-5	STCKWT	2460	1230	1230	0	0
35079	15832	19731009004	1974	NW34-43-28-4	STCKWT	2460	1230	1230	0	0
35214	15609	19760826005	1982	NE34-44-28-4	STCKWT	3700	1230	2470	0	0
35255	15514	19730906002	1981	SE30-44-27-4	STCKWT	3700	1230	2470	0	0
35260	15509	19740807001	1976	SW15-43-01-5	STCKWT	2460	1230	1230	0	0
35457	15154	19730312001	1983	SE20-44-01-5	STCKWT	4930	1230	3700	0	0
35682	14665	19810402004	1981	NE21-40-26-4	STCKWT	3700	1230	2470	0	0
36720	13456	19861027007	1987	SW15-46-02-5	STCKWT	1240	620	620	0	0
36885	13192	19700921002	1982	NE27-45-02-5	STCKWT	8630	1230	7400	0	0
36932	13116	19700702003	1971	NW07-42-27-4	STCKWT	2460	1230	1230	0	0
37357	12577	19681231001	1985	SE36-44-01-5	STCKWT	2460	1230	1230	0	0
37395	12534	19761124002	1977	SE30-43-27-4	STCKWT	2460	1230	1230	0	0
37515	12415	19680605005	1982	SE34-40-27-4	STCKWT	2460	1230	1230	0	0
37533	12398	19680527002	1982	NW31-44-01-5	STCKWT	3700	1230	2470	0	0
37625	12309	19680115003	1968	SE22-45-28-4	STCKWT	4930	1230	3700	0	0
37692	12251	19670615002	1984	NE04-45-01-5	STCKWT	4930	1230	3700	0	0
37940	12011	19651206002	1976	SE02-44-01-5	STCKWT	9860	1230	8630	0	0
37965	11985	19650923007	1984	NW12-44-01-5	STCKWT	2460	1230	1230	0	0
38167	11781	19650201003	1982	SW25-43-28-4	STCKWT	2460	1230	1230	0	0
38224	11719	19640714001	1982	NW04-45-01-5	STCKWT	1240	620	620	0	0
38264	11680	19640617004	1982	NE34-44-01-5	STCKWT	2460	1230	1230	0	0
38320	11626	19640310002	1985	NW22-46-01-5	STCKWT	3700	1230	2470	0	0
38473	11472	19630912003	1982	SW16-40-26-4	STCKWT	4930	1230	3700	0	0
38615	11323	19630524003	1982	SW03-43-28-4	STCKWT	1240	620	620	0	0
38737	11194	19630214002	1988	NW24-43-28-4	STCKWT	2460	1230	1230	0	0
38901	11021	19621001006	1980	SW01-42-28-4	STCKWT	1240	620	620	0	0
39176	10738	19620216005	1980	NE23-41-27-4	STCKWT	2460	1230	1230	0	0
39193	10710	19620201003	1982	SW21-40-27-4	STCKWT	4930	1230	3700	0	0
29567	21852	19850529004	1987	SW01-41-27-4	WTLNDS	85110	0	85110	0	0
31241	20148-4	19870603003	1994	SW15-43-28-4	WTLNDS	172690	0	172690	0	0
35679	14668	19810402006	1985	SW06-43-27-4	WTLNDS	488460	0	488460	0	0
80634	00071058	19990611001	1999	SW07-44-27-4	WTLNDS	7740	7740	0	0	0
					TOTAL	3733830	1811680	1416430	505720	247.4

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Table A3 Continued:
Battle River Basin – Alberta Licensed Surface Water Projects
Between Battle River near Ponoka (05FA001) and Battle River below Pipestone Creek (05FA021)

Upstream of Pipestone Creek near Wetaskiwin (05FA012) - Node 2

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
25399	25912	19920519002	1995	NE11-46-26-4	CROP	4930	4930	0	0	5.9
25825	25580	19921022002	1994	NW13-47-25-4	CROP	19730	14800	0	4930	7.0
27748	23644	19890428005	1993	SE13-47-26-4	CROP	23440	23440	0	0	13.0
27837	23565	19890322006	1991	SW17-48-24-4	CROP	74010	51810	0	22200	22.6
29817	21598	19850208008	1985	NE07-46-25-4	CROP	9870	9870	0	0	4.3
33879	17369	19751215004	1978	SE08-47-26-4	CROP	66610	60440	0	6170	26.3
35965	14364	19720727002	1973	NW21-47-24-4	CROP	7400	7400	0	0	1.4
37181	12780	19690715001	1971	SE31-46-26-4	CROP	44410	44410	0	0	14.6
39853	09999	19590401001	1961	SW12-44-26-4	FISHERY	49340	49340	0	0	0.0
30896	20508	19880511003	1988	SE21-47-24-4	OTHR	4930	1230	3700	0	0.0
26967	24594	19900514004	1993	NW12-47-24-4	PRK	109770	98670	11100	0	25.0
34259	16936	19741231001	1978	NE07-46-25-4	STBLZTN	1351900	0	1351900	0	0.0
22156	52104	19941122006	1995	NW03-45-26-4	STCKWT	2460	1230	1230	0	0.0
22157	52103	19941122005	1995	SW03-45-26-4	STCKWT	2460	1230	1230	0	0.0
22158	52102	19941122004	1995	SE03-45-26-4	STCKWT	2460	1230	1230	0	0.0
27749	23643	19890427001	1989	SE30-46-27-4	STCKWT	2460	1230	1230	0	0.0
30888	20518	19821102005	1984	SE11-47-27-4	STCKWT	1240	620	620	0	0.0
37183	12778	19690808002	1970	NW14-47-26-4	STCKWT	6160	1230	4930	0	0.0
164138	00164138	20020110002	2002	SE28-45-26-4	STCKWT	1650	1650	0	0	0.0
					TOTAL	1785230	374760	1377170	33300	120.0

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Table A3 Continued:
Battle River Basin – Alberta Licensed Surface Water Projects
Between Battle River near Ponoka (05FA001) and Battle River below Pipestone Creek (05FA021)

Downstream of Pipestone Creek near Wetaskiwin (05FA012) - Node 3

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
184773	00184771	20020419003	2003	SW36-44-23-4	CNSTRCT	18950	18950	0	0	0.0
25800	25604	19910930002	1993	NW19-42-25-4	CROP	3700	3700	0	0	11.0
33711	17577	19760226002	1979	NE02-47-23-4	CROP	357710	357710	0	0	117.2
37040	12966	19710323003	1982	NE31-45-22-4	CROP	50570	50570	0	0	24.9
37041	12966	19700105001	1982	NE31-45-22-4	CROP	28370	28370	0	0	14.0
144939	00075056	19970415003	1998	SE01-46-24-4	FISHERY	3700	0	3700	0	0.0
25188	26094	19921007001	1994	SW22-46-24-4	FLOODCNT	50570	0	50570	0	0.0
26496	25026	19900115005	1992	SE21-46-23-4	GRDN	7400	7400	0	0	9.2
31721	19527	19881209007	1989	NE26-46-23-4	INJECTN	485990	485990	0	0	0.0
31722	19527	19791116001	1983	SW26-47-23-4	INJECTN	1275420	1275420	0	0	0.0
28401	23062-2	19880314002	1991	NE36-44-23-4	OTHR	49340	0	0	49340	0.0
31485	19883	19800623001	1986	NW21-43-23-4	STBLZTN	187490	0	187490	0	0.0
35587	14949-A	19720207001	1978	NE26-46-23-4	STBLZTN	629070	0	629070	0	0.0
29433	21993	19850827002	1985	NE13-46-23-4	STCKWT	2460	1230	1230	0	0.0
35603	14914	19730412001	1984	NE12-43-24-4	STCKWT	3700	1230	2470	0	0.0
38236	11707	19640706002	1987	SE01-47-23-4	STCKWT	3700	1230	2470	0	0.0
136210	00136210	20000606001	2000	SE19-46-22-4	STCKWT	1000	1000	0	0	0.0
39230	10670	19811109001	1983	SW01-47-23-4	URBAN	1850230	462560	0	1387670	0.0
39231	10670	19630514005	1983	SW01-47-23-4	URBAN	616750	154190	0	462560	0.0
76785	23062	19980609003	1998	NE36-44-23-4	WTLNDS	59000	0	59000	0	0.0
81007	23062	19990916002	1999	NE36-44-23-4	WTLNDS	3000	0	3000	0	0.0
					TOTAL	5688120	2849550	939000	1899570	176.3

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Table A3 Continued:
Battle River Basin – Alberta Licensed Surface Water Projects
Between Battle River below Pipestone Creek (05FA021) and Battle River near Forestburg (05FC001)
Node 4

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
33634	17653	19790219002	1982	SW26-45-20-4	AGGWSH	24670	4930	19740	0	0.0
44707	01989	19290402001	1970	NW34-46-20-4	COOPD	185020	185020	0	0	0.0
26316	25180	19910306006	1992	SW07-46-20-4	CROP	134450	134450	0	0	37.7
27435	23898	19891002002	1995	NE16-48-20-4	CROP	4930	4930	0	0	2.1
28628	22843	19870925003	1988	SE24-42-18-4	CROP	2470	2470	0	0	3.4
28823	22638	19870224006	1988	SE05-48-20-4	CROP	18500	18500	0	0	11.4
29201	22246	19870224005	1990	SW05-48-20-4	CROP	12340	12340	0	0	4.7
29202	22246	19860324009	1990	SW05-48-20-4	CROP	12340	12340	0	0	4.5
29206	22239	19860324002	1988	-46-21-4	CROP	91280	91280	0	0	25.5
29207	22238	19860324003	1988	SW07-46-20-4	CROP	81410	81410	0	0	22.7
30394	21011	19840110012	1987	NE13-43-18-4	CROP	37000	37000	0	0	13.3
30395	21010	19840110011	1987	SE13-43-18-4	CROP	14800	14800	0	0	5.1
37752	12194	19670112006	1967	SW15-45-19-4	CROP	49340	49340	0	0	26.3
193274	21011	19840110012	1987	NE13-43-18-4	CROP	37000	37000	0	0	0.0
195751	22638	19870224006	1988	SE05-48-20-4	CROP	18500	18500	0	0	0.0
195755	22246	19870224005	1990	SW05-48-20-4	CROP	12340	12340	0	0	0.0
28319	23147	19880601002	1989	SW17-42-17-4	FLOODCNT	29600	29600	0	0	15.4
141091	85401	19981201004	2000	NE15-47-20-4	GLFCRS	13000	8000	5000	0	0.0
193739	22396	19860625002	2003	NE07-44-18-4	GLFCRS	38238	27137	11101	0	0.0
23969	27315	19950609001	1995	NW18-45-19-4	GRDN	2460	2460	0	0	0.0
37936	12015	19651122001	1972	SE05-48-20-4	INJECTN	616740	616740	0	0	0.0
24234	27021	19950127015	1995	SE32-45-20-4	OTHR	8630	8630	0	0	2.0
29056	22396	19860625002	1986	NE07-44-18-4	PRK	38240	27140	11100	0	5.9
29336	22097	19860127003		NW34-46-20-4	PRK	246700	214630	32070	0	23.9
146266		20010129001	2002	SE17-45-18-4	SRWILD	2000	2000	0	0	0.0
22154	52166	19941216006	1995	SW11-43-17-4	STCKWT	1220	610	610	0	0.0
25728	25655	19911022009	1994	SE13-44-20-4	STCKWT	6160	4930	1230	0	0.0
30653	20761	19830708008	1983	SE12-44-19-4	STCKWT	2460	1230	1230	0	0.0
30854	20553	19840201002	1984	SW26-42-17-4	STCKWT	3700	1230	2470	0	0.0
37548	12383	19680425004	1984	SW07-42-17-4	STCKWT	3700	1230	2470	0	0.0
38179	11768	19641104002	1987	NE15-43-17-4	STCKWT	2460	1230	1230	0	0.0
38322	11624	19640303002	1982	SE18-44-18-4	STCKWT	6160	1230	4930	0	0.0
38801	11130	19621211004	1982	NW07-46-21-4	STCKWT	2460	1230	1230	0	0.0
41307	07925	19461223001	1975	SE20-46-20-4	STCKWT	3700	1230	2470	0	0.0
182568	00182568	20020220004	2002	SW30-45-16-4	STCKWT	900	900	0	0	0.0
190738	00190735	20021030001	2002	NE11-46-18-4	STCKWT	1000	500	500	0	0.0
191203	4-20-046	20020411003	2002	NW21-46-20-4	STCKWT	1400	674	726	0	0.0
44708	01989	19820222001	1987	SW24-45-20-4	URBAN	986780	167750	0	819030	0.0
44709	01989	19780626001	1987	SW24-45-20-4	URBAN	863440	148020	0	715420	0.0
44710	01989	19580514001	1987	SW24-45-20-4	URBAN	1233480	209690	0	1023790	0.0

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Table A3 Continued:
Battle River Basin – Alberta Licensed Surface Water Projects
Between Battle River below Pipestone Creek (05FA021) and Battle River near Forestburg (05FC001)
Node 4

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
23820	27593	19960731003	1997	SE13-43-18-4	WTLNDS	14800	0	14800	0	0.0
36125	14278	19700603008	1984	NE24-46-19-4	WTLNDS	7400	0	7400	0	0.0
36127	14276	19700603006	1983	SW28-45-19-4	WTLNDS	12330	0	12330	0	0.0
36142	14261	19690501005	1983	NE02-44-18-4	WTLNDS	45640	0	45640	0	0.0
					TOTAL	4931188	2194671	178277	2558240	203.7

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Table A3 Continued:
Battle River Basin – Alberta Licensed Surface Water Projects
Between Battle River near Forestburg (05FC001) and Forestburg Reservoir (FOR.RES)
Node 5

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
40473	09221	19880909003	1992	SW28-40-15-5	COOLING	974450	0	974450	0	0.0
40474	09221	19760827001	1983	SW28-40-15-4	COOLING	234373900	187480	4185200	230001220	0.0
40475	09221	19550324001	1983	SW28-40-15-4	COOLING	456388310	244220	8149600	447994490	0.0
34837	16092	19740312005	1982	NE15-40-18-4	CROP	96210	83880	0	12330	36.5
35040	15873	19740109001	1987	SE31-38-18-4	CROP	30840	24670	0	6170	11.9
36389	13961	19720411002	1973	SW23-39-19-4	CROP	53040	53040	0	0	17.5
37042	12964	19691223003	1970	NE35-39-17-4	CROP	76480	76480	0	0	24.9
37204	12753	19691208003	1973	NW01-38-17-4	CROP	382380	382380	0	0	249.7
38405	11546	19640108004	1980	NW12-40-17-4	CROP	18500	18500	0	0	8.9
78205	00078205	20020118003	2002	SW32-41-17-4	FEEDLT	7759	6874	885	0	0.0
185609	27044	19950201003	2002	NE08-40-17-4	FEEDLT	129510	129510	0	0	0.0
47806	85101	19970722002	1998	NW10-40-18-4	FISHERY	2000	0	2000	0	0.0
22456	48971	19960418001	1996	SE05-41-17-4	FLOODCNT	10	10	0	0	0.0
24511	26726	19940422002	1995	NE13-39-19-4	PRK	186240	151710	34530	0	36.6
34487	16581	19800208001	1982	SW06-39-19-4	RCRTN	18500	0	18500	0	0.0
22008	80100	19970127001	1997	NW07-39-17-4	STCKWT	56730	45630	11100	0	0.0
22453	48995	19960531001	1996	SW05-41-17-4	STCKWT	7420	6730	690	0	0.0
24216	27044	19950201003	1995	NE08-40-17-4	STCKWT	129510	104840	24670	0	0.0
25725	25657	19910904005	1993	SW29-39-17-4	STCKWT	25890	23430	2460	0	0.0
27797	23598	19890407001	1991	SE21-43-20-4	STCKWT	18510	16040	2470	0	0.0
31857	19393	19790720010	1979	SE12-39-19-4	STCKWT	8630	1230	7400	0	0.0
34806	16160	19840831007	1985	SE29-39-17-4	STCKWT	12340	9870	2470	0	0.0
36394	13957	19720412003	1972	SE15-38-17-4	STCKWT	9860	1230	8630	0	0.0
37581	12352	19871123002	1988	NW03-39-19-4	STCKWT	13570	13570	0	0	0.0
37582	12352	19860826001	1988	NW03-39-19-4	STCKWT	13570	13570	0	0	0.0
37626	12308	19680110005	1968	SW23-38-18-4	STCKWT	14800	1230	13570	0	0.0
37627	12307	19680115002	1970	SE12-39-19-4	STCKWT	12330	1230	11100	0	0.0
39248	10651	19611117004	1986	SW01-40-17-4	STCKWT	4930	1230	3700	0	0.0
40429	09282	19540325003	1976	NW30-37-16-4	STCKWT	4930	1230	3700	0	0.0
40430	09280	19540325002	1989	SW23-38-17-4	STCKWT	2460	1230	1230	0	0.0
42159	06679	19430820002	1975	SW05-39-16-4	STCKWT	18500	1230	17270	0	0.0
43031	05051	19381031002	1977	NE33-39-18-4	STCKWT	2460	1230	1230	0	0.0
155932	74998	19981218002	2001	SE04-40-18-4	STCKWT	8000	8000	0	0	0.0
159337	00159337	20010530001	2002	NW30-38-16-4	STCKWT	1250	1250	0	0	0.0
160545	00160545	20011113003	2002	SE31-43-20-4	STCKWT	1860	1860	0	0	0.0
184604	00184604	20010921004	2002	NE32-39-17-4	STCKWT	1922	1344	578	0	0.0
29338	22094	19860127004	1987	NE03-39-18-4	WTLNDS	45640	0	45640	0	0.0
34686	16313	19811009004	1984	NE28-41-18-4	WTLNDS	56740	0	56740	0	0.0
36112	14291	19700629005	1984	NE04-43-19-4	WTLNDS	16040	0	16040	0	0.0
36130	14273	19700603003	1985	SW03-43-19-4	WTLNDS	41940	0	41940	0	0.0
					TOTAL	693267961	1615958	13637793	678014210	385.9

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Upstream of Ribstone Creek near Edgerton (05FD001) - Node 6

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
24539	26697	19940222006	1995	SW20-40-07-4	CROP	2460	2460	0	0	2.1
26573	24968	19901228004	1991	NW18-40-07-4	CROP	4930	4930	0	0	2.3
33412	17881	19760930001	1979	SE25-36-09-4	CROP	197360	148020	49340	0	85.0
34633	16377	19740401005	1975	SW31-35-08-4	CROP	20970	20970	0	0	8.9
36422	13928	19720317013	1983	SW35-42-06-4	CROP	76480	76480	0	0	45.7
36423	13927	19720317012	1983	NW14-42-06-4	CROP	80170	78940	0	1230	34.4
36424	13926	19720317011	1983	SE14-42-06-4	CROP	83870	65370	0	18500	28.7
36425	13924	19720317010	1983	SE14-42-06-4	CROP	115940	86340	0	29600	37.8
36426	13923	19720317009	1983	SW13-42-06-4	CROP	182550	113480	0	69070	49.7
36427	13922	19720317008	1982	NE12-42-06-4	CROP	51810	48110	0	3700	21.0
36428	13921	19720317007	1983	SW32-41-05-4	CROP	59210	44410	0	14800	19.4
36430	13919	19720317006	1983	SW32-41-05-4	CROP	178860	134450	0	44410	58.6
36431	13918	19720317005	1983	NW30-41-05-4	CROP	374970	281230	0	93740	123.0
36432	13917	19720317004	1983	SW25-41-06-4	CROP	407050	407050	0	0	219.0
36433	13916	19720317003	1983	NE11-41-06-4	CROP	86340	86340	0	0	79.6
36435	13914	19720317002	1984	NW01-41-06-4	CROP	314530	235590	0	78940	103.2
36436	13913	19720317001	1983	SW10-44-04-4	CROP	131980	90040	0	41940	45.7
36559	13701	19720316001	1983	NW28-43-05-4	CROP	104840	65370	0	39470	28.7
36560	13700	19720316010	1983	NE09-44-04-4	CROP	76480	44410	0	32070	25.5
36561	13699	19720316009	1983	SE16-44-04-4	CROP	201050	191190	0	9860	83.8
36562	13698	19720316008	1983	NE17-44-04-4	CROP	154180	78940	0	75240	34.4
36563	13697	19720316007	1983	NW20-44-04-4	CROP	361410	182560	0	178850	79.6
36566	13695	19720316005	1983	SE25-44-05-4	CROP	98680	72780	0	25900	31.5
36567	13694	19720316004	1983	SW25-44-05-4	CROP	77710	57970	0	19740	25.5
36568	13693	19720316003	1973	SE26-44-05-4	CROP	86340	86340	0	0	28.3
36676	13538	19710913006	1983	SW26-44-05-4	CROP	64140	61670	0	2470	26.7
36677	13537	19710913005	1983	NE27-44-05-4	CROP	51810	51810	0	0	26.3
36678	13536	19710913004	1983	SE21-44-05-4	CROP	54270	54270	0	0	31.9
36679	13535	19710913003	1983	NW16-44-05-4	CROP	70310	70310	0	0	35.6
36680	13534	19710913002	1983	NW09-44-05-4	CROP	120880	118410	0	2470	51.7
40040	09781	19580212003	1965	SW26-40-06-4	CROP	98680	98680	0	0	32.3
40776	08757	19500902002	1983	SE27-36-11-4	CROP	30840	30840	0	0	4.9
43826	03538	19370428001	1986	NE01-38-09-4	CROP	23430	18500	0	4930	8.1
44942	01583	19720316002	1983	SE33-43-05-4	CROP	187490	187490	0	0	127.3
36522	13749	19750213001	1982	SE35-43-05-4	FISHERY	18500	0	18500	0	0.0
42558	06012	19770722003	1983	SW24-36-11-4	FISHERY	29600	0	29600	0	0.0
42559	06012	19401028001	1983	SW24-36-11-4	FISHERY	29600	0	29600	0	0.0
35450	15166	19730410003	1984	NE04-44-05-4	FLOODCNT	1020090	0	1020090	0	0.0
40031	09793	19580207002	1984	SW35-40-07-4	INJECTN	146790	6170	0	140620	0.0
31515	19844	19800523002	1985	NE26-43-05-4	STBLZTN	65370	0	65370	0	0.0

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Upstream of Ribstone Creek near Edgerton (05FD001) - Node 6

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
31907	19353	19790712003	1984	NW36-38-09-4	STBLZTN	178850	0	178850	0	0.0
26384	25120	19910201002	1991	NE17-36-10-4	STCKWT	7390	1230	6160	0	0.0
30770	20641	19600219002	1984	SW31-37-08-4	STCKWT	16030	1230	14800	0	0.0
30856	20550	19840201001	1984	SE10-38-10-4	STCKWT	12330	1230	11100	0	0.0
31403	19976	19800908005	1980	SE15-36-10-4	STCKWT	1240	620	620	0	0.0
31531	19823	19800508005	1982	NE02-38-09-4	STCKWT	2460	1230	1230	0	0.0
32086	19229	19790419005	1980	SW08-39-07-4	STCKWT	1240	620	620	0	0.0
32624	18710	19780725004	1978	NW31-36-09-4	STCKWT	4930	1230	3700	0	0.0
33235	18085	19770407001	1978	SW02-38-09-4	STCKWT	3700	1230	2470	0	0.0
35690	14657	19810401004	1982	SE32-36-09-4	STCKWT	4930	1230	3700	0	0.0
36370	13976	19721012001	1973	SW04-37-10-4	STCKWT	14790	1230	13560	0	0.0
36400	13952	19720425002	1972	SE19-36-09-4	STCKWT	1240	620	620	0	0.0
36401	13951	19720412001	1974	SE13-36-10-4	STCKWT	2460	1230	1230	0	0.0
36402	13950	19720411001	1982	SE29-37-09-4	STCKWT	1240	620	620	0	0.0
37006	13017	19860217001	1986	SE01-37-10-4	STCKWT	1240	620	620	0	0.0
37056	12944	19851126001	1985	SW11-37-10-4	STCKWT	12330	1230	11100	0	0.0
38477	11467	19630904005	1968	SE11-36-10-4	STCKWT	8630	1230	7400	0	0.0
38797	11134	19630226006	1982	SW26-38-09-4	STCKWT	3700	1230	2470	0	0.0
39232	10669	19630424002	1986	NE08-36-09-4	STCKWT	2460	1230	1230	0	0.0
39316	10579	19610922007	1984	NW09-40-07-4	STCKWT	99910	1230	98680	0	0.0
39352	10544	19610817001	1982	NW14-40-06-4	STCKWT	2460	1230	1230	0	0.0
39475	10418	19610130006	1982	NE02-37-09-4	STCKWT	2460	1230	1230	0	0.0
39630	10247	19600728001	1982	NE14-38-09-4	STCKWT	8630	1230	7400	0	0.0
39783	10080	19590817003	1988	SW01-39-07-4	STCKWT	12340	2470	9870	0	0.0
39869	09983	19590119002	1983	NW01-38-09-4	STCKWT	8630	1230	7400	0	0.0
39941	09897	19581017001	1960	SE02-38-09-4	STCKWT	4930	1230	3700	0	0.0
40008	09821	19580618001	1980	NE34-37-09-4	STCKWT	6160	1230	4930	0	0.0
40080	09739	19571007001	1975	NE11-37-10-4	STCKWT	4930	1230	3700	0	0.0
40093	09726	19571023002	1959	SE03-37-09-4	STCKWT	6160	1230	4930	0	0.0
40377	09355	19590707001	1988	SW10-37-09-4	STCKWT	1240	620	620	0	0.0
40464	09233	19590708001	1985	SW17-36-09-4	STCKWT	2460	1230	1230	0	0.0
40545	09128	19530129001	1987	SE20-37-09-4	STCKWT	2460	1230	1230	0	0.0
41128	08217	19590911002	1983	NW07-36-08-4	STCKWT	1240	620	620	0	0.0
41223	08059	19480225002	1984	SE26-36-11-4	STCKWT	3700	1230	2470	0	0.0
41225	08057	19471230001	1985	SE21-36-10-4	STCKWT	4930	1230	3700	0	0.0
41233	08043	19470823002	1985	NE06-37-09-4	STCKWT	7400	1230	6170	0	0.0
41234	08042	19470823001	1985	SE35-36-10-4	STCKWT	11100	1230	9870	0	0.0
41328	07890	19461217001	1948	NE17-37-10-4	STCKWT	2150	1230	920	0	0.0
41648	07438	19450731001	1984	NW36-38-07-4	STCKWT	2460	1230	1230	0	0.0
42128	06724	19490706001	1984	SW31-37-08-4	STCKWT	8630	1230	7400	0	0.0

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Upstream of Ribstone Creek near Edgerton (05FD001) - Node 6

APPROVAL ID	FILE NO.	EFFECTIV PRIORITY	DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
42824	05491	19390816001	1984	NW15-36-11-4	STCKWT	11100	1230	9870	0	0
42900	05329	19470726001	1980	SW19-36-08-4	STCKWT	12330	1230	11100	0	0
43028	05063	19381104002	1982	SW13-38-09-4	STCKWT	11100	1230	9870	0	0
43276	04567	19380603002	1983	NE18-36-10-4	STCKWT	3700	1230	2470	0	0
43602	03963	19370811001	1983	SW01-37-09-4	STCKWT	2460	1230	1230	0	0
43653	03850	19370719003	1982	NW20-37-09-4	STCKWT	2460	1230	1230	0	0
43902	03405	19370113001	1983	SW30-36-10-4	STCKWT	7400	1230	6170	0	0
43970	03287	19371019001	1982	SE09-37-10-4	STCKWT	8630	1230	7400	0	0
161019	00161019	20011227001	2002	NW04-38-07-4	STCKWT	395	395	0	0	0
161019	00161019	20011227003	2002	NW04-38-07-4	STCKWT	850	850	0	0	0
161019	00161019	20011227004	2002	NW04-38-07-4	STCKWT	360	360	0	0	0
161019	00161019	20011227005	2002	NW04-38-07-4	STCKWT	1050	1050	0	0	0
161019	00161019	20011227011	2002	NW04-38-07-4	STCKWT	930	930	0	0	0
161019	00161019	20011227012	2002	NW04-38-07-4	STCKWT	615	615	0	0	0
161019	00161019	20011227013	2002	NW04-38-07-4	STCKWT	310	310	0	0	0
161019	00161019	20011227014	2002	NW04-38-07-4	STCKWT	1300	1300	0	0	0
161019	00161019	20011227015	2002	NW04-38-07-4	STCKWT	975	975	0	0	0
161019	00161019	20011227016	2002	NW04-38-07-4	STCKWT	740	740	0	0	0
161019	00161019	20011227017	2002	NW04-38-07-4	STCKWT	370	370	0	0	0
161019	00161019	20011227018	2002	NW04-38-07-4	STCKWT	370	370	0	0	0
161019	00161019	20011227019	2002	NW04-38-07-4	STCKWT	370	370	0	0	0
24026	27238	19950410001	1995	SW32-41-05-4	WTLNDS	32070	0	32070	0	0
28728	22732-4	19870522004	1989	NE16-36-10-4	WTLNDS	23440	0	23440	0	0
28729	22732-4	19870522003	1989	NW16-36-10-4	WTLNDS	23100	0	23100	0	0
28730	22732-4	19870522002	1989	NW17-36-10-4	WTLNDS	20970	0	20970	0	0
36147	14255	19680426001	1984	NE06-36-08-4	WTLNDS	139380	0	139380	0	0
36564	13696	19890822002	1991	NE19-44-04-4	WTLNDS	399640	199820	149250	50570	87.41
36599	13647	19720315001	1984	NE07-43-05-4	WTLNDS	296040	0	296040	0	0
					TOTAL	7029995	3665155	2386720	978120	1733.39

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Downstream of Ribstone Creek near Edgerton (05FD001) - Node 7

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
28478	22975	19880215009	1988	SE03-40-13-4	COOPD	6170	6170	0	0	0.0
40628	09005	19510912001	1982	NW02-45-08-4	COOPD	5019030	762290	241760	4014980	0.0
24735	26520	19930914008	1995	NW08-41-09-4	CROP	386080	386080	0	0	101.2
24925	26318	19930319002	1993	SE27-43-11-4	CROP	2460	2460	0	0	1.9
25915	25507	19910801002	1994	NE28-43-13-4	CROP	4930	4930	0	0	2.0
26711	24838	19901009009	1991	SE12-42-10-4	CROP	272600	272600	0	0	67.0
26712	24837	19901009008	1991	NW12-42-10-4	CROP	40700	40700	0	0	10.1
26713	24836	19901009007	1991	NE12-42-10-4	CROP	124580	124580	0	0	30.5
26788	24760	19900824012	1995	SW28-39-15-4	CROP	80180	80180	0	0	19.6
26886	24670	19900627008	1992	NW19-38-13-4	CROP	28370	8630	0	19740	16.7
26929	24634	19900605012	1992	SW30-39-14-4	CROP	25900	25900	0	0	6.8
26930	24633	19900605016	1991	SW23-40-16-4	CROP	59200	29600	0	29600	19.4
26996	24566	19890726012	1990	NE35-39-11-4	CROP	35770	35770	0	0	16.8
27070	00142454	19900329002	1996	NW18-46-13-4	CROP	3700	3700	0	0	3.1
27687	23685	19890519001	1991	NW06-39-14-4	CROP	3700	3700	0	0	2.1
28184	23293	19901009003	1993	NE08-42-03-4	CROP	9860	9860	0	0	8.1
28390	23076	19880321006	1989	NE03-39-12-4	CROP	43170	43170	0	0	10.5
28479	22974	19880215007	1989	SE27-39-15-4	CROP	45640	45640	0	0	11.5
28624	22849	19871008007	1994	SW26-45-02-4	CROP	43170	43170	0	0	10.5
29204	22243	19860324008	1989	SW03-39-15-4	CROP	7400	4930	0	2470	2.1
29343	22088	19860114004	1990	NW11-39-15-4	CROP	4930	4930	0	0	3.4
30116	21287	19840507002	1987	NW18-44-11-4	CROP	224490	224490	0	0	55.0
30448	20966	19351231002	1975	NW32-36-13-4	CROP	189960	189960	0	0	62.2
30586	20833	19830829012	1991	SE18-41-09-4	CROP	119650	119650	0	0	36.3
30682	20729	19830607010	1983	SW09-43-09-4	CROP	138150	138150	0	0	45.3
30685	20726	19830607018	1985	SW05-43-09-4	CROP	54270	54270	0	0	18.0
30730	20681	19830509006	1983	SE30-46-06-4	CROP	53040	53040	0	0	17.4
31005	20386	19820614004	1989	NE10-38-12-4	CROP	43170	43170	0	0	12.0
33172	18160	19770525003	1981	NE10-40-10-4	CROP	38240	38240	0	0	11.5
33294	18024	19770303008	1980	NE05-40-14-4	CROP	13570	13570	0	0	5.9
33599	17690	19760602012	1990	NW18-39-16-4	CROP	20970	9870	0	11100	4.5
33883	17364	19840831008	1990	NE08-39-14-4	CROP	1230	1230	0	0	3.6
34165	17018	19750210010	1980	NE32-37-13-4	CROP	16030	11100	0	4930	4.7
34179	17004	19750210011	1984	SE10-39-14-4	CROP	9870	6170	0	3700	2.7
34737	16250	19700609001	1982	NE17-37-12-4	CROP	4930	4930	0	0	10.2
35758	14597	19690425002	1969	SW02-40-13-4	CROP	43170	43170	0	0	15.0
36596	13650	19720328001	1973	SE01-42-10-4	CROP	171450	171450	0	0	56.2
36597	13649	19710901002	1971	NW06-42-09-4	CROP	67840	67840	0	0	33.3
36646	13576	19710914002	1971	NW28-39-14-4	CROP	11100	11100	0	0	3.6
36723	13439	19710302002	1972	NE10-40-16-4	CROP	66610	66610	0	0	21.8

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Downstream of Ribstone Creek near Edgerton (05FD001) - Node 7

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
37420	12508	19681015001	1969	SW33-39-14-4	CROP	24670	24670	0	0	8.5
37583	12351	19680320001	1982	SW09-40-15-4	CROP	12330	12330	0	0	6.1
37799	12149	19661007001	1967	NE08-40-15-4	CROP	37000	37000	0	0	12.5
38155	11792	19641116006	1965	SW33-38-13-4	CROP	14800	14800	0	0	4.9
38393	11558	19640108005	1982	SE35-38-14-4	CROP	19730	14800	0	4930	6.5
38406	11545	19631118003	1964	NW07-40-15-4	CROP	12330	12330	0	0	4.3
38604	11335	19630524004	1965	NE27-48-06-4	CROP	37000	37000	0	0	12.1
38607	11332	19630502001	1968	SW04-39-13-4	CROP	22700	22700	0	0	11.2
38647	11293	19630225003	1975	SE18-40-15-4	CROP	12330	8630	0	3700	4.0
39031	10888	19620621003	1964	SE26-37-14-4	CROP	43170	43170	0	0	20.6
39082	10840	19620523001	1994	NE16-43-10-4	CROP	80180	80180	0	0	47.7
39844	10013	19840810008	1985	NW11-43-10-4	CROP	78940	78940	0	0	19.4
40175	09619	19561227001	1970	NW08-39-13-4	CROP	64140	64140	0	0	21.0
40359	09382	19541206001	1984	NE36-36-14-4	CROP	19740	19740	0	0	19.6
40469	09228	19550301001	1983	SE12-38-14-4	CROP	37000	37000	0	0	29.8
40677	08915	19510502001	1982	NE01-37-14-4	CROP	37000	37000	0	0	29.5
40807	08718	19500714001	1986	NE06-41-03-4	CROP	30840	19740	0	11100	8.4
41115	08238	19680904003	1982	SW09-40-14-4	CROP	25900	25900	0	0	17.0
43010	05116	19381215002	1985	SE29-39-13-4	CROP	11100	11100	0	0	11.8
43084	04949	19380912002	1981	NE28-39-13-4	CROP	13570	9870	0	3700	4.5
39623	10254	19600530001	1980	SW36-37-13-4	FISHERY	30840	0	30840	0	0.0
30044	21367	19811216001	1985	NE01-40-16-4	FLOODCNT	10	10	0	0	0.0
30110	21293	19840511003	1985	NW12-40-16-4	FLOODCNT	120	120	0	0	0.0
30559	20849	19830921001	1985	NE01-40-16-4	FLOODCNT	10	10	0	0	0.0
37421	12507	19710618001	1973	NW09-40-14-4	FLOODCNT	10	10	0	0	0.0
36515	13759	19850819001	1986	SW19-47-04-4	INJECTN	8630	8630	0	0	0.0
37170	12796	19720602001	1973	NW06-39-11-4	INJECTN	2466960	2466960	0	0	0.0
37171	12796	19710830003	1973	NW06-39-11-4	INJECTN	986790	986790	0	0	0.0
37172	12796	19690819002	1973	NW06-39-11-4	INJECTN	1480180	1480180	0	0	0.0
37819	12128	19660823001	1986	SE25-42-10-4	INJECTN	61670	61670	0	0	0.0
24326	26923	19940913003	1995	NW29-46-06-4	PRK	9860	8630	1230	0	1.9
40380	09351	19541008001	1985	NE22-43-14-4	RCRTN	17270	0	17270	0	0.0
49734	24929	19971001002	1998	SE13-47-06-4	SNOW/ICE	51000	50000	1000	0	0.0
27096	24495	19900316003	1991	NE16-45-02-4	STBLZTN	128280	0	128280	0	0.0
28210	23264	19880908003	1991	NE21-38-11-4	STBLZTN	1253210	0	1253210	0	0.0
34933	15945	19830218004	1984	NW20-49-07-4	STBLZTN	44410	0	44410	0	0.0
22006	80120	19970224001	1997	NW24-44-02-4	STCKWT	300	190	110	0	0.0
22138	52283	19950328013	1995	NW29-49-07-4	STCKWT	1220	610	610	0	0.0
22139	52282	19950328012	1995	NE29-49-07-4	STCKWT	2460	1230	1230	0	0.0
22140	52281	19950328011	1995	SW28-49-07-4	STCKWT	1220	610	610	0	0.0

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Downstream of Ribstone Creek near Edgerton (05FD001) - Node 7

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
22472	48763	19950222002	1995	SW06-41-16-4	STCKWT	3690	1230	2460	0	0.0
22473	48758	19950217004	1995	NE03-39-14-4	STCKWT	6250	2150	4100	0	0.0
22475	48733	19950103005	1995	SE22-38-14-4	STCKWT	3690	610	3080	0	0.0
22480	48656	19940804001	1995	NE24-38-15-4	STCKWT	2460	1230	1230	0	0.0
24783	26480	19930730004	1995	SE10-39-15-4	STCKWT	4930	1230	3700	0	0.0
26833	24713	19900711006	1991	SE07-39-16-4	STCKWT	7400	7400	0	0	0.0
28194	23284	19880927002	1991	SE27-39-15-4	STCKWT	4930	1230	3700	0	0.0
29038	22417	19861119001	1986	SE23-44-01-4	STCKWT	12330	1230	11100	0	0.0
29534	21877	19460227001	1986	NW32-38-15-4	STCKWT	6160	1230	4930	0	0.0
29970	21444	19841001002	1984	NW15-45-08-4	STCKWT	4930	1230	3700	0	0.0
30161	21236	19840403013	1984	SE14-38-14-4	STCKWT	1240	620	620	0	0.0
30264	21146	19840228008	1984	SE10-47-05-4	STCKWT	1240	620	620	0	0.0
30519	20895	19831101007	1986	SE05-41-03-4	STCKWT	1240	620	620	0	0.0
30772	20639	19840201005	1984	SW01-42-17-4	STCKWT	1240	620	620	0	0.0
30774	20637	19840201004	1984	SW01-42-17-4	STCKWT	4930	1230	3700	0	0.0
30841	20568	19840117001	1984	NW07-39-15-4	STCKWT	4930	1230	3700	0	0.0
30852	20556	19840201003	1984	SE10-45-03-4	STCKWT	1240	620	620	0	0.0
30855	20552	19840117002	1984	NE06-39-15-4	STCKWT	3700	1230	2470	0	0.0
31313	20072	19830301005	1983	NE31-38-14-4	STCKWT	3700	1230	2470	0	0.0
31423	19950	19861124003	1986	SW16-45-07-4	STCKWT	2460	1230	1230	0	0.0
31572	19756	19800319002	1981	SE13-38-14-4	STCKWT	2460	1230	1230	0	0.0
32875	18482	19780303001	1980	NW18-39-13-4	STCKWT	3700	1230	2470	0	0.0
33681	17612	19760329003	1976	SE16-38-14-4	STCKWT	2460	1230	1230	0	0.0
34108	17078	19750320007	1980	SW22-39-15-4	STCKWT	23430	1230	22200	0	0.0
34707	16282	19810910008	1982	SW21-45-07-4	STCKWT	2460	1230	1230	0	0.0
34710	16279	19810910001	1981	SE33-45-04-4	STCKWT	6160	1230	4930	0	0.0
34712	16277	19810910006	1981	NE30-47-04-4	STCKWT	2460	1230	1230	0	0.0
35170	15686	19870220002	1987	SW21-39-13-4	STCKWT	4930	1230	3700	0	0.0
35270	15483	19870220001	1987	NE29-38-13-4	STCKWT	2460	1230	1230	0	0.0
35688	14659	19810402003	1983	SW09-39-15-4	STCKWT	4930	1230	3700	0	0.0
35892	14448	19910201007	1991	NE03-37-13-4	STCKWT	9860	1230	8630	0	0.0
35905	14430	19861107001	1986	NE14-44-01-4	STCKWT	25900	1230	24670	0	0.0
35911	14422	19870312013	1987	SE23-39-12-4	STCKWT	14800	1230	13570	0	0.0
35934	14396	19720907004	1972	SW04-38-13-4	STCKWT	12330	1230	11100	0	0.0
36032	14357	19710223002	1987	SW20-37-12-4	STCKWT	7400	1230	6170	0	0.0
36393	13958	19720412002	1973	NE27-37-14-4	STCKWT	2460	1230	1230	0	0.0
36782	13318	19720915002	1983	SW27-39-13-4	STCKWT	2460	1230	1230	0	0.0
36795	13298	19710125001	1971	NW11-38-12-4	STCKWT	71540	1230	70310	0	0.0
36809	13284	19701221001	1971	SW23-39-14-4	STCKWT	2460	1230	1230	0	0.0
37277	12678	19690317001	1969	SW02-40-13-4	STCKWT	9860	1230	8630	0	0.0

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Downstream of Ribstone Creek near Edgerton (05FD001) - Node 7

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
37551	12380	19680425003	1982	SW19-39-11-4	STCKWT	6160	1230	4930	0	0.0
37822	12124	19660930002	1968	SE32-39-13-4	STCKWT	4930	1230	3700	0	0.0
37823	12123	19660823002	1966	NE34-38-15-4	STCKWT	4930	1230	3700	0	0.0
37837	12109	19660726005	1976	NE15-39-15-4	STCKWT	4930	1230	3700	0	0.0
38180	11767	19640923001	1987	SW19-46-03-4	STCKWT	1240	620	620	0	0.0
38378	11574	19640626001	1986	NW26-37-13-4	STCKWT	4930	1230	3700	0	0.0
38379	11573	19851204001	1985	NW27-39-13-4	STCKWT	2460	1230	1230	0	0.0
38491	11454	19630807001	1967	SW05-47-14-4	STCKWT	3700	1230	2470	0	0.0
38651	11288	19630226008	1983	SW14-47-04-4	STCKWT	2460	1230	1230	0	0.0
39179	10734	19620201002	1986	NW14-39-15-4	STCKWT	2460	1230	1230	0	0.0
39205	10697	19620123001	1983	NE22-37-14-4	STCKWT	4930	1230	3700	0	0.0
39227	10673	19611221005	1983	SW34-44-03-4	STCKWT	12330	1230	11100	0	0.0
39228	10672	19611207001	1986	SE04-38-12-4	STCKWT	7400	1230	6170	0	0.0
39336	10560	19610925007	1982	NE02-47-05-4	STCKWT	2460	1230	1230	0	0.0
39344	10552	19610913004	1983	SE32-46-05-4	STCKWT	1240	620	620	0	0.0
39345	10551	19610913003	1983	NW33-46-05-4	STCKWT	3700	1230	2470	0	0.0
39576	10305	19600726001	1982	SE08-38-14-4	STCKWT	2460	1230	1230	0	0.0
39648	10224	19600317002	1982	NE21-43-09-4	STCKWT	1240	620	620	0	0.0
39771	10091	19590911001	1982	NW21-40-14-4	STCKWT	1240	620	620	0	0.0
39774	10088	19840228003	1984	SE22-45-03-4	STCKWT	2460	1230	1230	0	0.0
39825	10036	19590625001	1986	NE06-40-10-4	STCKWT	2460	1230	1230	0	0.0
39831	10030	19590702003	1986	SE22-40-15-4	STCKWT	1240	620	620	0	0.0
39833	10028	19590611001	1986	NW34-39-13-4	STCKWT	2460	1230	1230	0	0.0
39834	10026	19590709001	1987	NW28-38-13-4	STCKWT	4930	1230	3700	0	0.0
39839	10020	19590608001	1986	NW09-40-15-4	STCKWT	7400	1230	6170	0	0.0
39864	09989	19590209001	1979	SW02-39-15-4	STCKWT	1240	620	620	0	0.0
39942	09896	19581001001	1981	SE20-49-07-4	STCKWT	2460	1230	1230	0	0.0
39989	09844	19580722001	1982	SE07-48-05-4	STCKWT	4930	1230	3700	0	0.0
39995	09838	19580717001	1982	NE20-38-13-4	STCKWT	2460	1230	1230	0	0.0
39996	09837	19580708001	1960	NW16-37-12-4	STCKWT	18500	1230	17270	0	0.0
40065	09755	19580102001	1985	NE19-39-11-4	STCKWT	1240	620	620	0	0.0
40184	09607	19561107002	1982	NW12-43-11-4	STCKWT	2460	1230	1230	0	0.0
40450	09255	19531214001	1984	NE13-37-12-4	STCKWT	9860	1230	8630	0	0.0
40498	09199	19530810003	1982	SE09-38-13-4	STCKWT	4930	1230	3700	0	0.0
40511	09181	19530618001	1982	SW11-42-11-4	STCKWT	2460	1230	1230	0	0.0
40640	08986	19510823001	1983	SW28-36-13-4	STCKWT	12330	1230	11100	0	0.0
40744	08802	19501021001	1982	NW32-39-13-4	STCKWT	3700	1230	2470	0	0.0
40778	08755	19500830001	1983	SE33-39-13-4	STCKWT	7400	1230	6170	0	0.0
40836	08658	19500628002	1982	SE10-38-13-4	STCKWT	1240	620	620	0	0.0
40853	08612	19500525001	1982	NW11-48-05-4	STCKWT	9860	1230	8630	0	0.0

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Downstream of Ribstone Creek near Edgerton (05FD001) - Node 7

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
40860	08604	19500523002	1982	NE07-39-14-4	STCKWT	3700	1230	2470	0	0.0
40955	08454	19491015002	1988	NW33-39-15-4	STCKWT	2460	1230	1230	0	0.0
41026	08348	19490514001	1950	SW02-40-14-4	STCKWT	6160	1230	4930	0	0.0
41057	08308	19490226001	1951	NE14-37-12-4	STCKWT	14800	1230	13570	0	0.0
41071	08289	19490628002	1982	SE09-37-13-4	STCKWT	3700	1230	2470	0	0.0
41075	08281	19481228001	1985	NE35-39-11-4	STCKWT	17270	1230	16040	0	0.0
41197	08100	19611011003	1982	NW19-37-12-4	STCKWT	6160	1230	4930	0	0.0
41198	08099	19490824001	1981	NW06-38-12-4	STCKWT	8630	1230	7400	0	0.0
41221	08064	19500629001	1982	SE34-37-13-4	STCKWT	1240	620	620	0	0.0
41241	08031	19510327002	1982	SW16-39-15-4	STCKWT	3700	1230	2470	0	0.0
41273	07980	19470611001	1983	SE16-40-13-4	STCKWT	4930	1230	3700	0	0.0
41282	07960	19480423002	1949	SW14-39-16-4	STCKWT	12330	1230	11100	0	0.0
41303	07931	19470204001	1985	SW21-37-12-4	STCKWT	1240	620	620	0	0.0
41308	07924	19461224001	1983	NW28-37-12-4	STCKWT	2460	1230	1230	0	0.0
41309	07923	19470103001	1982	NW24-43-02-4	STCKWT	1240	620	620	0	0.0
41314	07917	19461206002	1982	NE17-37-12-4	STCKWT	1240	620	620	0	0.0
41350	07855	19461001002	1982	SW15-38-13-4	STCKWT	3700	1230	2470	0	0.0
41373	07813	19460906001	1982	NE19-46-03-4	STCKWT	3700	1230	2470	0	0.0
41439	07714	19460706004	1987	SE32-37-12-4	STCKWT	3700	1230	2470	0	0.0
41446	07700	19460704003	1982	NW09-38-13-4	STCKWT	6160	1230	4930	0	0.0
41448	07698	19460717002	1982	SE03-39-15-4	STCKWT	3700	1230	2470	0	0.0
41451	07694	19460702001	1985	NE28-39-14-4	STCKWT	1240	620	620	0	0.0
41495	07638	19591002002	1984	SE33-38-13-4	STCKWT	8630	1230	7400	0	0.0
41531	07588	19460304002	1982	SW05-37-13-4	STCKWT	4930	1230	3700	0	0.0
41538	07579	19460220002	1985	NW29-38-15-4	STCKWT	18500	1230	17270	0	0.0
41665	07416	19450718004	1982	NE31-38-11-4	STCKWT	3700	1230	2470	0	0.0
41845	07150	19440921001	1977	NE17-38-13-4	STCKWT	2460	1230	1230	0	0.0
41896	07072	19440814001	1989	SE24-38-14-4	STCKWT	7400	1230	6170	0	0.0
41898	07066	19440805003	1975	NW17-39-14-4	STCKWT	3700	1230	2470	0	0.0
41901	07063	19440801003	1982	NW10-38-13-4	STCKWT	1240	620	620	0	0.0
41903	07061	19440727003	1982	NW11-38-14-4	STCKWT	1240	620	620	0	0.0
41904	07058	19440729002	1982	NW28-37-13-4	STCKWT	2460	1230	1230	0	0.0
41906	07056	19440728001	1982	NE31-38-14-4	STCKWT	3700	1230	2470	0	0.0
41910	07052	19440726001	1983	SE34-37-14-4	STCKWT	2460	1230	1230	0	0.0
41926	07026	19440704001	1982	SE08-46-14-4	STCKWT	3700	1230	2470	0	0.0
42020	06883	19440126001	1975	NW25-38-16-4	STCKWT	7400	1230	6170	0	0.0
42146	06696	19430624002	1985	SE16-39-15-4	STCKWT	2460	1230	1230	0	0.0
42200	06620	19421119002	1982	SE25-45-14-4	STCKWT	3700	1230	2470	0	0.0
42230	06578	19420916001	1980	SE26-37-13-4	STCKWT	6160	1230	4930	0	0.0
42245	06552	19420731002	1983	SW03-50-05-4	STCKWT	3700	1230	2470	0	0.0

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Downstream of Ribstone Creek near Edgerton (05FD001) - Node 7

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
42258	06529	19421029002	1982	SE16-38-12-4	STCKWT	2460	1230	1230	0	0.0
42309	06425	19420420002	1982	NW12-39-14-4	STCKWT	2460	1230	1230	0	0.0
42326	06382	19420212002	1983	SW29-39-13-4	STCKWT	1240	620	620	0	0.0
42362	06317	19411126001	1982	NE13-39-14-4	STCKWT	2460	1230	1230	0	0.0
42371	06302	19411219001	1987	NE21-36-13-4	STCKWT	3700	1230	2470	0	0.0
42393	06259	19450102002	1984	NW22-37-13-4	STCKWT	1240	620	620	0	0.0
42607	05924	19401120001	1982	NW35-37-13-4	STCKWT	4930	1230	3700	0	0.0
42639	05865	19400130001	1982	SE07-39-13-4	STCKWT	12330	1230	11100	0	0.0
42799	05560	19390906001	1982	SW31-44-01-4	STCKWT	1240	620	620	0	0.0
42801	05548	19391030002	1982	NE30-40-13-4	STCKWT	3700	1230	2470	0	0.0
42915	05303	19390612007	1940	NW10-40-15-4	STCKWT	6160	1230	4930	0	0.0
42928	05275	19390525002	1982	NE04-38-14-4	STCKWT	2460	1230	1230	0	0.0
42929	05274	19390529004	1980	NW36-39-14-4	STCKWT	8630	1230	7400	0	0.0
43045	05032	19381017003	1986	NW08-42-12-4	STCKWT	1240	620	620	0	0.0
43046	05031	19381012002	1982	SE07-42-12-4	STCKWT	1240	620	620	0	0.0
43148	04826	19450816001	1982	NE24-37-13-4	STCKWT	3700	1230	2470	0	0.0
43201	04717	19391018003	1982	NW13-38-14-4	STCKWT	1240	620	620	0	0.0
43207	04709	19390919001	1983	NW33-37-14-4	STCKWT	3700	1230	2470	0	0.0
43213	04694	19380616003	1982	SE06-39-14-4	STCKWT	7400	1230	6170	0	0.0
43214	04691	19380606002	1984	SW22-38-14-4	STCKWT	1240	620	620	0	0.0
43243	04637	19380425005	1982	NW14-38-14-4	STCKWT	1240	620	620	0	0.0
43296	04538	19380205001	1982	SW02-38-13-4	STCKWT	2460	1230	1230	0	0.0
43369	04415	19371230001	1982	SE31-39-13-4	STCKWT	4930	1230	3700	0	0.0
43375	04398	19371203001	1986	NW28-39-13-4	STCKWT	1240	620	620	0	0.0
43527	04116	19370908003	1987	SW20-37-12-4	STCKWT	4930	1230	3700	0	0.0
43692	03777	19370722004	1982	SE32-40-14-4	STCKWT	7400	1230	6170	0	0.0
43694	03771	19370708001	1982	NE30-37-11-4	STCKWT	6160	1230	4930	0	0.0
43805	03575	19370515001	1982	NE33-37-12-4	STCKWT	2460	1230	1230	0	0.0
44039	03187	19360926001	1938	SW05-39-14-4	STCKWT	37000	1230	35770	0	0.0
162204	00162204	20020103004	2002	SW09-47-05-4	STCKWT	1700	1700	0	0	0.0
185489	00182579	20020116003	2002	NW30-48-05-4	STCKWT	500	350	150	0	0.0
191727	00186689	20020613003	2002	SW20-40-16-4	STCKWT	1150	1150	0	0	0.0
29795	21627	19850222006	1987	NW02-45-08-4	URBAN	1726880	155420	172690	1398770	0.0
38630	11309	19630625005	1985	SW10-40-13-4	URBAN	74020	9870	23440	40710	0.0
39799	10061-3	19870715004	1988	SW30-46-13-4	URBAN	209690	85110	0	124580	0.0
39800	10061-3	19800818001	1988	SW30-46-13-4	URBAN	337980	12340	61670	263970	0.0
40837	08655	19520125001	1983	SW02-38-14-4	URBAN	246690	18500	61670	166520	0.0
23818	27599	19960716002	1998	SW18-49-05-4	WTLNDS	8630	0	8630	0	0.0
25366	25935	19920526007	1995	NW01-46-14-4	WTLNDS	34530	0	34530	0	0.0
25541	25794	19920228001	1995	SE15-46-14-4	WTLNDS	22200	0	22200	0	0.0

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Forestburg Reservoir (FOR.RES) and Battle River near the Sask Boundary (05FE004)

Downstream of Ribstone Creek near Edgerton (05FD001) - Node 7

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
28334	23131	19880512001	1989	NE20-38-14-4	WTLNDS	22200	0	22200	0	0.0
28483	22969	19880208005	1990	SE26-41-13-4	WTLNDS	44410	0	44410	0	0.0
28527	22923	19880106001	1990	SE11-41-04-4	WTLNDS	48110	0	48110	0	0.0
28589	22884	19871119001	1989	NE28-43-13-4	WTLNDS	171450	0	171450	0	0.0
28675	22792	19870804001	1990	SE15-39-16-4	WTLNDS	59200	1230	57970	0	0.0
28870	22589	19870126004	1988	SW29-38-15-4	WTLNDS	22200	0	22200	0	0.0
29254	22184	19860228003	1988	SE21-39-12-4	WTLNDS	27140	0	27140	0	0.0
29640	21779	19850509004	1987	SE13-43-14-4	WTLNDS	40710	0	40710	0	0.0
29882	21534	19841218001	1986	NW23-41-13-4	WTLNDS	527930	0	527930	0	0.0
30298	21116	19840220001	1985	NE20-43-13-4	WTLNDS	416920	0	416920	0	0.0
30446	20968	19831201001	1984	NE14-43-04-4	WTLNDS	103610	0	103610	0	0.0
30895	20509	19821021002	1984	NE11-48-06-4	WTLNDS	43170	0	43170	0	0.0
31028	20360	19820527001	1984	NE24-42-12-4	WTLNDS	17270	0	17270	0	0.0
31200	20189	19830405002	1984	SE02-49-09-4	WTLNDS	129520	0	129520	0	0.0
31547	19792	19800410001	1987	NE18-47-14-4	WTLNDS	51810	0	51810	0	0.0
31654	19621	19851031003	1988	NE17-45-09-4	WTLNDS	107310	0	107310	0	0.0
34256	16940	19861031001	1988	NE31-41-12-4	WTLNDS	117180	0	117180	0	0.0
34989	15904	19830208011	1984	NW11-43-10-4	WTLNDS	1255680	64140	503260	688280	27.9
35713	14643	19810323001	1984	NE28-49-07-4	WTLNDS	727750	0	727750	0	0.0
36348	14020	19390928001	1984	SE25-47-15-4	WTLNDS	50570	0	50570	0	0.0
36456	13884	19720405001	1983	SE26-45-14-4	WTLNDS	66610	0	66610	0	0.0
72639	85325	19980716002	1999	NW29-48-04-4	WTLNDS	36000	0	36000	0	0.0
72639	85325	19980716003	1999	NW29-48-04-4	WTLNDS	13000	0	13000	0	0.0
72639	85325	19980716004	1999	NW29-48-04-4	WTLNDS	14000	14000	0	0	0.0
72639	85325	19980716006	1999	NW29-48-04-4	WTLNDS	17000	0	17000	0	0.0
73287	69771	19990415001	2000	SE25-37-12-4	WTLNDS	42000	0	42000	0	0.0
					TOTAL	22370940	9419550	6158610	6792780	1091.6

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Table A3 Continued:
Battle River Basin - Alberta Licensed Surface Water Projects
Between Battle River near the Sask Boundary (05FE004) and Battle River near Unwin (05FE001)
(Node 8)

APPROVAL ID	FILE NO.	PRIORITY	EFFECTIVE DATE	LEGAL LOCATION	SPECIFIC	QUANTITY (cm)	CONS (cm)	LOSSES (cm)	RETURN (cm)	IRRIGATED AREA (ha)
37241	12712-A	19660708001	1985	SW24-49-02-4	FLOODCNT	10	10	0	0	0.0
28173	23303	19881012002	1988	NW35-49-02-4	STCKWT	8630	1230	7400	0	0.0
39342	10554	19610908002	1986	SW13-49-02-4	STCKWT	1240	620	620	0	0.0
35736	14623	19810318001	1984	SE19-48-01-4	WTLNDS	172690	0	172690	0	0.0
					TOTAL	182570	1860	180710	0	0.0

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Table A4: Surface Water Licence Dataset Duplicate Approval IDs
(duplicate entries represent changes to existing licenses)

No.	Apv Id	Specific	Priority	Quantity (cm)	Cons (cm)	Losses (cm)	Return (cm)	Irr Area (ha)
1	28728	WTLNDS	19870522004	23,440	0	23,440	0	0
2	28728	WTLNDS	19870522004	23,440	0	23,440	0	0
3	28729	WTLNDS	19870522003	23,100	0	23,100	0	0
4	28729	WTLNDS	19870522003	23,100	0	23,100	0	0
5	28730	WTLNDS	19870522002	20,970	0	20,970	0	0
6	28730	WTLNDS	19870522002	20,970	0	20,970	0	0
7	31240	CROP	19870603004	646,340	140,620	0	505,720	108
8	31240	CROP	19870603004	646,340	140,620	0	505,720	108
9	31241	WTLNDS	19870603003	172,690	0	172,690	0	0
10	31241	WTLNDS	19870603003	172,690	0	172,690	0	0
11	36720	STCKWT	19861027007	1,240	620	620	0	0
12	39799	URBAN	19870715004	209,690	85,110	0	124,580	0
13	39800	URBAN	19800818001	337,980	12,340	61,670	263,970	0
14	144939	STCKWT	19970415003	3,700	3,700	0	0	0
15	191203	STCKWT	20020411003	1,400	674	726	0	0
			Total	2,327,090	383,684	543,416	1,399,990	215
Note:	AE require a unique Priority for each valid Approval ID							
	The above are duplicate Priority Numbers listed in Battle.xls:noncancelled lic							
	C:\HYD\Studies\Battle.River.Natural.Flow\Water.Demands\[EDA.Aproval.IDs.5.xls]Duplicates							

EDA.Aproval.IDs.5.xls

Table A5: Specific Purpose File Structure

GROUP	FILE	SPECIFIC(S)				
1	AGGWSH.2.xls	AGGWSH	CNSTRCT			
2	CROP.2A.xls	CROP	PRK			
3	CROP.2B.xls	CROP	RCRTN	GLFCRS		
4	STCKWT.2.xls	STCKWT	STBLZTN	FEEDLT	GRDN	SRWILD
5	SNOW.ICE.2.xls	SNOW/ICE				
6	FISHERY.2A.xls	FISHERY				
7	FISHERY.2B.xls	FISHERY				
8	WTLNDS.2.xls	WTLNDS				
9	WTLNDS.2B.xls	WTLNDS				
10	INJECTN.2.xls	INJECTN				
11	OTHER.2.xls	OTHR				
12	REMAIN.2.xls	COOLING	COOPD	URBAN	FLOODCNT	

EDA.Aproval.IDs.5.xls!Water.Use.Array.Export

Table A6: Licensed Surface Water Projects

GROUP	QUANTITY (cu.m)	CONS (cu.m)	LOSSES (cu.m)	RETURN (cu.m)	IRR.AREA (ha)	COUNT
1	129,960	100,350	29,610	0	0	4
2	10,873,450	9,274,930	159,100	1,439,420	3,816	132
3	225,848	119,977	105,871	0	0	11
4	6,264,606	741,717	5,522,889	0	9	329
5	51,000	50,000	1,000	0	0	1
6	184,550	49,340	135,210	0	0	8
8	6,401,970	286,930	5,376,190	738,850	115	51
10	6,826,090	6,826,090	0	0	0	5
11	395,940	342,900	3,700	49,340	2	4
12	706,933,340	3,578,490	14,941,140	688,413,710	15	26
TOTAL	738,286,754	21,370,724	26,274,710	690,641,320	3,958	571
	31,353,414	TOTAL LESS GROUP 12				

EDA.Aproval.IDs.5.xls!Water.Use.Array.Export

Table A7: Battle River Basin Surface Water Uses by Node and Specific Group (m^3)

	TOTAL								
	LICENSED	BATTLE RIVER BASIN WATER DEMAND NODES (EXCEL FILE)							
SPECIFIC GROUP	QUANTITY	05FA001.1.xls	05FA012.2.xls	05FA021.3.xls	05FC001.4.xls	FOR.RES.5.xls	05FD001.6.xls	05FE004.7.xls	05FE001.8.xls
(EXCEL FILE)	(cu.m)	(cu.m)	(cu.m)	(cu.m)	(cu.m)	(cu.m)	(cu.m)	(cu.m)	(cu.m)
AGGWSH.2.xls	129,960	86,340	0	18,950	24,670	0	0	0	0
CROP.2A.xls	10,873,450	1,099,010	360,170	440,350	743,800	843,690	4,232,020	3,154,410	0
CROP.2B.xls	225,848	71,000	0	0	119,078	18,500	0	17,270	0
STCKWT.2.xls	6,264,606	629,380	1,370,790	834,820	39,780	506,741	618,755	2,254,470	9,870
SNOW.ICE.2.xls	51,000	0	0	0	0	0	0	51,000	0
FISHERY.2A.xls	184,550	20,970	49,340	3,700	0	2,000	77,700	30,840	0
FISHERY.2B.xls	0	0	0	0	0	0	0	0	0
WTLNDS.2.xls	6,401,970	754,000	0	62,000	80,170	160,360	934,640	4,238,110	172,690
WTLNDS.2B.xls	0	0	0	0	0	0	0	0	0
INJECTN.2.xls	6,826,090	0	0	1,275,420	616,740	0	0	4,933,930	0
OTHER.2.xls	395,940	333,040	4,930	49,340	8,630	0	0	0	0
REMAIN.2.xls	706,933,340	740,090	0	2,517,550	3,298,320	691,736,670	1,020,090	7,620,610	10
TOTAL	738,286,754	3,733,830	1,785,230	5,202,130	4,931,188	693,267,961	6,883,205	22,300,640	182,570

Summary.2.xls <- Load left column files first to display above table summary

Table A8: Oil Injection Licensed Surface Water Projects Within the Battle River EDA

Apv Id	txtFileNo	Specific	Source	Priority	Quantity	Cons	Losses	Return
00040031	09793	INJECTN	Shorncliffe Lake	19580207002	146790	6170	0	140620
00031721	19527	INJECTN	Coal Lake	19881209007	485990	485990	0	0
00031722	19527	INJECTN	Coal Lake	19791116001	1275420	1275420	0	0
00037819	12128	INJECTN	Battle River	19660823001	61670	61670	0	0
00036515	13759	INJECTN	Battle River	19850819001	8630	8630	0	0
00037171	12796	INJECTN	Battle River	19710830003	986790	986790	0	0
00037172	12796	INJECTN	Battle River	19690819002	1480180	1480180	0	0
00037170	12796	INJECTN	Battle River	19720602001	2466960	2466960	0	0
00037936	12015	INJECTN	Camrose Creek	19651122001	616740	616740	0	0

Battle.xls

Note: No reported consumptive uses for Approval ID 40031, 31721, 37819 and 36515

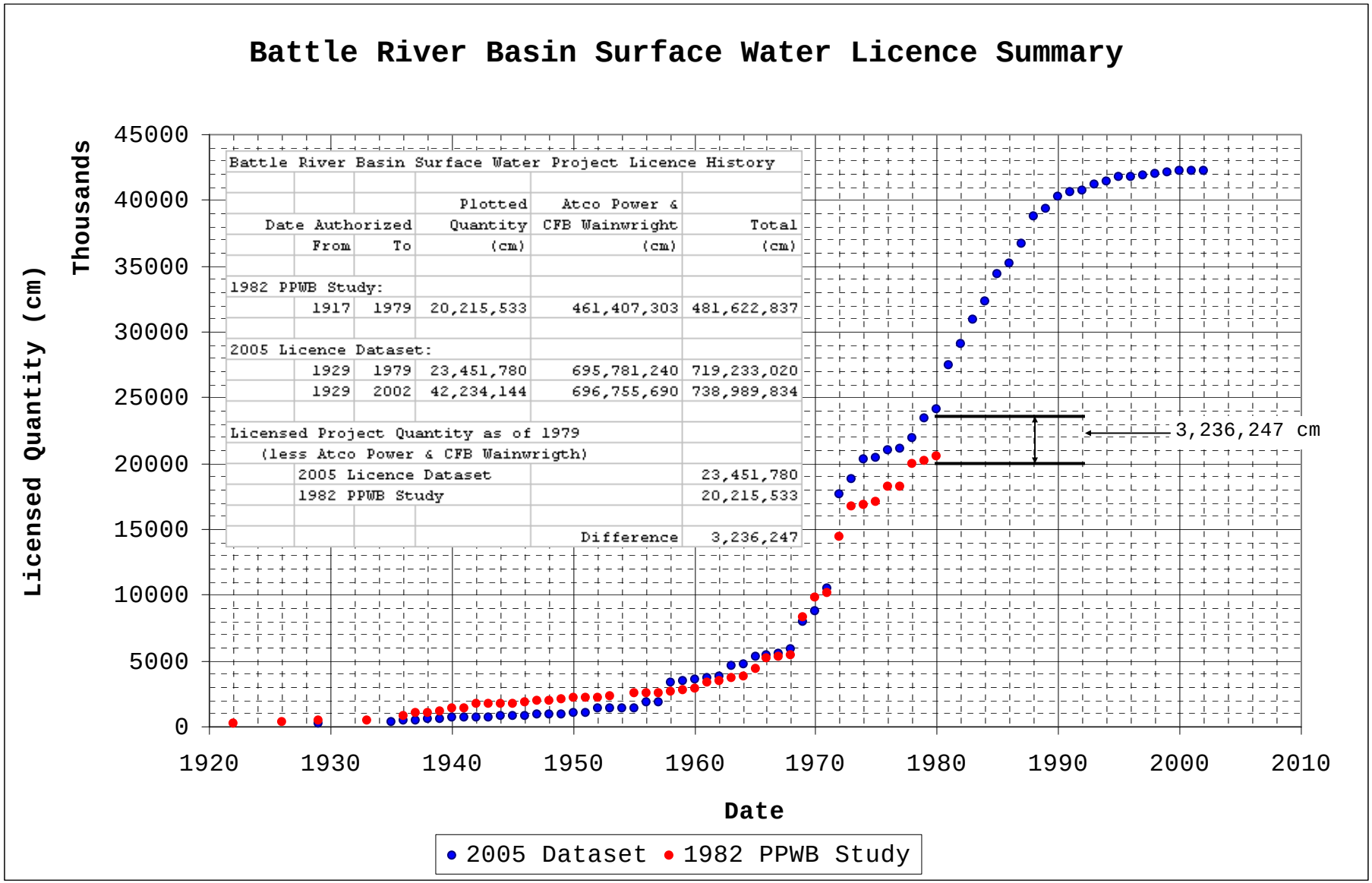
Table A9: Injection Recorded Use Summary

Injection - Surface Water Supply				
Recorded Uses				
Lakes	Injection Location	Apv_ID	Apv_ID Location	Comments
	15-5-48-20-4	37936	SE 5-48-20 W4	
	4-14-47-28-4			no reported use after 1975
	4-26-47-23-4	31722	SW 26-47-23 W4	
Rivers				
	13-6-39-11-4	37170, 37171, 37172	NW 6-39-11 W4	
	8-25-42-9-4			no reported use after 1985
	8-25-42-10-4	37819		
missing				
		40031	SW 35-40-7 W4	
		31721	NE 26-46-23 W4	
		36515	SW 19-47-4 W4	
		9 Injection Licenses		

Table A10: Project Licenses with No Quantity (Excludes FLOODCNT Purpose)

APR_ID	NAME	SPECIFIC
29330	ALTA ENVIRONMENTAL PROTECTION, WR, 22106	STBLZTN
42285	ALTA ENVIRONMENTAL PROTECTION, WR, 06478	STBLZTN
70002	STETTLER/ALIGNMENT/STETTLER CTY - F80556	URBAN
70724	MA-ME-O-BEACH/DRAINAGE/SUMMER VILLAGE OF GRANDVIEW F - 85354	CNSTRCT
71374	GADSBY/DRAINAGE/GADSBY HUTTERITES-F80294	DRAINAGE

Figure A1



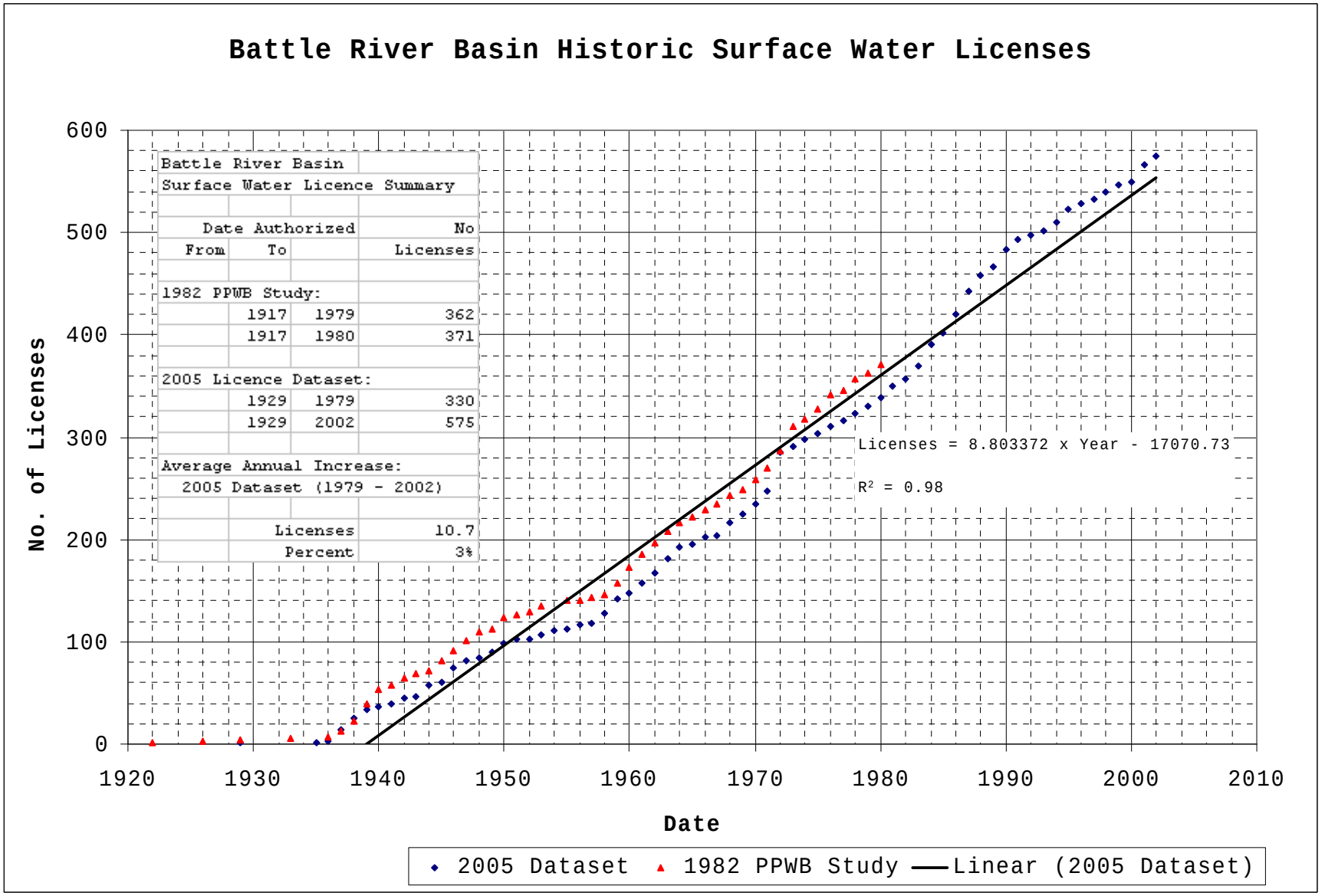
Battle River Basin Surface Water Project Licence History

Date Authorized From	To	Plotted Quantity (cm)	Atco Power & CFB Wainwright (cm)	Total (cm)
1982 PPWB Study:				
1917	1979	20,215,533	461,407,303	481,622,837
2005 Licence Dataset:				
1929	1979	23,451,780	695,781,240	719,233,020
1929	2002	42,234,144	696,755,690	738,989,834

Licensed Project Quantity as of 1979 (less Atco Power & CFB Wainwrigth)	
2005 Licence Dataset	23,451,780
1982 PPWB Study	20,215,533
Difference	3,236,247

Water.Demand.Cumulative.Historic.Quantity.2.xls

Figure A2


Battle River Basin Historic Surface Water Licenses
Battle River Basin
Surface Water Licence Summary
Date Authorized
From To
No Licenses
1982 PPWB Study:
1917 1979 362
1917 1980 371
2005 Licence Dataset:
1929 1979 330
1929 2002 575
Average Annual Increase:
2005 Dataset (1979 - 2002)
Licenses 10.7
Percent 3%
Licenses = 8.803372 x Year - 17070.73
R² = 0.98
No. of Licenses
0
100
200
300
400
500
600
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Date
2005 Dataset
1982 PPWB Study
Linear (2005 Dataset)

Appendix B

Battle River Basin Precipitation and Evaporation (1980 – 2004)

Appendix B: Battle river Basin Precipitation and Evaporation (1980-2004)

Table B1: Atco Power Reservoir (1980-2004)
Monthly Precipitation (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1980	16.3	13.0	17.7	5.7	43.3	142.6	60.2	122.1	36.9	6.0	0.2	45.9	509.9
1981	10.5	7.8	19.5	11.9	66.1	26.1	74.3	30.4	44.6	17.7	7.7	6.0	322.6
1982	44.8	8.9	20.3	6.9	56.8	46.6	135.9	93.9	44.8	24.5	11.3	5.2	499.9
1983	8.6	8.7	12.8	7.5	55.2	147.3	70.7	20.6	24.2	7.3	20.1	18.3	401.3
1984	24.3	0.5	10.7	17.3	22.2	80.1	23.0	36.6	117.8	11.2	14.9	20.6	379.2
1985	6.8	16.6	1.2	42.8	65.0	39.1	60.7	99.9	21.4	19.8	8.5	37.6	395.3
1986	12.1	13.7	28.9	23.1	23.4	46.6	149.8	24.6	65.3	15.4	18.9	1.8	423.6
1987	3.6	13.3	27.4	26.8	14.3	31.1	83.5	93.1	50.8	4.3	5.5	10.8	364.5
1988	6.3	14.9	30.0	1.4	10.0	86.3	38.3	88.8	62.7	7.3	6.9	19.1	372.0
1989	20.3	7.7	3.2	13.5	34.3	96.6	107.6	58.1	21.2	30.1	14.1	13.3	420.0
1990	15.7	7.1	16.0	16.0	20.4	103.2	140.3	42.1	4.8	12.3	16.0	11.9	405.8
1991	6.1	13.7	2.4	43.0	84.7	121.2	65.0	51.5	4.3	41.2	1.1	9.6	443.8
1992	8.0	18.6	5.7	19.9	64.7	21.7	96.2	31.1	38.0	22.6	10.2	22.7	359.4
1993	5.0	6.6	45.5	40.0	44.7	95.6	89.1	35.6	21.8	20.0	21.6	9.2	434.7
1994	54.2	15.8	1.0	3.3	64.2	119.0	61.7	67.7	36.7	26.5	12.4	8.1	470.6
1995	10.8	4.3	26.8	18.1	29.1	62.7	44.9	110.9	3.1	3.7	34.3	22.3	371.0
1996	27.0	5.0	17.2	39.6	79.0	105.4	50.2	46.7	79.7	10.1	47.6	17.5	525.0
1997	10.9	1.0	10.5	27.1	41.4	124.9	28.7	23.1	48.1	34.3	4.1	2.9	357.0
1998	22.6	3.6	16.2	29.7	15.6	59.1	43.0	18.5	50.0	24.6	10.7	11.6	286.1
1999	34.8	2.7	13.0	53.5	63.5	50.1	159.8	56.1	2.2	9.0	12.7	6.8	464.2
2000	19.6	10.7	14.8	35.8	35.4	62.1	60.7	70.5	78.1	3.1	2.5	12.2	405.5
2001	1.1	7.2	4.9	1.7	24.9	93.8	115.8	0.4	48.0	16.7	12.1	7.4	334.0
2002	3.8	6.3	19.6	35.8	3.7	12.7	27.3	62.3	34.5	16.3	5.8	9.5	237.6
2003	30.6	20.9	13.7	55.8	66.7	75.7	33.8	31.7	29.7	17.5	7.3	3.8	387.2
2004	30.2	1.6	6.1	11.0	20.2	46.8	133.1	57.0	21.4	34.8	0.9	28.0	404.1
MIN	1.1	0.5	1.0	1.4	3.7	12.7	23.0	0.4	2.2	3.1	0.2	1.8	237.6
MAX	54.2	20.9	45.5	55.8	84.7	147.3	159.8	122.1	117.8	41.2	47.6	45.9	525.0
MEAN	17.4	9.2	15.4	23.5	42.0	75.9	78.1	54.9	39.6	17.5	12.3	14.5	399.0

Precipitation data fill sequence:

1 FORESTBURG PLANT SITE, ALBERTA
Latitude: 52° 28' N Longitude: 112° 7' W
Climate ID: 3012652

2 BROWNFIELD, ALBERTA
Latitude: 52° 19' N Longitude: 111° 28' W
Climate ID: 3010890

Table B2: Wetaskiwin (1980-2004)
Monthly Precipitation (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1980	15.4	7.5	28.5	1.0	31.2	163.8	117.4	139.9	42.2	23.2	0.6	41.8	612.5
1981	7.0	12.0	7.0	1.0	65.5	43.4	151.2	20.6	44.0	23.2	2.9	11.0	388.8
1982	56.6	25.4	73.2	5.8	23.8	48.2	161.4	63.4	44.2	47.4	13.0	8.2	570.6
1983	11.2	17.6	30.6	24.2	11.0	154.6	82.4	20.0	25.9	3.2	19.4	20.8	420.9
1984	44.2	2.0	17.5	7.4	70.0	72.4	33.0	43.3	103.8	27.4	22.0	48.0	491.0
1985	8.0	22.8	5.0	24.0	21.7	47.5	70.6	97.4	57.4	24.4	17.6	30.4	426.8
1986	13.4	18.0	30.8	53.6	71.6	45.2	135.8	26.5	75.8	25.4	22.4	8.0	526.5
1987	5.6	13.2	31.4	14.4	41.4	68.4	114.8	89.2	26.2	9.2	4.5	19.6	437.9
1988	7.0	29.0	49.8	6.0	15.4	106.0	149.4	107.5	53.8	6.6	8.0	15.2	553.7
1989	52.8	14.6	10.0	34.2	80.0	59.0	57.2	68.0	31.2	47.8	38.2	19.2	512.2
1990	18.8	28.8	26.8	37.0	45.0	116.2	144.2	43.6	2.6	25.8	26.2	28.8	543.8
1991	19.2	38.0	11.2	39.0	101.6	113.4	112.6	56.4	21.0	72.6	18.2	10.6	613.8
1992	23.4	38.0	4.4	47.6	77.6	24.0	56.6	33.2	49.6	16.0	17.4	27.6	415.4
1993	7.4	10.4	54.6	50.9	47.2	85.4	50.6	51.8	33.2	20.0	21.4	13.0	445.9
1994	91.6	20.7	0.8	3.8	57.4	127.2	59.1	83.2	51.0	12.4	27.8	21.0	556.0
1995	24.8	5.6	10.4	20.4	44.2	65.8	84.2	90.4	43.2	22.8	60.8	21.4	494.0
1996	32.2	5.4	29.2	58.0	48.2	86.2	95.8	26.2	73.4	2.2	69.2	23.4	549.4
1997	22.2	17.2	35.2	22.4	52.7	140.2	75.0	57.6	60.0	29.0	5.4	11.0	527.9
1998	32.4	0.0	16.8	36.2	36.0	122.0	73.6	45.2	32.2	44.4	31.2	33.6	503.6
1999	64.6	12.6	27.0	33.0	66.4	37.2	156.0	47.4	18.8	13.8	19.2	8.8	504.8
2000	24.6	10.8	29.8	16.6	49.7	80.0	124.4	31.8	47.6	4.4	15.6	17.4	452.7
2001	2.6	17.0	17.6	13.6	8.8	82.3	158.8	28.0	16.0	36.8	44.2	13.2	438.9
2002	12.8	14.2	49.6	36.6	22.6	26.0	53.8	63.0	25.2	24.0	21.6	7.2	356.6
2003	47.5	37.6	26.6	47.0	64.2	67.4	33.2	56.6	22.2	16.2	27.6	6.6	452.7
2004	54.9	6.2	31.4	29.6	40.6	41.2	147.8	48.6	42.4	52.4	4.0	54.8	553.9
MIN	2.6	0.0	0.8	1.0	8.8	24.0	33.0	20.0	2.6	2.2	0.6	6.6	356.6
MAX	91.6	38.0	73.2	58.0	101.6	163.8	161.4	139.9	103.8	72.6	69.2	54.8	613.8
MEAN	28.0	17.0	26.2	26.5	47.8	80.9	100.0	57.6	41.7	25.2	22.3	20.8	494.0

Precipitation data fill sequence:

1 WETASKIWIN SOUTH, ALBERTA
Latitude: 52° 37' N Longitude: 113° 22' W
Climate ID: 3017286

2 BRIGHTVIEW, ALBERTA
Latitude: 52° 58' N Longitude: 113° 43' W
Climate ID: 3010830

3 PONOKA SOUTH, ALBERTA
Latitude: 52° 39' N Longitude: 113° 37' W
Climate ID: 3015283

Table B3: Stettler (1980-2004)
Monthly Precipitation (mm)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1980	18.0	11.2	20.2	9.0	40.0	169.0	50.0	93.8	46.2	7.3	1.2	26.7	492.6
1981	6.2	8.2	20.0	11.0	90.0	28.2	54.4	16.0	41.6	18.8	1.0	3.6	299.0
1982	42.9	11.6	45.4	8.6	66.6	65.6	179.0	85.2	31.6	20.8	6.2	5.2	568.7
1983	14.0	11.2	10.2	10.6	40.6	148.2	64.2	12.2	20.8	7.0	12.8	24.4	376.2
1984	25.4	0.0	14.6	19.6	50.6	95.8	37.4	29.0	129.2	54.1	18.6	37.4	511.7
1985	5.4	16.0	4.4	35.6	50.4	35.2	43.4	134.6	60.6	13.2	15.1	16.2	430.1
1986	3.8	24.9	30.2	19.5	67.4	66.2	169.6	25.8	89.2	21.8	26.6	2.6	547.6
1987	8.4	17.2	37.6	14.6	12.0	22.2	70.0	105.6	43.8	12.0	5.6	18.6	367.6
1988	0.8	21.0	68.0	1.4	12.2	100.4	64.7	91.6	65.0	12.6	10.0	22.0	469.7
1989	13.0	4.0	4.0	21.5	36.5	90.1	82.5	66.8	37.7	43.6	22.0	35.0	456.7
1990	17.0	16.0	28.6	41.4	48.0	106.5	116.5	56.5	2.0	9.0	30.0	21.0	492.5
1991	32.5	23.0	7.0	41.6	106.9	76.8	74.6	85.7	34.8	53.3	12.0	8.0	556.2
1992	18.0	28.6	11.5	42.0	72.6	53.6	89.9	35.2	59.7	21.8	20.0	38.5	491.4
1993	8.0	8.0	25.5	52.8	50.0	85.0	132.0	55.5	38.0	27.0	19.5	11.0	512.3
1994	61.0	19.5	1.0	3.5	67.5	126.8	85.0	76.0	45.0	32.5	25.5	19.5	562.8
1995	13.5	6.0	22.5	11.5	38.5	97.5	81.0	107.3	8.0	17.0	40.5	18.0	461.3
1996	44.5	4.0	29.5	24.5	82.0	104.5	70.0	12.5	85.0	13.5	52.5	16.0	538.5
1997	15.5	10.5	23.5	10.5	33.5	127.5	29.1	43.5	56.8	21.5	5.0	7.0	383.9
1998	22.5	4.0	20.5	23.0	22.5	93.0	100.5	45.5	30.0	29.0	26.0	33.5	450.0
1999	52.5	6.5	26.0	58.5	79.5	71.0	220.5	91.0	6.0	14.5	17.0	6.0	649.0
2000	38.5	14.5	35.5	32.5	34.5	83.0	112.0	69.5	43.0	6.5	11.5	9.5	490.5
2001	1.0	19.5	9.0	3.0	28.5	108.0	104.0	15.0	13.6	7.2	39.8	10.4	359.0
2002	8.4	15.0	32.8	15.0	10.6	13.4	24.0	74.2	51.6	19.0	6.4	15.0	285.4
2003	24.4	28.2	10.9	34.3	42.3	59.1	19.3	21.9	16.4	10.8	5.2	1.9	274.7
2004	24.0	0.0	8.6	12.4	22.6	41.5	95.3	70.9	20.5	28.4	2.5	22.1	348.8
MIN	0.8	0.0	1.0	1.4	10.6	13.4	19.3	12.2	2.0	6.5	1.0	1.9	274.7
MAX	61.0	28.6	68.0	58.5	106.9	169.0	220.5	134.6	129.2	54.1	52.5	38.5	649.0
MEAN	20.8	13.1	21.9	22.3	48.2	82.7	86.8	60.8	43.0	20.9	17.3	17.2	455.0

Precipitation data fill sequence:

1 STETTLER NORTH, ALBERTA
Latitude: 52° 19' N Longitude: 112° 43' W
Climate ID: 3016119

2 STETTLER AGDM, ALBERTA
Latitude: 52° 21' N Longitude: 112° 36' W
Climate ID: 3016124

3 RED WILLOW, ALBERTA
Latitude: 52° 25' N Longitude: 112° 34' W
Climate ID: 301NDR1

4 HACKETT, ALBERTA
Latitude: 52° 10' N Longitude: 112° 37' W
Climate ID: 3012992

Table B4: Lacombe (1980 – 2004)
Monthly Gross Evaporation (mm)

LACOMBE GROSS LAKE EVAPORATION (MM)

BATTLE RIVER HISTOIRCAL NATURAL FLOWS REPORT (1912 TO 1983)

YEAR	JAN (mm)	FEB (mm)	MAR (mm)	APR (mm)	MAY (mm)	JUN (mm)	JUL (mm)	AUG (mm)	SEP (mm)	OCT (mm)	NOV (mm)	DEC (mm)	TOTAL (mm)
1980	-2	-2	11	81	114	118	146	99	45	26	6	0	642
1981	-7	6	36	70	96	124	123	133	60	19	4	-3	661
1982	0	1	10	66	107	130	127	97	57	26	0	-2	619
1983	0	2	22	65	112	105	135	126	47	23	4	-2	639
1984	0	8	25	82	79	123	145	126	44	20	-3	-2	647
1985	-5	0	32	76	128	148	155	102	41	21	-3	-2	693
1986	0	-1	32	64	113	135	123	127	45	27	-2	-4	659
1987	-1	4	19	80	125	154	130	95	76	30	2	-1	713
1988	-1	8	37	90	131	145	144	119	56	31	4	-1	763
1989	-2	-2	2	76	113	144	161	89	64	26	3	-1	673
1990	-3	2	37	65	104	127	147	119	77	24	2	-1	700
1991	-6	9	-1	75	108	106	158	120	63	21	-3	-2	648
1992	2	4	39	68	99	130	130	113	49	24	6	-1	663
1993	-2	7	26	54	102	108	106	94	54	24	3	-1	575
1994	-2	0	35	67	98	113	135	97	61	23	3	-1	629
1995	-1	7	29	50	101	114	111	90	62	22	4	0	589
1996	-1	3	11	55	74	120	143	127	44	23	-1	0	598
1997	-1	3	15	67	94	126	147	103	62	21	5	3	645
1998	0	0	25	70	116	104	136	121	60	21	-1	0	652
1999	-1	4	17	54	83	97	108	89	50	21	2	1	525
2000	0	1	25	52	87	102	133	107	53	25	2	-1	586
2001	1	2	24	51	73	108	137	128	63	22	3	-2	610
2002	0	0	-1	53	105	133	176	101	46	16	0	0	630
2003	-1	0	14	58	101	124	162	127	53	24	2	-2	663
2004	-1	-1	1	84	93	113	136	91	40	18	-3	-3	568

Battle River Basin Historic Natural Flows (1912 to 1983), Alberta Environment, Jan-1986

Battle River Basin in Alberta Extension of Historic Natural Flow Database (1984 to 2001), MPE Engineering Ltd., Oct-2003

SWA Morton to Meyers Correlation Analysis, Appendix C

Appendix C

Battle River Basin
Recorded Stream Flows
(1980 – 2004)

Appendix C: Battle River basin Recorded Stream Flows (1980-2004)

Table C1: Battle River near Ponoka (A05FA001)
Mean Monthly Recorded Flows from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.121	0.079	0.083	5.484	0.890	2.714	3.628	2.471	3.437	1.905	1.342	0.655	59952
1981	0.576	0.426	4.529	2.412	3.597	2.221	5.187	13.633	2.494	2.846	2.572	2.078	113074
1982	1.403	0.485	0.496	19.695	8.672	2.610	16.500	3.482	3.071	2.864	1.775	1.279	164478
1983	0.920	0.965	2.424	9.943	3.331	1.922	6.020	0.899	0.210	0.456	0.416	0.185	72837
1984	0.193	0.292	1.527	2.166	1.827	3.184	0.106	0.056	1.219	0.993	0.653	0.394	33077
1985	0.306	0.218	2.442	16.169	3.242	1.008	0.224	0.457	0.518	0.515	0.485	0.175	67364
1986	0.216	0.200	5.324	2.440	8.743	1.509	10.356	3.692	0.637	2.189	0.922	0.513	97877
1987	0.337	0.310	0.416	7.862	3.580	2.026	0.655	2.203	1.845	0.763	0.832	0.243	55271
1988	0.052	0.047	0.576	1.139	0.438	1.446	5.689	1.420	0.871	0.687	0.540	0.331	35097
1989	0.187	0.114	0.123	13.796	4.463	1.643	0.876	0.826	0.660	1.056	1.008	0.535	66220
1990	0.408	0.211	4.307	9.525	5.222	12.994	35.999	4.241	2.057	1.768	0.452	0.251	205183
1991	0.236	0.420	1.171	10.461	8.133	6.509	8.474	2.957	1.072	1.174	0.727	0.463	110217
1992	0.411	0.488	7.289	3.667	3.358	3.309	0.888	0.425	0.363	0.416	0.350	0.195	55881
1993	0.179	0.201	4.912	4.384	2.138	0.394	0.489	0.252	0.368	0.367	0.323	0.210	37552
1994	0.219	0.213	3.030	2.965	1.369	1.564	0.768	0.377	0.489	0.532	0.230	0.137	31348
1995	0.120	0.100	1.379	1.010	0.831	0.590	0.671	0.855	0.449	0.724	0.312	0.212	19199
1996	0.242	0.269	1.129	8.520	2.617	2.634	3.109	1.977	0.378	0.730	0.462	0.304	58812
1997	0.239	0.265	0.831	11.851	3.032	4.657	1.575	0.817	1.379	1.249	0.724	0.341	70529
1998	0.330	0.316	1.374	1.658	0.880	0.520	6.188	0.329	0.428	0.746	0.363	0.200	35375
1999	0.174	0.257	0.640	15.308	4.659	0.713	13.937	2.896	0.676	0.551	0.604	0.295	107481
2000	0.281	0.211	1.292	2.791	2.516	3.915	11.250	3.095	0.938	0.837	0.463	0.286	73901
2001	0.306	0.210	0.511	0.901	0.877	0.907	1.094	3.563	0.265	0.431	0.457	0.407	26323
2002	0.122	0.124	0.137	5.877	2.306	0.074	0.014	0.116	0.027	0.110	0.147	0.111	23986
2003	0.040	0.040	0.186	16.366	4.325	0.422	0.049	0.040	0.033	0.140	0.139	0.057	57011
2004	0.032	0.029	0.165	0.969	0.678	0.528	0.629	0.502	0.212	0.437	0.320	0.163	12308
MIN	0.032	0.029	0.083	0.901	0.438	0.074	0.014	0.040	0.027	0.110	0.139	0.057	12308
MAX	1.403	0.965	7.289	19.695	8.743	12.994	35.999	13.633	3.437	2.864	2.572	2.078	205183
MEAN	0.306	0.259	1.852	7.094	3.269	2.401	5.375	2.063	0.964	0.979	0.665	0.401	67614

Table C2: Continued - Pipestone Creek near Wetaskiwin (A05FA012) Mean Monthly Recorded Flows from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	-	-	0.003	5.229	0.725	0.714	1.239	1.245	3.356	1.309	-	-	-
1981	-	-	3.338	1.598	0.740	0.326	0.244	1.213	0.231	0.077	-	-	-
1982	-	-	0.000	8.977	5.858	2.010	5.221	0.533	0.210	0.248	-	-	-
1983	-	-	0.517	4.598	0.768	1.065	7.479	0.244	0.020	0.038	-	-	-
1984	-	-	0.915	1.010	0.238	0.710	0.084	0.008	0.239	0.147	-	-	-
1985	-	-	1.533	11.558	1.397	0.068	0.141	0.050	0.038	0.040	-	-	-
1986	-	-	2.855	1.107	2.369	0.337	0.583	0.552	0.026	0.236	-	-	-
1987	-	-	0.131	3.467	0.567	0.125	0.036	0.106	0.081	0.018	-	-	-
1988	-	-	0.049	0.188	0.066	0.032	0.099	0.075	0.034	0.024	-	-	-
1989	-	-	0.027	3.904	1.150	0.310	0.393	0.078	0.083	0.108	-	-	-
1990	-	-	1.755	7.103	1.571	1.286	9.295	0.806	0.011	0.010	-	-	-
1991	-	-	0.230	6.570	2.675	0.802	3.329	0.339	0.041	0.058	-	-	-
1992	-	-	4.613	2.378	0.628	0.264	0.021	0.006	0.011	0.075	-	-	-
1993	-	-	1.480	3.610	0.260	0.133	0.045	0.004	0.003	0.062	-	-	-
1994	-	-	0.767	1.188	0.069	0.196	0.457	0.126	0.111	0.027	-	-	-
1995	-	-	0.552	0.406	0.050	0.046	0.027	0.032	0.013	0.062	-	-	-
1996	-	-	0.692	4.730	1.182	0.813	0.325	0.237	0.016	0.039	-	-	-
1997	-	-	0.196	10.336	1.567	2.360	1.361	0.445	0.114	0.061	-	-	-
1998	-	-	0.203	0.766	0.091	0.496	4.087	0.037	0.005	0.040	-	-	-
1999	-	-	0.031	9.322	3.321	0.530	1.917	0.502	0.048	0.016	-	-	-
2000	-	-	0.045	0.647	0.149	0.387	0.323	0.196	0.026	0.011	-	-	-
2001	-	-	0.002	0.047	0.098	0.081	0.119	0.199	0.020	0.019	-	-	-
2002	-	-	0.000	1.627	0.907	0.017	0.003	0.004	0.003	0.008	-	-	-
2003	-	-	0.067	3.488	1.328	0.073	0.006	0.001	0.033	0.002	-	-	-
2004	-	-	0.002	0.079	0.010	0.010	0.155	0.028	0.003	0.045	-	-	-
MIN	-	-	0.000	0.047	0.010	0.010	0.003	0.001	0.003	0.002	-	-	-
MAX	-	-	4.613	27.269	12.027	2.441	9.295	1.744	3.356	1.309	-	-	-
MEAN	-	-	0.777	4.183	1.464	0.571	1.383	0.316	0.211	0.139	-	-	-

Table C3: Continued - Ribstone Creek near Edgerton (A05FD001)
Mean Monthly Recorded Flows from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	-	-	0.000	0.115	0.028	0.536	0.431	0.204	0.083	0.056	-	-	-
1981	-	-	0.022	0.055	0.597	1.069	0.222	0.058	0.002	0.000	-	-	-
1982	-	-	0.000	0.100	0.050	0.528	0.318	0.105	0.011	0.025	-	-	-
1983	-	-	0.000	0.037	0.021	0.462	3.469	1.685	0.036	0.024	-	-	-
1984	-	-	0.008	0.129	0.070	1.596	0.736	0.041	0.048	0.039	-	-	-
1985	-	-	0.050	1.434	3.751	1.485	0.477	0.175	0.156	0.195	-	-	-
1986	-	-	0.110	0.010	0.285	0.336	0.782	0.324	0.077	0.112	-	-	-
1987	-	-	0.003	0.655	1.194	0.795	0.685	0.541	0.429	0.163	-	-	-
1988	-	-	0.098	0.067	0.149	0.197	0.372	0.100	0.001	0.011	-	-	-
1989	-	-	0.000	0.009	0.340	1.471	0.191	0.004	0.000	0.000	-	-	-
1990	-	-	0.001	0.002	0.623	0.491	0.287	0.304	0.087	0.008	-	-	-
1991	-	-	0.007	0.002	0.714	0.352	0.194	0.020	0.000	0.000	-	-	-
1992	-	-	0.000	0.001	0.021	0.836	0.025	0.000	0.000	0.000	-	-	-
1993	-	-	0.000	0.005	0.000	0.259	1.088	0.516	0.071	0.008	-	-	-
1994	-	-	0.012	0.000	0.363	1.432	0.587	0.128	0.033	0.006	-	-	-
1995	-	-	0.019	0.043	1.242	0.819	0.019	0.075	0.031	0.003	-	-	-
1996	-	-	0.000	0.008	0.223	1.044	0.820	0.419	0.197	0.049	-	-	-
1997	-	-	0.007	0.162	3.914	1.264	0.719	0.071	0.018	0.036	-	-	-
1998	-	-	0.007	0.016	0.019	0.004	0.024	0.000	0.000	0.000	-	-	-
1999	-	-	0.000	0.003	0.018	0.066	0.148	0.088	0.005	0.000	-	-	-
2000	-	-	0.013	0.011	0.094	0.274	0.241	0.059	0.141	0.021	-	-	-
2001	-	-	0.001	0.074	0.119	0.345	0.137	0.002	0.000	0.000	-	-	-
2002	-	-	0.000	0.001	0.007	0.002	0.000	0.000	0.000	0.000	-	-	-
2003	-	-	0.001	0.011	0.013	0.004	0.168	0.000	0.000	0.000	-	-	-
2004	-	-	0.000	0.000	0.006	0.165	0.242	0.049	0.045	0.103	-	-	-
MIN	-	-	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	-	-	-
MAX	-	-	0.403	3.544	7.185	4.715	3.469	1.685	0.975	1.185	-	-	-
MEAN	-	-	0.033	0.512	1.027	0.825	0.635	0.242	0.110	0.117	-	-	-

Table C4: Battle River near the Saskatchewan Border (A05FE004) Mean Monthly Recorded Flows from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.566	0.382	0.545	23.661	11.917	5.811	9.390	6.690	8.534	10.885	6.920	3.004	232535
1981	1.888	1.579	8.292	22.073	8.831	6.959	3.177	5.534	10.383	5.051	3.878	2.377	210182
1982	1.400	1.400	1.235	8.726	47.384	14.762	23.687	24.926	8.926	7.180	4.945	2.787	391092
1983	2.258	1.862	4.427	26.947	17.032	8.022	50.545	12.842	4.685	2.847	2.392	1.763	359133
1984	1.000	1.186	2.895	14.172	5.164	6.062	2.972	0.975	1.478	2.132	0.914	0.810	104229
1985	0.831	0.533	4.707	56.143	30.742	7.592	2.372	1.557	1.694	1.528	0.432	0.323	284654
1986	0.459	0.552	11.043	28.133	11.514	11.235	7.825	11.953	5.826	5.410	3.628	1.883	262034
1987	1.268	1.286	2.078	39.882	13.141	5.224	3.314	3.580	5.890	3.380	2.119	0.990	215115
1988	0.310	0.284	1.515	8.517	3.397	1.821	2.625	1.424	1.288	1.395	1.006	0.688	63838
1989	0.655	0.446	0.378	15.307	14.531	7.686	5.477	2.002	1.385	1.158	0.993	1.073	134540
1990	1.109	0.582	8.391	41.667	14.897	15.168	35.229	32.442	6.631	3.780	2.106	1.160	431196
1991	0.573	0.826	1.377	15.243	20.061	13.400	12.668	9.448	7.119	4.090	2.108	1.744	233974
1992	1.330	1.080	11.858	23.790	10.050	6.547	2.646	0.896	0.426	0.772	0.753	0.557	159592
1993	0.505	0.501	2.573	30.837	11.099	4.204	6.275	8.172	1.554	1.102	1.014	0.777	180394
1994	0.751	0.773	9.809	18.311	7.314	8.584	3.951	1.572	0.906	1.714	1.275	0.743	146484
1995	0.673	0.646	5.854	10.493	5.960	3.013	1.423	2.141	1.327	0.858	0.682	0.501	88413
1996	0.633	0.640	1.618	25.844	21.923	16.347	14.031	5.118	3.407	2.728	2.015	1.574	252517
1997	1.095	0.928	3.927	47.240	36.581	14.250	12.285	4.442	2.297	2.308	1.863	1.193	338013
1998	0.897	1.177	1.338	6.127	3.445	1.204	6.054	5.370	1.213	1.492	1.138	0.756	79777
1999	0.394	0.619	0.913	20.308	32.406	8.640	19.855	14.132	7.500	2.875	2.086	1.693	294942
2000	0.736	0.610	1.372	10.116	6.589	4.611	5.006	8.660	8.858	5.231	2.898	1.307	147531
2001	0.786	0.540	1.563	5.547	1.993	2.213	1.434	1.103	1.185	1.270	0.639	0.522	49373
2002	0.334	0.344	0.341	2.092	8.003	2.815	0.530	0.491	0.222	0.549	0.462	0.338	43675
2003	0.042	0.030	0.649	10.701	24.223	6.430	1.773	0.781	0.713	0.534	0.395	0.302	123159
2004	0.219	0.026	0.637	3.984	1.307	1.089	2.623	0.673	0.879	0.534	0.560	0.618	34649
MIN	0.042	0.026	0.341	2.092	1.307	1.089	0.530	0.491	0.222	0.534	0.395	0.302	34649
MAX	2.258	1.862	11.858	56.143	47.384	16.347	50.545	32.442	10.383	10.885	6.920	3.004	431196
MEAN	0.829	0.753	3.573	20.400	14.487	7.216	9.248	6.460	3.914	2.882	1.889	1.159	194442

Appendix D

Battle River Basin
Historic Water Use
(1980 – 2004)

Appendix D: Battle River Basin Historic Water Use (1980-2004)

Table D1: Battle River near Ponoka (J05FA001) Historic Water Use from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.013	0.013	0.013	-0.075	0.042	0.039	0.046	0.037	0.037	-0.112	0.013	0.013	208
1981	0.013	0.013	0.105	0.028	0.038	-0.119	0.042	0.048	0.037	-0.112	0.013	0.013	318
1982	0.013	0.013	0.105	0.157	0.049	-0.106	0.045	0.052	0.039	-0.112	0.013	0.013	739
1983	0.013	0.013	0.105	0.161	0.052	-0.132	0.065	0.063	0.044	-0.112	0.013	0.013	785
1984	0.013	0.013	0.105	0.161	0.038	-0.111	0.077	0.057	0.035	-0.112	0.013	0.013	794
1985	0.013	0.013	0.121	0.180	0.049	-0.122	0.068	0.044	0.036	-0.112	0.013	0.013	829
1986	0.013	0.013	0.121	0.179	0.038	-0.115	0.058	0.073	0.035	-0.112	0.013	0.013	867
1987	0.013	0.013	0.153	0.218	0.057	-0.120	0.097	0.065	0.062	-0.112	0.013	0.013	1245
1988	0.013	0.013	0.153	0.218	0.077	-0.142	0.071	0.051	0.040	-0.112	0.013	0.013	1075
1989	0.013	0.013	0.153	0.217	0.038	-0.122	0.142	0.081	0.058	-0.112	0.013	0.013	1339
1990	0.013	0.013	0.153	0.247	0.054	-0.163	0.075	0.100	0.081	-0.112	0.013	0.013	1283
1991	0.013	0.013	0.153	0.245	0.038	-0.171	0.099	0.090	0.066	-0.112	0.013	0.013	1215
1992	0.013	0.013	0.153	0.250	0.038	-0.072	0.163	0.122	0.045	-0.112	0.013	0.013	1687
1993	0.013	0.013	0.153	0.247	0.055	-0.138	0.168	0.105	0.060	-0.112	0.013	0.013	1565
1994	0.013	0.013	0.153	0.246	0.046	-0.162	0.160	0.076	0.043	-0.112	0.013	0.013	1331
1995	0.013	0.013	0.153	0.249	0.058	-0.108	0.137	0.069	0.051	-0.112	0.013	0.013	1450
1996	0.013	0.013	0.153	0.250	0.055	-0.142	0.126	0.129	0.035	-0.112	0.013	0.013	1443
1997	0.013	0.013	0.153	0.252	0.050	-0.185	0.146	0.100	0.035	-0.112	0.013	0.013	1300
1998	0.013	0.013	0.153	0.253	0.066	-0.159	0.147	0.111	0.061	-0.112	0.013	0.013	1513
1999	0.013	0.013	0.154	0.251	0.038	-0.092	0.071	0.110	0.075	-0.112	0.013	0.013	1440
2000	0.013	0.013	0.154	0.254	0.054	-0.124	0.103	0.128	0.047	-0.112	0.013	0.013	1469
2001	0.013	0.013	0.154	0.255	0.093	-0.120	0.070	0.131	0.079	-0.112	0.013	0.013	1590
2002	0.013	0.013	0.154	0.258	0.080	-0.073	0.171	0.098	0.070	-0.112	0.013	0.013	1841
2003	0.013	0.013	0.154	0.256	0.040	-0.117	0.191	0.104	0.073	-0.112	0.013	0.013	1694
2004	0.013	0.013	0.154	0.251	0.063	-0.084	0.080	0.111	0.052	-0.112	0.013	0.013	1498
												TOTAL	30519
MIN	0.013	0.013	0.013	-0.075	0.038	-0.185	0.042	0.037	0.035	-0.112	0.013	0.013	208
MAX	0.013	0.013	0.154	0.258	0.093	0.039	0.191	0.131	0.081	-0.112	0.013	0.013	1841
MEAN	0.013	0.013	0.137	0.208	0.052	-0.118	0.105	0.086	0.052	-0.112	0.013	0.013	1221

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Table D2: Pipestone Creek near Wetaskiwin (J05FA012)
Historic Water Use from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.000	0.000	0.000	0.526	0.005	0.000	0.012	0.000	0.003	0.000	0.000	0.000	1417
1981	0.000	0.000	0.000	0.541	0.000	0.018	0.006	0.017	0.003	0.000	0.000	0.000	1518
1982	0.000	0.000	0.000	0.527	0.007	0.018	0.005	0.010	0.003	0.000	0.000	0.000	1475
1983	0.000	0.000	0.000	0.538	0.009	0.000	0.017	0.017	0.006	0.000	0.000	0.000	1524
1984	0.000	0.000	0.000	0.534	0.000	0.014	0.025	0.013	0.000	0.000	0.000	0.000	1522
1985	0.000	0.000	0.000	0.541	0.008	0.019	0.021	0.005	0.000	0.000	0.000	0.000	1545
1986	0.000	0.000	0.000	0.533	0.000	0.020	0.010	0.017	0.000	0.000	0.000	0.000	1505
1987	0.000	0.000	0.000	0.542	0.004	0.016	0.013	0.006	0.006	0.000	0.000	0.000	1525
1988	0.000	0.000	0.000	0.537	0.009	0.009	0.008	0.004	0.001	0.000	0.000	0.000	1476
1989	0.000	0.000	0.000	0.535	0.000	0.031	0.042	0.018	0.009	0.000	0.000	0.000	1654
1990	0.000	0.000	0.000	0.535	0.009	0.017	0.019	0.033	0.024	0.000	0.000	0.000	1658
1991	0.000	0.000	0.000	0.528	0.000	0.018	0.032	0.028	0.016	0.000	0.000	0.000	1619
1992	0.000	0.000	0.000	0.541	0.000	0.058	0.057	0.039	0.005	0.000	0.000	0.000	1825
1993	0.000	0.000	0.000	0.533	0.009	0.033	0.064	0.034	0.013	0.000	0.000	0.000	1786
1994	0.000	0.000	0.000	0.530	0.004	0.014	0.060	0.019	0.004	0.000	0.000	0.000	1645
1995	0.000	0.000	0.000	0.534	0.010	0.042	0.049	0.016	0.008	0.000	0.000	0.000	1716
1996	0.000	0.000	0.000	0.531	0.008	0.033	0.043	0.045	0.000	0.000	0.000	0.000	1722
1997	0.000	0.000	0.000	0.536	0.006	0.008	0.053	0.031	0.000	0.000	0.000	0.000	1650
1998	0.000	0.000	0.000	0.537	0.014	0.016	0.053	0.036	0.013	0.000	0.000	0.000	1747
1999	0.000	0.000	0.000	0.529	0.000	0.055	0.016	0.036	0.019	0.000	0.000	0.000	1707
2000	0.000	0.000	0.000	0.537	0.008	0.035	0.031	0.042	0.006	0.000	0.000	0.000	1715
2001	0.000	0.000	0.000	0.539	0.026	0.034	0.015	0.044	0.021	0.000	0.000	0.000	1769
2002	0.000	0.000	0.000	0.546	0.020	0.060	0.062	0.029	0.016	0.000	0.000	0.000	1911
2003	0.000	0.000	0.000	0.542	0.001	0.041	0.071	0.031	0.018	0.000	0.000	0.000	1837
2004	0.000	0.000	0.000	0.530	0.012	0.053	0.020	0.035	0.008	0.000	0.000	0.000	1713
												TOTAL	41,182
MIN	0.000	0.000	0.000	0.526	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	1,417
MAX	0.000	0.000	0.000	0.546	0.026	0.060	0.071	0.045	0.024	0.000	0.000	0.000	1,911
MEAN	0.000	0.000	0.000	0.535	0.007	0.027	0.032	0.024	0.008	0.000	0.000	0.000	1,647

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Table D3: Ribstone Creek near Edgerton (J05FD001)
Historic Water Use from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.000	0.000	0.081	0.319	0.159	-0.114	0.870	0.197	0.087	0.000	0.000	0.000	4263
1981	0.000	0.000	0.081	0.337	0.000	0.685	0.843	0.674	0.117	0.000	0.000	0.000	7232
1982	0.000	0.000	0.081	0.311	0.000	0.444	0.080	0.250	0.180	0.000	0.000	0.000	3526
1983	0.000	0.000	0.081	0.332	0.156	-0.065	0.783	0.697	0.248	0.000	0.000	0.000	5939
1984	0.000	0.000	0.081	0.325	0.094	0.260	0.948	0.595	0.000	0.000	0.000	0.000	6117
1985	0.000	0.000	0.081	0.337	0.096	0.653	0.911	0.000	0.000	0.000	0.000	0.000	5479
1986	0.000	0.000	0.081	0.327	0.000	0.446	0.137	0.614	0.000	0.000	0.000	0.000	4236
1987	0.000	0.000	0.094	0.360	0.331	0.731	0.748	0.125	0.103	0.000	0.000	0.000	6569
1988	0.000	0.000	0.094	0.358	0.330	0.240	0.780	0.211	0.000	0.000	0.000	0.000	5340
1989	0.000	0.000	0.168	0.428	0.181	0.186	0.671	0.363	0.141	0.000	0.000	0.000	5661
1990	0.000	0.000	0.168	0.427	0.110	0.065	0.463	0.426	0.367	0.000	0.000	0.000	5354
1991	0.000	0.000	0.168	0.419	0.000	0.228	0.721	0.247	0.160	0.000	0.000	0.000	5133
1992	0.000	0.000	0.168	0.426	0.000	0.397	0.627	0.557	0.002	0.000	0.000	0.000	5762
1993	0.000	0.000	0.168	0.416	0.098	0.187	0.368	0.433	0.140	0.000	0.000	0.000	4784
1994	0.000	0.000	0.168	0.416	0.000	-0.047	0.658	0.307	0.095	0.000	0.000	0.000	4240
1995	0.000	0.000	0.174	0.428	0.169	0.129	0.682	0.115	0.330	0.000	0.000	0.000	5356
1996	0.000	0.000	0.174	0.422	0.000	0.037	0.750	0.698	0.000	0.000	0.000	0.000	5533
1997	0.000	0.000	0.174	0.441	0.200	-0.061	1.001	0.507	0.020	0.000	0.000	0.000	6081
1998	0.000	0.000	0.174	0.436	0.267	0.175	0.562	0.495	0.191	0.000	0.000	0.000	6091
1999	0.000	0.000	0.174	0.416	0.000	0.244	0.000	0.215	0.343	0.000	0.000	0.000	3641
2000	0.000	0.000	0.174	0.425	0.194	0.200	0.492	0.347	0.108	0.000	0.000	0.000	5133
2001	0.000	0.000	0.174	0.440	0.230	0.063	0.541	0.682	0.295	0.000	0.000	0.000	6428
2002	0.000	0.000	0.174	0.449	0.340	0.660	1.032	0.318	0.053	0.000	0.000	0.000	8009
2003	0.000	0.000	0.174	0.449	0.146	0.363	1.061	0.640	0.277	0.000	0.000	0.000	8236
2004	0.000	0.000	0.174	0.441	0.267	0.497	0.594	0.339	0.251	0.000	0.000	0.000	6762
												TOTAL	140903
MIN	0.000	0.000	0.081	0.325	0.000	-0.065	0.000	0.000	0.000	0.000	0.000	0.000	3641
MAX	0.000	0.000	0.174	0.449	0.340	0.731	1.061	0.698	0.367	0.000	0.000	0.000	140903
MEAN	0.000	0.000	0.149	0.405	0.146	0.254	0.660	0.406	0.142	0.000	0.000	0.000	11599

05FD001.NAT.xls

Table D4: Battle River near the Saskatchewan Border (J05FE004) Historic Water Use from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.393	0.338	0.230	1.617	0.889	0.412	2.111	1.015	0.839	0.019	0.252	0.469	22662
1981	0.213	0.316	1.765	1.939	0.395	1.284	1.839	1.566	0.494	0.154	0.245	0.317	27772
1982	0.262	0.266	0.581	5.326	1.807	-2.601	-0.545	0.827	0.631	0.142	0.035	0.020	17724
1983	0.008	0.025	1.243	3.053	1.642	-0.139	2.131	1.640	0.667	0.069	0.185	0.205	28403
1984	0.191	0.218	1.511	2.308	0.949	0.348	2.248	1.406	0.619	0.338	0.387	0.324	28702
1985	0.182	0.402	1.539	1.791	-0.715	-0.365	2.015	0.742	0.339	0.029	0.230	0.336	17196
1986	0.246	0.246	2.113	2.157	0.618	0.037	0.929	1.749	0.489	0.208	0.221	0.213	24397
1987	0.160	0.142	1.372	3.023	1.928	0.748	1.636	0.817	0.352	-0.074	0.661	0.540	29830
1988	0.125	0.105	1.314	3.347	1.654	-0.124	1.891	0.979	0.438	0.106	0.183	0.087	26719
1989	0.003	0.141	1.278	4.748	2.228	-0.540	1.449	1.302	0.973	0.246	0.482	0.501	33788
1990	0.227	0.165	2.199	3.617	1.179	-0.314	0.959	0.955	1.193	0.209	0.180	0.144	28243
1991	0.102	0.181	1.660	4.753	1.545	-0.945	2.087	1.301	0.502	-0.034	0.116	0.186	30251
1992	0.274	0.412	2.332	3.613	0.882	0.329	1.795	1.634	0.404	-0.233	0.188	0.352	31630
1993	0.261	0.146	2.556	4.388	1.397	-0.283	1.194	1.374	0.541	-0.007	0.313	0.441	32535
1994	0.262	0.015	2.114	4.192	1.360	-0.659	2.025	1.486	0.667	-0.120	0.266	0.155	31115
1995	0.091	0.140	2.184	3.717	1.356	-0.240	1.883	0.869	1.042	-0.136	0.067	0.137	29326
1996	0.140	0.144	2.223	4.549	1.235	-0.759	1.621	1.819	0.370	-0.190	0.164	0.146	30300
1997	0.127	0.287	1.263	4.412	1.968	-0.397	2.599	1.683	0.757	-0.164	0.031	0.123	33496
1998	0.150	0.286	1.512	4.084	1.941	0.224	3.271	2.548	0.701	-0.209	0.148	0.164	39174
1999	0.136	0.159	1.939	5.714	2.966	0.088	1.222	1.206	0.710	0.020	0.115	0.192	38131
2000	0.154	0.143	2.011	3.397	1.500	0.003	1.832	1.616	0.652	-0.207	0.070	0.177	30016
2001	0.136	0.106	1.248	3.614	1.595	-0.350	1.469	2.112	0.852	-0.175	0.017	0.206	28621
2002	0.131	0.013	0.951	5.174	3.260	1.032	2.335	1.118	0.364	-0.175	-0.079	-0.008	37244
2003	0.000	0.048	1.976	5.959	2.560	-0.085	2.360	1.668	0.812	-0.160	-0.110	0.023	39731
2004	0.097	0.118	1.414	3.373	1.497	0.416	1.303	0.772	0.567	0.025	0.369	0.458	27453
2005	0.087												233
											TOTAL (1980 - 2005)		744691
MIN, MAX, MEAN FROM 1980 TO 2004											TOTAL (1980 - 2004)		744458
MIN	0.000	0.013	0.230	1.617	-0.715	-2.601	-0.545	0.742	0.339	-0.233	-0.110	-0.008	17196
MAX	0.393	0.412	2.556	5.959	3.260	1.284	3.271	2.548	1.193	0.338	0.661	0.540	39731
MEAN	0.163	0.183	1.621	3.755	1.505	-0.115	1.746	1.368	0.639	-0.013	0.189	0.236	29778

05FE004.NAT.3.xls

Table D5: Battle River Basin Uses at the Sask-Alberta Border (dam^3)

Type of Use	Total Uses (1980-2004) (cu.dam)	Uses for Jan 2005 (cu.dam)	Total Basin Uses 1980 to Jan 2005 (cu.dam)	Appendix Reference	Average Annual Use (1980-2004) (cu.dam)
Pipestone Creek at Coal Lake (U1+U2+U3)	193,162	22	193,183	<- G, Table G6	7726
Atco Power Reservoir	153,505	189	153,694	<- H, Table H6	6140
Municipal	-10,001	17	-9,985	<- F, Table F22	-400
Balance of Project Uses	407,793	5	407,798	<- D, Table D7	16312
Average Annual Uses at Sask/AB Border	744,458	233	744,691	<- D, Table D4	29,778

Note: Uses for Jan 2005 reflect a Travel Time Adjustment at the Sask-AB Border included to balance with total basin Uses

05FE004.NAT.3.xls

Table D6: Battle River Basin Uses Summarized by Group and Node from 1980 to 2004 (m^3)

SPECIFIC GROUP (EXCEL FILE)	TOTAL USES (1980-2004) (cu.m)	BATTLE RIVER BASIN WATER DEMAND NODES (EXCEL FILE) 05FA001.1.xls (cu.m)	05FA012.2.xls (cu.m)	05FA021.3.xls (cu.m)	05FC001.4.xls (cu.m)	FOR.RES.5.xls (cu.m)	05FD001.6.xls (cu.m)	05FE004.7.xls (cu.m)	05FE001.8.xls (cu.m)
AGGWSH.2.xls	557,310	355,230	0	17,055	185,025	0	0	0	0
CROP.2A.xls	245,105,299	13,302,821	0	11,327,992	10,291,306	26,533,202	119,080,285	64,569,693	0
CROP.2B.xls	1,680,231	199,678	0	0	1,048,696	223,354	0	208,504	0
STCKWT.2.xls	100,033,780	13,871,150	0	20,764,200	726,600	5,793,505	15,061,945	43,647,300	169,080
SNOW.ICE.2.xls	8,160	0	0	0	0	0	0	8,160	0
FISHERY.2A.xls	5,700	0	0	3,700	0	2,000	0	0	0
FISHERY.2B.xls	1,888,290	250,206	0	19,876	0	10,744	1,150,728	456,737	0
WTLNDS.2.xls	994,806	994,806	0	0	0	0	0	0	0
WTLNDS.2B.xls	31,218,079	1,737,916	0	248,356	2,116,232	2,624,626	5,610,324	17,293,390	1,587,234
INJECTN.2.xls	19,650,309	0	0	14,409,247	562,199	0	0	4,678,863	0
OTHER.2.xls	8,412,300	8,326,000	0	0	86,300	0	0	0	0
SUB-TOTAL	409,554,263	39,037,807	0	46,790,425	15,016,358	35,187,430	140,903,282	130,862,647	1,756,314
Table D6 ->	407,797,949	SUBTOTAL LESS 05FE001.8							
COAL.LAKE.USES.2.xls	193,183,283	0	0	193,183,283	0	0	0	0	0
FORESTBURG.RES.USES.2.xls	153,694,000	0	0	0	0	153,694,000	0	0	0
Urban.Uses.3.xls	-9,984,684	-8,163,605	0	-21,719,443	9,996,962	-15,036,231	0	24,937,633	0
TOTAL	746,446,863	30,874,202	0	218,254,265	25,013,320	173,845,200	140,903,282	155,800,280	1,756,314
	744,690,549	TOTAL LESS 05FE001.8							

Summary.2.xls

Note: Uses at Node 05FA012.2 included in Coal Lake Analysis (Refer to Section 2.2.2)

Appendix E

Battle River Basin
Natural Flows
(1980 – 2004)

Appendix E: Battle River Basin Natural Flows (1980-2004)

Table E1: Battle River near Ponoka (B05FA001) Historic Natural Flow from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.134	0.092	0.097	5.409	0.932	2.753	3.674	2.508	3.474	1.794	1.356	0.667	60167
1981	0.589	0.439	4.633	2.440	3.635	2.102	5.229	13.682	2.530	2.735	2.585	2.091	113392
1982	1.416	0.498	0.600	19.852	8.720	2.504	16.545	3.534	3.110	2.753	1.788	1.292	165218
1983	0.933	0.978	2.529	10.104	3.383	1.790	6.084	0.962	0.254	0.344	0.429	0.198	73622
1984	0.206	0.304	1.632	2.327	1.866	3.073	0.183	0.113	1.253	0.881	0.667	0.407	33895
1985	0.319	0.231	2.562	16.349	3.291	0.885	0.292	0.501	0.553	0.403	0.498	0.188	68193
1986	0.228	0.213	5.444	2.619	8.781	1.394	10.415	3.765	0.672	2.077	0.935	0.526	98744
1987	0.350	0.323	0.569	8.079	3.637	1.906	0.752	2.268	1.907	0.652	0.846	0.255	56516
1988	0.065	0.060	0.729	1.357	0.515	1.304	5.760	1.471	0.911	0.575	0.553	0.344	36176
1989	0.199	0.127	0.276	14.014	4.501	1.521	1.018	0.908	0.717	0.945	1.021	0.548	67560
1990	0.421	0.224	4.459	9.772	5.276	12.830	36.074	4.341	2.138	1.656	0.465	0.264	206466
1991	0.249	0.433	1.323	10.706	8.171	6.338	8.573	3.047	1.138	1.062	0.740	0.476	111432
1992	0.424	0.500	7.442	3.917	3.396	3.236	1.051	0.547	0.408	0.304	0.363	0.208	57610
1993	0.192	0.214	5.065	4.631	2.193	0.257	0.657	0.357	0.428	0.255	0.336	0.223	39117
1994	0.232	0.226	3.182	3.211	1.415	1.403	0.929	0.453	0.533	0.421	0.243	0.150	32679
1995	0.133	0.113	1.532	1.258	0.889	0.482	0.808	0.924	0.500	0.612	0.326	0.224	20649
1996	0.255	0.281	1.282	8.770	2.672	2.491	3.235	2.106	0.412	0.618	0.475	0.317	60279
1997	0.252	0.278	0.983	12.103	3.083	4.472	1.720	0.916	1.414	1.137	0.737	0.353	71829
1998	0.343	0.329	1.527	1.911	0.946	0.361	6.335	0.440	0.490	0.635	0.376	0.213	36888
1999	0.187	0.270	0.795	15.559	4.697	0.621	14.008	3.007	0.751	0.439	0.618	0.307	108922
2000	0.294	0.223	1.446	3.045	2.570	3.791	11.353	3.223	0.985	0.725	0.476	0.299	75389
2001	0.319	0.223	0.665	1.156	0.971	0.786	1.164	3.695	0.344	0.319	0.470	0.420	27914
2002	0.135	0.137	0.291	6.134	2.386	0.001	0.186	0.213	0.097	-0.001	0.160	0.123	25827
2003	0.053	0.053	0.341	16.622	4.365	0.305	0.241	0.144	0.105	0.028	0.152	0.070	58705
2004	0.045	0.042	0.319	1.220	0.740	0.444	0.709	0.613	0.264	0.326	0.333	0.176	13808
MIN	0.045	0.042	0.097	1.156	0.515	0.001	0.183	0.113	0.097	-0.001	0.152	0.070	13808
MAX	1.416	0.978	7.442	19.852	8.781	12.830	36.074	13.682	3.474	2.753	2.585	2.091	206466
MEAN	0.319	0.272	1.989	7.303	3.321	2.282	5.480	2.150	1.016	0.868	0.678	0.413	68840

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Table E2: Pipestone Creek near Wetaskiwin (B05FA012) Historic Natural Flow from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.119	0.078	0.003	5.755	0.730	0.714	1.251	1.245	3.359	1.309	1.199	0.590	42831
1981	0.034	0.026	3.338	2.138	0.740	0.345	0.251	1.230	0.234	0.077	0.151	0.122	23009
1982	0.111	0.039	0.000	9.504	5.865	2.027	5.226	0.543	0.212	0.248	0.141	0.102	63295
1983	0.099	0.104	0.517	5.136	0.777	1.065	7.496	0.261	0.026	0.038	0.046	0.021	41176
1984	0.037	0.053	0.915	1.544	0.238	0.724	0.110	0.021	0.239	0.147	0.120	0.073	11072
1985	0.026	0.019	1.533	12.099	1.405	0.087	0.162	0.055	0.039	0.040	0.041	0.015	40504
1986	0.022	0.020	2.855	1.640	2.369	0.357	0.593	0.569	0.026	0.236	0.089	0.050	23457
1987	0.014	0.013	0.131	4.009	0.571	0.141	0.049	0.112	0.087	0.018	0.035	0.010	13534
1988	0.003	0.002	0.049	0.725	0.075	0.041	0.106	0.079	0.036	0.025	0.023	0.014	3083
1989	0.024	0.015	0.027	4.440	1.151	0.341	0.434	0.096	0.092	0.108	0.123	0.066	18090
1990	0.005	0.003	1.755	7.638	1.579	1.303	9.314	0.840	0.035	0.010	0.006	0.003	59462
1991	0.013	0.023	0.230	7.097	2.675	0.820	3.362	0.368	0.057	0.058	0.039	0.025	38855
1992	0.055	0.063	4.613	2.918	0.629	0.321	0.079	0.046	0.016	0.075	0.047	0.027	23513
1993	0.022	0.025	1.480	4.144	0.269	0.166	0.109	0.038	0.015	0.063	0.039	0.026	16745
1994	0.034	0.033	0.767	1.718	0.073	0.210	0.517	0.145	0.115	0.027	0.036	0.022	9717
1995	0.010	0.009	0.552	0.940	0.060	0.089	0.075	0.048	0.021	0.062	0.025	0.017	5013
1996	0.014	0.015	0.692	5.261	1.190	0.846	0.369	0.282	0.016	0.039	0.026	0.017	22944
1997	0.017	0.019	0.196	10.872	1.573	2.367	1.414	0.476	0.114	0.061	0.051	0.024	44866
1998	0.018	0.017	0.203	1.304	0.105	0.512	4.140	0.074	0.018	0.041	0.020	0.011	17141
1999	0.013	0.019	0.031	9.852	3.321	0.586	1.933	0.537	0.068	0.016	0.043	0.022	43121
2000	0.007	0.005	0.045	1.183	0.156	0.422	0.354	0.239	0.032	0.012	0.012	0.008	6487
2001	0.029	0.020	0.002	0.586	0.123	0.115	0.134	0.243	0.041	0.020	0.043	0.038	3662
2002	0.039	0.039	0.000	2.172	0.927	0.077	0.065	0.033	0.019	0.008	0.046	0.035	9060
2003	0.021	0.021	0.067	4.030	1.330	0.114	0.077	0.033	0.051	0.003	0.060	0.028	15253
2004	0.004	0.004	0.002	0.609	0.022	0.063	0.175	0.063	0.012	0.045	0.032	0.017	2744
MIN	0.003	0.002	0.000	0.586	0.022	0.041	0.049	0.021	0.012	0.003	0.006	0.003	2,744
MAX	0.119	0.104	4.613	12.099	5.865	2.367	9.314	1.245	3.359	1.309	1.199	0.590	63,295
MEAN	0.032	0.027	0.800	4.293	1.118	0.554	1.512	0.307	0.199	0.111	0.100	0.055	23,945

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Table E3: Ribstone Creek near Edgerton (B05FD001)
March to October Historic Natural Flow from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	-	-	0.081	0.434	0.187	0.422	1.301	0.401	0.170	0.056	-	-	-
1981	-	-	0.103	0.392	0.597	1.754	1.065	0.732	0.119	0.000	-	-	-
1982	-	-	0.081	0.412	0.050	0.972	0.398	0.355	0.191	0.025	-	-	-
1983	-	-	0.081	0.369	0.176	0.398	4.252	2.382	0.284	0.024	-	-	-
1984	-	-	0.090	0.453	0.164	1.857	1.684	0.636	0.048	0.039	-	-	-
1985	-	-	0.132	1.771	3.846	2.138	1.388	0.175	0.156	0.195	-	-	-
1986	-	-	0.192	0.337	0.285	0.783	0.919	0.938	0.077	0.112	-	-	-
1987	-	-	0.097	1.014	1.524	1.526	1.433	0.667	0.531	0.163	-	-	-
1988	-	-	0.191	0.425	0.479	0.437	1.152	0.311	0.001	0.011	-	-	-
1989	-	-	0.169	0.437	0.521	1.657	0.862	0.367	0.142	0.000	-	-	-
1990	-	-	0.170	0.429	0.733	0.555	0.750	0.730	0.455	0.008	-	-	-
1991	-	-	0.175	0.421	0.714	0.580	0.915	0.268	0.160	0.000	-	-	-
1992	-	-	0.168	0.427	0.021	1.233	0.652	0.557	0.002	0.000	-	-	-
1993	-	-	0.168	0.421	0.098	0.447	1.456	0.949	0.211	0.008	-	-	-
1994	-	-	0.181	0.416	0.363	1.385	1.244	0.435	0.128	0.006	-	-	-
1995	-	-	0.193	0.471	1.411	0.948	0.701	0.190	0.361	0.003	-	-	-
1996	-	-	0.174	0.429	0.223	1.082	1.570	1.116	0.197	0.049	-	-	-
1997	-	-	0.181	0.604	4.113	1.203	1.720	0.578	0.039	0.036	-	-	-
1998	-	-	0.182	0.452	0.286	0.179	0.586	0.495	0.191	0.000	-	-	-
1999	-	-	0.174	0.418	0.018	0.309	0.148	0.303	0.348	0.000	-	-	-
2000	-	-	0.187	0.436	0.287	0.474	0.732	0.406	0.249	0.021	-	-	-
2001	-	-	0.176	0.514	0.350	0.407	0.678	0.684	0.295	0.000	-	-	-
2002	-	-	0.174	0.450	0.348	0.662	1.032	0.318	0.053	0.000	-	-	-
2003	-	-	0.176	0.460	0.159	0.367	1.229	0.640	0.277	0.000	-	-	-
2004	-	-	0.174	0.441	0.273	0.663	0.837	0.387	0.296	0.103	-	-	-
MIN	-	-	0.081	0.337	0.018	0.179	0.148	0.175	0.001	0.000	-	-	-
MAX	-	-	0.193	1.771	4.113	2.138	4.252	2.382	0.531	0.195	-	-	-
MEAN	-	-	0.155	0.513	0.689	0.897	1.148	0.601	0.199	0.034	-	-	-

05FD001.NAT.xls

Table E4: Battle River near the Saskatchewan Border (B05FE004) Historic Natural Flow from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.959	0.720	0.774	25.278	12.806	6.223	11.501	7.705	9.373	10.904	7.172	3.472	255230
1981	2.101	1.895	10.057	24.012	9.226	8.242	5.017	7.100	10.877	5.205	4.123	2.694	237954
1982	1.662	1.666	1.816	14.051	49.191	12.162	23.142	25.753	9.557	7.322	4.980	2.808	408816
1983	2.266	1.887	5.670	30.000	18.673	7.883	52.677	14.482	5.351	2.916	2.577	1.968	387536
1984	1.191	1.404	4.406	16.480	6.112	6.410	5.220	2.381	2.098	2.470	1.301	1.134	133033
1985	1.013	0.935	6.246	57.934	30.027	7.227	4.387	2.299	2.033	1.557	0.661	0.659	301850
1986	0.705	0.798	13.155	30.290	12.132	11.272	8.754	13.702	6.315	5.618	3.849	2.096	286431
1987	1.428	1.428	3.450	42.905	15.068	5.972	4.950	4.397	6.242	3.307	2.780	1.530	244946
1988	0.434	0.389	2.830	11.864	5.051	1.697	4.516	2.404	1.726	1.501	1.189	0.775	90582
1989	0.658	0.587	1.656	20.055	16.760	7.146	6.926	3.304	2.358	1.404	1.475	1.575	168328
1990	1.335	0.747	10.590	45.283	16.076	14.854	36.188	33.396	7.824	3.990	2.286	1.304	459439
1991	0.675	1.007	3.037	19.997	21.606	12.455	14.755	10.749	7.621	4.056	2.224	1.930	264225
1992	1.605	1.492	14.190	27.403	10.932	6.876	4.441	2.530	0.830	0.539	0.941	0.909	191315
1993	0.766	0.647	5.129	35.225	12.497	3.921	7.469	9.546	2.094	1.095	1.327	1.219	212928
1994	1.013	0.788	11.923	22.503	8.674	7.925	5.976	3.059	1.573	1.594	1.541	0.897	177599
1995	0.764	0.787	8.038	14.210	7.316	2.773	3.306	3.010	2.370	0.723	0.749	0.638	117738
1996	0.773	0.784	3.841	30.394	23.157	15.588	15.651	6.937	3.777	2.538	2.179	1.720	282873
1997	1.222	1.215	5.190	51.652	38.549	13.853	14.883	6.124	3.054	2.144	1.894	1.316	371509
1998	1.047	1.463	2.851	10.211	5.385	1.428	9.325	7.918	1.914	1.284	1.286	0.919	118951
1999	0.531	0.777	2.852	26.022	35.372	8.728	21.077	15.338	8.210	2.895	2.201	1.885	333073
2000	0.891	0.753	3.383	13.513	8.090	4.614	6.839	10.275	9.510	5.024	2.968	1.484	177599
2001	0.922	0.646	2.811	9.161	3.588	1.864	2.902	3.215	2.037	1.095	0.655	0.728	77994
2002	0.465	0.357	1.292	7.266	11.263	3.847	2.865	1.609	0.586	0.374	0.383	0.330	80919
2003	0.042	0.078	2.625	16.660	26.782	6.346	4.132	2.449	1.525	0.374	0.286	0.325	162890
2004	0.316	0.143	2.051	7.357	2.804	1.505	3.925	1.445	1.447	0.560	0.929	1.076	62104
MIN	0.042	0.078	0.774	7.266	2.804	1.428	2.865	1.445	0.586	0.374	0.286	0.325	62104
MAX	2.266	1.895	14.190	57.934	49.191	15.588	52.677	33.396	10.877	10.904	7.172	3.472	459439
MEAN	0.991	0.936	5.195	24.389	16.285	7.232	11.233	8.045	4.412	2.820	2.078	1.416	224235

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Table E5: Pipestone Creek at Coal Lake Inlet - Project Historic Natural Flow from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.134	0.088	0.003	6.515	0.827	0.809	1.416	1.409	3.803	1.483	1.358	0.668	48491
1981	0.039	0.029	3.779	2.421	0.838	0.390	0.284	1.392	0.265	0.087	0.171	0.138	26049
1982	0.126	0.044	0.000	10.760	6.640	2.295	5.917	0.615	0.241	0.280	0.159	0.115	71660
1983	0.112	0.118	0.585	5.815	0.880	1.206	8.487	0.296	0.029	0.043	0.052	0.024	46617
1984	0.042	0.060	1.036	1.748	0.269	0.820	0.124	0.023	0.271	0.166	0.136	0.083	12535
1985	0.030	0.021	1.735	13.698	1.590	0.099	0.183	0.062	0.044	0.045	0.046	0.017	45857
1986	0.025	0.023	3.233	1.857	2.682	0.405	0.672	0.645	0.029	0.267	0.101	0.057	26557
1987	0.016	0.015	0.148	4.539	0.647	0.160	0.055	0.127	0.099	0.020	0.039	0.012	15322
1988	0.003	0.003	0.055	0.821	0.085	0.047	0.120	0.089	0.041	0.028	0.026	0.016	3490
1989	0.027	0.017	0.030	5.026	1.303	0.386	0.492	0.109	0.104	0.122	0.139	0.075	20481
1990	0.006	0.003	1.986	8.648	1.788	1.475	10.545	0.951	0.040	0.012	0.006	0.004	67321
1991	0.015	0.026	0.261	8.035	3.029	0.928	3.806	0.416	0.065	0.066	0.044	0.028	43990
1992	0.062	0.071	5.223	3.304	0.712	0.364	0.089	0.052	0.018	0.085	0.053	0.031	26621
1993	0.025	0.028	1.676	4.692	0.304	0.188	0.123	0.043	0.017	0.071	0.044	0.029	18958
1994	0.039	0.038	0.868	1.945	0.082	0.237	0.585	0.165	0.130	0.031	0.041	0.025	11001
1995	0.011	0.010	0.625	1.064	0.068	0.100	0.085	0.054	0.024	0.070	0.028	0.019	5676
1996	0.016	0.017	0.783	5.956	1.347	0.958	0.417	0.320	0.018	0.044	0.029	0.019	25977
1997	0.020	0.022	0.222	12.308	1.781	2.680	1.601	0.539	0.129	0.070	0.057	0.027	50795
1998	0.020	0.019	0.230	1.476	0.118	0.580	4.687	0.084	0.020	0.046	0.022	0.013	19407
1999	0.015	0.022	0.036	11.154	3.760	0.663	2.189	0.608	0.077	0.019	0.049	0.024	48820
2000	0.008	0.006	0.051	1.340	0.177	0.478	0.400	0.270	0.036	0.013	0.014	0.009	7344
2001	0.033	0.023	0.002	0.664	0.140	0.131	0.151	0.275	0.047	0.022	0.049	0.043	4146
2002	0.044	0.044	0.000	2.460	1.049	0.087	0.073	0.037	0.022	0.009	0.052	0.040	10257
2003	0.024	0.024	0.076	4.563	1.505	0.129	0.088	0.037	0.057	0.003	0.068	0.031	17268
2004	0.005	0.004	0.002	0.689	0.025	0.072	0.198	0.072	0.013	0.051	0.037	0.019	3107
MIN	0.003	0.003	0.000	0.664	0.025	0.047	0.055	0.023	0.013	0.003	0.006	0.004	3107
MAX	0.134	0.118	5.223	13.698	6.640	2.680	10.545	1.409	3.803	1.483	1.358	0.668	71660
MEAN	0.036	0.031	0.906	4.860	1.266	0.627	1.712	0.348	0.226	0.126	0.113	0.063	27110

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Appendix F

Battle River Basin
Urban Use (1980 – 2004)

Appendix F: Battle River Basin Urban Use (1980-2004)

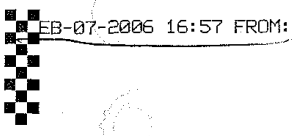
Table F1: Battle River Basin Urban Licenses

Community	Size	Location	EDA/GDA	Node	Quantity	Lic Use	2004 Use	Location	Water Source
Alliance	Village	15-40-13-W4	EDA	05FE004	74	10	39	EDA	Battle River
Alliance	Village	15-40-13-W4	EDA	05FE004	42	42		EDA	Groundwater
Amisk	Village	26-41-8-W4	GDA		23	5	22	GDA	Groundwater
Bawlf	Village	31-45-17-W4	GDA		26	11	44	GDA	Groundwater
Bittern Lake	Village	36-46-21-W4	GDA		47	47	16	GDA	Groundwater
Botha	Village	33-38-18-W4	EDA	FOR.RES			21	EDA	Stettler
Camrose	City	46,47-20-W4	EDA	05FC001	3084	525	2176	EDA	Driedmeat Lake
Camrose	City	46,47-20-W4	EDA	05FC001	185	185		EDA	Camrose Creek
Castor	Town	35-37-14-W4	EDA	05FE004	247	81	163	EDA	Castor Creek
Chauvin	Village	7-43-1-W4	GDA		60	60	75	GDA	Groundwater
Coronation	Town	13-36-11-W4	EDA	05FD001	342	68	197	EDA	Groundwater
Czar	Village	20-40-6-W4	EDA	05FD001				EDA	Groundwater
Daysland	Town	9-45-16-W4	GDA		167	33	101	GDA	Groundwater
Donalda	Village	6-42-18-W4	EDA	FOR.RES	53	33		EDA	Groundwater
Edberg	Village	14-44-20-W4	EDA	05FC001	16	16	11	EDA	Groundwater
Edgerton	Village	1-44-4-W4	EDA	05FE004	43	26	38	EDA	Groundwater
Ferintosh	Village	3-44-21-W4	EDA	FOR.RES	31	6	12	EDA	Little Beaver River
Ferintosh	Village	3-44-21-W4	EDA	FOR.RES	15	15	12	EDA	Groundwater
Forestburg	Village	2-42-15-W4	GDA		178	178		GDA	Groundwater
Gadsby	Village	27-38-17-W4	EDA	FOR.RES		18		EDA	Stettler
Galahad	Village	10-41-14-W4	GDA		43	9	22	GDA	Groundwater
Halkirk	Village	24-38-16-W4	EDA	05FE004	21	4	14	EDA	Groundwater
Hardisty	Town	6-43-9-W4	EDA	05FE004	99	20	174	EDA	Groundwater
Hay Lakes	Village	6-49-21-W4	GDA		88	29	61	GDA	Camrose Creek
Heisler	Village	2-43-16-W4	GDA		37	37	21	GDA	Groundwater
Hughenden	Village	8-41-7-W4	GDA		63	63	33	GDA	Groundwater
Irma	Village	27-45-9-W4	EDA	05FE004	148	30	49	EDA	Groundwater
Killam	Town	17-44-13-W4	EDA	05FE004	214	214	183	EDA	Groundwater
Lacombe	Town	30-40-26-W4	EDA	05FA001	2805	1460	1117	EDA	Groundwater
Lougheed	Village	33-43-11-W4	GDA		62	62	70	GDA	Groundwater
Millet	Town	32-47-24-W4	EDA	05FA021	85	17	234	EDA	Groundwater
New Norway	Village	11-45-21-W4	GDA		48	10	35	GDA	Groundwater
Paradise Valley	Village	6-47-2-W4	GDA		37	7	27	GDA	Groundwater
Ponoka	Town	4-43-25-W4	EDA	05FA021	1647	475	839	EDA	Groundwater
Rosalind	Village	17-44-17-W4	GDA		41	30	29	GDA	Groundwater
Samson 137	Indian Reserve	13-44-24-W4	EDA	05FA021	423	423		EDA	Groundwater
Samson 137A	Indian Reserve	4-44-24-W4	EDA	05FA021				EDA	Groundwater
Sedgewick	Town	9-44-12-W4	GDA		227	227	124	GDA	Groundwater
Stettler	Town	5-39-19-W4	EDA	FOR.RES	1700	340	987	EDA	Red Deer River
Strome	Village	23-44-15-W4	GDA		74	15	34	GDA	Groundwater
Veteran	Village	17-35-8-W4	GDA		47	9	50	GDA	Groundwater
Viking	Town	36-47-13-W4	GDA		548	159		GDA	Iron Creek
Wainwright	Town	31-44-6-W4	EDA	05FE004	1726	1332	894	EDA	Battle River
Wainwright CFB	Military Area	42-45,5-9,W4	EDA	05FE004	5020	1004		EDA	Battle River
Wetaskiwin	City	14-46-24-W4	EDA	05FA021	2467	617	1847	EDA	Coal Lake
Wetaskiwin	City	14-46-24-W4	EDA	05FA021	163	33		EDA	Groundwater

Notes:

1. Source: Battle River Basin: Water Use Assessment and Projections, Watrecon, May 10, 2005
2. EDA/GDA designation mapped in ArcGIS from Google Earth Reference Lat/Long

Figure F1: Battle River Basin Urban Return Flows Identified by AE



EB-07-2006 16:57 FROM: TO:306 694 3944 P.1/1

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Item#3 Outlet rating curve and/or table for Forestburg Reservoir
Item #7 Wetaskiwin wastewater is returned to Pipestone Creek below Coal Lake
Item #8 The following Towns and Villages have significant discharge to the Battle River, or a tributary with a high likely hood of the discharge being recorded at a WSC gauging station, Blackfalds, Lacombe Ponoka, Wetaskiwin, Camrose, Stettler, Killam, Sedgewick, Hardisty, Castor, Coronation
Item #11 Licence ID# 28401 is a gravel washing licence and as such has no consumptive value due to its proximity to the river
Item #12 Identified as item 4.2.12 in the Saskatchewan Methodology Report, it is an active licence for snowmaking and supporting infrastructure has been built. 50-dam3 consumptive use component

More later. .. Will phone you as soon as I FAX this.

Total pages sent including cover: 01

Table F2: Urban Surface Water Licenses within the Battle River Basin EDA

	Community	Size	Node	Licensed Quantity (cm)	Est Cons (cm)	Est Losses (cm)	Est Return Flow (cm)	Watrecon Water Use (cm)	Watrecon Reported Use 2004 (cm)	Ratio Reported Use 2004/ Quantity (%)	Ratio Return/ Quantity (%)	Return Flow	Water Supply	Comment
URBAN USES WITHIN THE BATTLE RIVER BASIN EDA														
Recorded Data - Partial Period of Record														
1	Camrose	City	05FC001	3083700	525460		2558240		2176000		83%	Y	Driedmeat Lake	
2	Camrose	City	05FC001	185020	185020						0%	Y	Camrose Creek	
3	Wainwright	Town	05FE004	1726880	155420	172690	1398770		894000		81%	Y	Battle River	
4	Wainwright CFB	Military Area	05FE004	5019030	762290	241760	4014980				80%	Y	Battle River	
5	Wetaskiwin	City	05FA021	2466980	616750		1850230		1847000		75%	Y	Coal Lake	
6	Wetaskiwin	City	05FA021	163000							0%	Y	Groundwater	
Small Community Surface Water Supply														
1	Alliance	Village	05FE004	74020	9870	23440	40710		39000	53%	55%	N	Battle River	Switched to GW in 2002
2	Castor	Town	05FE004	246690	18500	61670	166520		163000	66%	68%	Y	Castor Creek	
3	Ferintosh	Village	FOR.RES	30830	6160		24670		12000	39%	80%	N	Little Beaver River	Switched to GW in 2000
									Mean	53%	68%			
Interbasin Transfer														
	Stettler	Town	FOR.RES	1700000				340000	987000	58%		Y	Red Deer River	
Note:														
1	Water Use is the estimated consumption and loss included in the licence													
2	Assume the 2004 Use is the Withdrawal Volume													
3	Watrecon refers to the Battle River Basin Water Use Assessment and Projections Report Table 3.3, pg 31													
4	Return Flows identified by AE considered significant													

Table F3: Alliance Uses (m^3/s)

ALLIANCE USES (CMS)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1981	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1982	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1983	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1984	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1985	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1986	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1987	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1988	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1989	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1990	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1991	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1992	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1993	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1994	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1995	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1996	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1997	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1998	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
1999	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
2000	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
2001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
2002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
												TOTAL	1009633
1980-2004													
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
MAX	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	45892
MEAN	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	40385

Alliance.Uses.xls

Table F4: City of Camrose Licence

CITY OF CAMROSE								
Apv Id	Ah Roles Nonterm	Specific	Source	Priority	Quantity (m^3)	Cons (m^3)	Losses (m^3)	Return (m^3)
44710	CITY OF CAMROSE	URBAN	Driedmeat Lake	19580514001	1233480	209690	0	1023790
44709	CITY OF CAMROSE	URBAN	Driedmeat Lake	19780626001	863440	148020	0	715420
44708	CITY OF CAMROSE	URBAN	Driedmeat Lake	19820222001	986780	167750	0	819030
				SUB-TOTAL	3083700	525460	0	2558240
44707	CITY OF CAMROSE	COOPD	Camrose Creek	19290402001	185020	185020	0	0
RATIO URBAN RETURN/QUANTITY			78%	TOTAL	3268720	710480	0	2558240

Table F5: City of Camrose Uses (m^3/s)

CAMROSE USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.038	0.042	0.040	0.042	-0.021	-0.017	-0.021	-0.023	-0.023	-0.025	0.039	0.038	286070
1981	0.038	0.044	0.040	0.042	-0.021	-0.017	-0.021	-0.023	-0.023	-0.025	0.039	0.038	286070
1982	0.055	0.063	0.057	0.060	-0.030	-0.025	-0.030	-0.032	-0.032	-0.036	0.057	0.055	409775
1983	0.055	0.063	0.057	0.060	-0.030	-0.025	-0.030	-0.032	-0.032	-0.036	0.057	0.055	409775
1984	0.055	0.061	0.057	0.060	-0.030	-0.025	-0.030	-0.032	-0.032	-0.036	0.057	0.055	409775
1985	0.055	0.063	0.057	0.060	-0.030	-0.025	-0.030	-0.032	-0.032	-0.036	0.057	0.055	409775
1986	0.055	0.063	0.057	0.060	-0.030	-0.025	-0.030	-0.032	-0.032	-0.036	0.057	0.055	409775
1987	0.052	0.054	0.065	0.058	-0.028	-0.019	-0.038	-0.036	-0.033	-0.027	0.057	0.057	414283
1988	0.063	0.064	0.074	0.066	-0.009	-0.042	-0.037	-0.042	-0.041	-0.040	0.048	0.052	406529
1989	0.050	0.056	0.047	0.050	-0.031	-0.021	-0.025	-0.028	-0.024	-0.033	0.051	0.048	358857
1990	0.046	0.053	0.034	0.054	-0.028	-0.020	-0.022	-0.025	-0.016	-0.028	0.046	0.043	344917
1991	0.051	0.046	0.050	0.051	-0.025	-0.026	-0.025	-0.025	-0.026	-0.028	0.046	0.045	341167
1992	0.050	0.046	0.048	0.046	-0.030	-0.019	-0.025	-0.020	-0.030	-0.033	0.050	0.053	353176
1993	0.053	0.050	0.048	0.048	-0.025	-0.011	-0.033	-0.029	-0.031	-0.030	0.050	0.051	359473
1994	0.059	0.063	0.066	0.066	-0.023	-0.027	-0.027	-0.037	-0.042	-0.037	0.054	0.047	412949
1995	0.050	0.049	0.052	0.049	-0.024	-0.024	-0.017	-0.024	-0.031	-0.034	0.046	0.048	360825
1996	0.052	0.056	0.052	0.062	-0.032	-0.020	-0.020	-0.034	-0.034	-0.035	0.055	0.055	406071
1997	0.056	0.059	0.059	0.059	-0.033	-0.031	-0.030	-0.027	-0.033	-0.034	0.059	0.061	421539
1998	0.061	0.074	0.076	0.078	-0.032	-0.034	-0.040	-0.037	-0.038	-0.045	0.063	0.064	483434
1999	0.059	0.062	0.063	0.062	-0.038	-0.023	-0.034	-0.034	-0.033	-0.034	0.062	0.062	444525
2000	0.060	0.064	0.063	0.063	-0.034	-0.029	-0.033	-0.033	-0.037	-0.039	0.060	0.063	437501
2001	0.057	0.065	0.061	0.063	-0.024	-0.034	-0.032	-0.030	-0.035	-0.037	0.063	0.062	457171
2002	0.062	0.061	0.062	0.061	-0.036	-0.022	-0.017	-0.039	-0.038	-0.039	0.065	0.062	466002
2003	0.061	0.062	0.063	0.068	-0.038	-0.035	-0.022	-0.025	-0.038	-0.038	0.063	0.059	458844
2004	0.062	0.059	0.061	0.063	-0.031	-0.026	-0.034	-0.036	-0.038	-0.037	0.063	0.068	448684
												TOTAL	9996962
1980-2004													
MIN	0.038	0.042	0.034	0.042	-0.038	-0.042	-0.040	-0.042	-0.042	-0.045	0.039	0.038	286070
MAX	0.063	0.074	0.076	0.078	-0.009	-0.011	-0.017	-0.020	-0.016	-0.025	0.065	0.068	483434
MEAN	0.054	0.058	0.056	0.058	-0.029	-0.025	-0.028	-0.031	-0.032	-0.034	0.055	0.054	399878

Camrose.Uses.xls

Table F6: Castor Licence (m^3)

Apv Id	Ah Roles Nonterm	Source	Priority	Quantity	Cons	Losses	Return
				(cu.m)	(cu.m)	(cu.m)	(cu.m)
40837	TOWN OF CASTOR	Castor Creek	19520125001	246690	18500	61670	166520
RATIO APV ID RETURN TO LICENSED QUANTITY			68%				
RATIO WITHDRAWAL TO LICENSED QUANTITY			62%	Table F7			

Castor.Uses.xls

Table F7: Castor Recorded Diversion (m^3)

CASTOR RECORDED DIVERSION (m^3)														Ratio Diversion/ Licensed
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Quantity
1980	13329	10997	13320	13396	20789	15728	16658	14181	9234	14395	11396	11659	165082	67%
1981	10330	11479	11559	11530	15862	15528	18061	18927	10289	14529	14529	12396	165019	67%
1982	12329	12663	14662	13929	16728	17538	13596	14862	14395	14929	12684	13662	171978	70%
1983														
1984	10732	8881	10500	9774	12290	12233	16820	12289	9719	10221	9216	9048	131722	53%
1985	10109	8266	12145	9795	12080	14746	14652	13042	10001	9947	9266	9593	133641	54%
1986	8911	7467	8421	8176	11310	10356	9157	8993	8830	8939	8830	7794	107181	43%
1987	9102	7113	8473	11521	19283	19382	15423	14424	13816	19176	14008	14402	166122	67%
1988	12753	11425	12290	13751	21162	20238	16923	13633	12455	14101	13561	14607	176897	72%
1989	14343	13981	16804	16708	19887	16455	16595	12605	10641	12230	11338	11821	173408	70%
1990	11953	10074	11702	11352	14048	13896	12763	12942	11740	12670	10863	10820	144822	59%
1991	12279	10653	11171	11814	12762	11782	13253	15021	11952	11776	11116	11511	145087	59%
1992	11558	11061	12569	13615	17037	17911	16804	17547	13837	14703	14042	10907	171589	70%
1993														
1994														
1995														
1996														
1997														
1998														
1999														
2000														
2001	11510	9830	11466	11340	15624	15020	16590	19629	15054	13750	11992	12457	164262	67%
2002	12523	13589	13778	12486	15135	17509	18101	14807	12611	11656	11314	11133	164642	67%
2003	12523	11150	12656	13890	14281				11749	11506	10138	10782	108675	44%
2004	11130	13002	14911	13057	15361	15298	15534	14051	13377	14315	11638	12108	163782	66%
Average	11588	10727	12277	12258	15852	15575	15395	14463	11856	13053	11621	11544	156209	62%
Distribution	7%	7%	8%	8%	10%	10%	10%	9%	8%	8%	7%	7%	100%	

Castor.Uses.xls

Table F8: Castor Uses (m^3/s)

CASTOR USES (CMS)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.002	0.001	0.002	0.002	0.004	0.002	0.002	0.002	0.000	0.002	0.001	0.001	53346
1981	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.004	0.000	0.002	0.002	0.001	53628
1982	0.001	0.002	0.002	0.002	0.002	0.003	0.001	0.002	0.002	0.002	0.001	0.002	55890
1983	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50765
1984	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.001	0.001	0.001	0.001	42565
1985	0.001	0.001	0.002	0.001	0.002	0.003	0.002	0.002	0.001	0.001	0.001	0.001	43431
1986	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	34832
1987	0.000	-0.001	0.000	0.001	0.003	0.004	0.002	0.002	0.002	0.004	0.002	0.002	53987
1988	0.001	0.001	0.001	0.002	0.004	0.004	0.002	0.001	0.001	0.001	0.001	0.002	57164
1989	0.002	0.002	0.003	0.003	0.004	0.002	0.002	0.001	0.000	0.001	0.001	0.001	56355
1990	0.002	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.001	0.002	0.001	0.001	47065
1991	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.003	0.002	0.001	0.001	0.001	47151
1992	0.001	0.001	0.001	0.002	0.003	0.003	0.002	0.003	0.002	0.002	0.002	0.000	55448
1993	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50765
1994	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50765
1995	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50765
1996	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50478
1997	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50765
1998	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50765
1999	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50765
2000	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50478
2001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.004	0.002	0.002	0.001	0.001	53382
2002	0.001	0.002	0.002	0.001	0.002	0.003	0.003	0.002	0.001	0.001	0.001	0.001	53506
2003	0.002	0.001	0.001	0.002	0.002	0.003	0.002	0.002	0.001	0.001	0.001	0.001	50083
2004	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	52926
												TOTAL	1267071
1980-2004													
MIN	0.000	-0.001	0.000	0.001	0.002	0.001	0.001	0.001	0.000	0.001	0.001	0.000	34832
MAX	0.002	0.002	0.003	0.003	0.004	0.004	0.003	0.004	0.002	0.004	0.002	0.002	57164
MEAN	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	50683

Castor.Uses.xls

Table F9: Coronation Uses (m^3/s)

CORONATION USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1981	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1982	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1983	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1984	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1985	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1986	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1987	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1988	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1989	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1991	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1992	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1993	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1994	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1995	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1996	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1997	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1998	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1999	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
												TOTAL	0
1980-2004													
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
MAX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
MEAN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0

Coronation.Uses.xls

Table F10: Ferintosh Uses (m^3/s)

FERINTOSH USES (CMS)

USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1981	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1982	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1983	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1984	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1985	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1986	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1987	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1988	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1989	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1990	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1991	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1992	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1993	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1994	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1995	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1996	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1997	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1998	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
1999	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
												TOTAL	382292
1980-2004													
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
MAX	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	19115
MEAN	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	15292

Ferintosh.Uses.xls

Table F11: Hardisty Uses (m^3/s)

HARDISTY USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1981	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1982	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1983	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1984	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1985	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1986	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1987	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1988	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1989	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1990	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1991	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1992	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1993	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1994	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1995	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1996	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1997	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1998	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
1999	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
2000	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
2001	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
2002	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
2003	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
2004	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
												TOTAL	-1428000
1980-2004													
MIN	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
MAX	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120
MEAN	0.000	0.000	0.000	-0.011	0.000	0.000	0.000	0.000	0.000	-0.011	0.000	0.000	-57120

Hardisty.Uses.xls

Table F12: Killam Uses (m^3/s)

KILLAM USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1981	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1982	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1983	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1984	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1985	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1986	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1987	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1988	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1989	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1990	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1991	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1992	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1993	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1994	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1995	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1996	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1997	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1998	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
1999	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
2000	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
2001	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
2002	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
2003	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
2004	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
												TOTAL	-2247000
1980-2004													
MIN	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
MAX	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880
MEAN	0.000	0.000	0.000	-0.017	0.000	0.000	0.000	0.000	0.000	-0.017	0.000	0.000	-89880

Killam.Uses.xls

Table F13: Lacombe Uses (m^3/s)

LACOMBE USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1981	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1982	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1983	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1984	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1985	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1986	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1987	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1988	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1989	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1990	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1991	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1992	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1993	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1994	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1995	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1996	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1997	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1998	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
1999	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
2000	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
2001	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
2002	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
2003	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
2004	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
												TOTAL	-19635000
1980-2004													
MIN	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
MAX	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400
MEAN	0.000	0.000	0.000	-0.152	0.000	0.000	0.000	0.000	0.000	-0.147	0.000	0.000	-785400

LaCombe.Uses.xls

Table F14: Lacombe County Uses (m^3/s)

LACOMBE COUNTY USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1981	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1982	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1983	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1984	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1985	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1986	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1987	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1988	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1989	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1990	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1991	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1992	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1993	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1994	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1995	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1996	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1997	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1998	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
1999	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
2000	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
2001	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
2002	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
2003	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
2004	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
												TOTAL	11471395
1980-2004													
MIN	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
MAX	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856
MEAN	0.013	0.013	0.013	0.014	0.017	0.018	0.017	0.016	0.013	0.014	0.013	0.013	458856

LaCombe.County.Uses.xls

Table F15: Ponoka Uses (m^3/s)

PONOKA USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1981	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1982	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1983	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1984	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1985	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1986	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1987	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1988	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1989	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1990	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1991	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1992	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1993	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1994	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1995	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1996	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1997	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1998	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
1999	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
2000	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
2001	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
2002	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
2003	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
2004	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
												TOTAL	-17293500
1980-2004													
MIN	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
MAX	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740
MEAN	0.000	0.000	0.000	-0.133	0.000	0.000	0.000	0.000	0.000	-0.129	0.000	0.000	-691740

Ponoka.Uses.xls

Table F16: Spady Uses (m^3/s)

SPADY USES (cms)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1981	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1982	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1983	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1984	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1985	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1986	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1987	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1988	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1989	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1990	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1991	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1992	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1993	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1994	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1995	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1996	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1997	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1998	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
1999	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
2000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
2001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
2002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
2003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
2004	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
												TOTAL	65032
1980-2004													
MIN	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
MAX	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3825
MEAN	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	2601

Spady.Uses.xls

Table F17: Stettler Uses (m^3/s)

STETTLER USES (CMS)
USES = DIVERSION - RETURN FLOW

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cu.m)
1980	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1981	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1982	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1983	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1984	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1985	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1986	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1987	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1988	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1989	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1990	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1991	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1992	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1993	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1994	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1995	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1996	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1997	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1998	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
1999	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
2000	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
2001	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
2002	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
2003	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
2004	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
												TOTAL	-15418523
1980-2004													
MIN	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
MAX	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741
MEAN	0.000	0.000	0.000	-0.119	0.000	0.000	0.000	0.000	0.000	-0.115	0.000	0.000	-616741

Stettler.Uses.xls

Table F18: CFB Wainwright and Town of Wainwright Reported and Estimated Uses (m^3)

CFB WAINWRIGHT AND TOWN OF WAINWRIGHT USES

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL RECORDED/ ESTIMATED USE (cu.m)	LICENSED CONSUMPTION & LOSS (cu.m)	RATIO USE/ (CONS+ LOSS) (%)
1980	0.000	0.000	0.000	0.000	0.052	0.052	0.052	0.052	0.052	0.052	0.000	0.000	833052	1004050	83%
1981	0.000	0.000	0.000	0.000	0.052	0.052	0.052	0.052	0.052	0.052	0.000	0.000	833052	1004050	83%
1982	0.000	0.000	0.000	0.000	0.052	0.052	0.052	0.052	0.052	0.052	0.000	0.000	833052	1004050	83%
1983	0.000	0.000	0.000	0.000	0.052	0.052	0.052	0.052	0.052	0.052	0.000	0.000	833052	1004050	83%
1984	0.000	0.000	0.000	0.000	0.052	0.052	0.052	0.052	0.052	0.052	0.000	0.000	833052	1004050	83%
1985	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1986	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1987	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1988	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1989	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1990	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1991	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1992	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1993	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1994	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1995	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1996	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1997	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1998	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%
1999	0.000	0.000	0.000	0.000	0.069	0.069	0.069	0.069	0.069	0.069	0.000	0.000	1093036	1332160	82%
2000	0.000	0.000	0.000	0.000	0.067	0.067	0.067	0.067	0.067	0.067	0.000	0.000	1064302	1332160	80%
2001	0.000	0.000	0.000	0.000	0.072	0.072	0.072	0.072	0.072	0.072	0.000	0.000	1145465	1332160	86%
2002	0.000	0.000	0.000	0.000	0.071	0.071	0.071	0.071	0.071	0.071	0.000	0.000	1132818	1332160	85%
2003	0.000	0.000	0.000	0.000	0.069	0.069	0.069	0.069	0.069	0.069	0.000	0.000	1094004	1332160	82%
2004	0.000	0.000	0.000	0.000	0.069	0.069	0.069	0.069	0.069	0.069	0.000	0.000	1102067	1332160	83%
												TOTAL	26270898		
1980-2004 (FILLED AND RECORDED)															
MIN	0.000	0.000	0.000	0.000	0.052	0.052	0.052	0.052	0.052	0.052	0.000	0.000	833052	1004050	
MAX	0.000	0.000	0.000	0.000	0.072	0.072	0.072	0.072	0.072	0.072	0.000	0.000	1145465	1332160	
MEAN	0.000	0.000	0.000	0.000	0.066	0.066	0.066	0.066	0.066	0.066	0.000	0.000	1050836	1266538	
1999-2004 (RECORDED)															
MIN	0.000	0.000	0.000	0.000	0.067	0.067	0.067	0.067	0.067	0.067	0.000	0.000	1064302		
MAX	0.000	0.000	0.000	0.000	0.072	0.072	0.072	0.072	0.072	0.072	0.000	0.000	1145465		
MEAN	0.000	0.000	0.000	0.000	0.070	0.070	0.070	0.070	0.070	0.070	0.000	0.000	1105282	1332160	83%

Filled Uses from 1980 to 1998
Wainright.Uses.2.xls

Table F19: CFB Wainwright and Town of Wainwright Surface Water Licence (m^3)

Apv Id	Ah Roles Nonterm	Specific	Source	Priority	Quantity (cu.m)	Cons (cu.m)	Losses (cu.m)	Return (cu.m)
40628	NATIONAL DEFENCE	COOPD	Battle River	19510912001	5019030	762290	241760	4014980
29795	TOWN OF WAINWRIGHT	URBAN	Battle River	19850222006	1726880	155420	172690	1398770
				Total	6745910	917710	414450	5413750
				Cons + Losses			1332160	

Wainright.Uses.2.xls

Table F20: City of Wetaskiwin Recorded and Estimated Return Flow Volume (m^3)

CITY OF WETASKIWIN RECORDED AND FILLED (BLUE) RETURN FLOW VOLUMES (cu.m)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1980	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1981	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1982	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1983	7595	7943	18071	19519	18135	16358	13144	24358	13177	13952	11058	8272	171582
1984	11440	11650	15595	13269	15045	10794	11275	10705	9930	11672	11516	11883	144774
1985	344	7432	7570	11250	5237	10906	3124	8309	7977	8964	6270	2637	80022
1986	4779	7793	7995	10853	38876	38720	27389	8940	9298	10646	9723	4639	179648
1987	20351	29479	31907	11431	24146	19363	26535	19036	21722	25264	20001	23192	272427
1988	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1989	30379	17756	23619	20326	28166	29549	42801	52469	41211	40190	36102	23370	385936
1990	51392	15229	22652	18775	37201	21062	25525	33576	25302	25763	13328	15550	305353
1991	17269	18285	29301	18569	24247	11792	24523	12343	9251	7485	6342	3106	182510
1992	5469	4031	4965	9301	2708	1828	2634	4284	7619	9538	7236	7159	66769
1993	7366	4993	7059	8980	10791	8545	3555	5357	3597	7487	5080	5082	77889
1994	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1995	4494	202	3361	14227	8765	7702	10919	8268	703	3513	13277	5078	80507
1996	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1997	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1998	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
1999	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
2000	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
2001	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
2002	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
2003	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
2004	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
Average (1983-1995)													
	14625	11345	15645	14227	19392	16056	17402	17058	13617	14952	12721	9997	177038
Missing Data	1980-82, 1988, 1996-2004												

Wetaskiwin.Uses.xls

Table F21: City of Wetaskiwin Return Flow (m^3/s) (Return flow represented as a negative use)

CITY OF WETASKIWIN USES (cms)
Wetaskiwin Return Flow as Negative Use

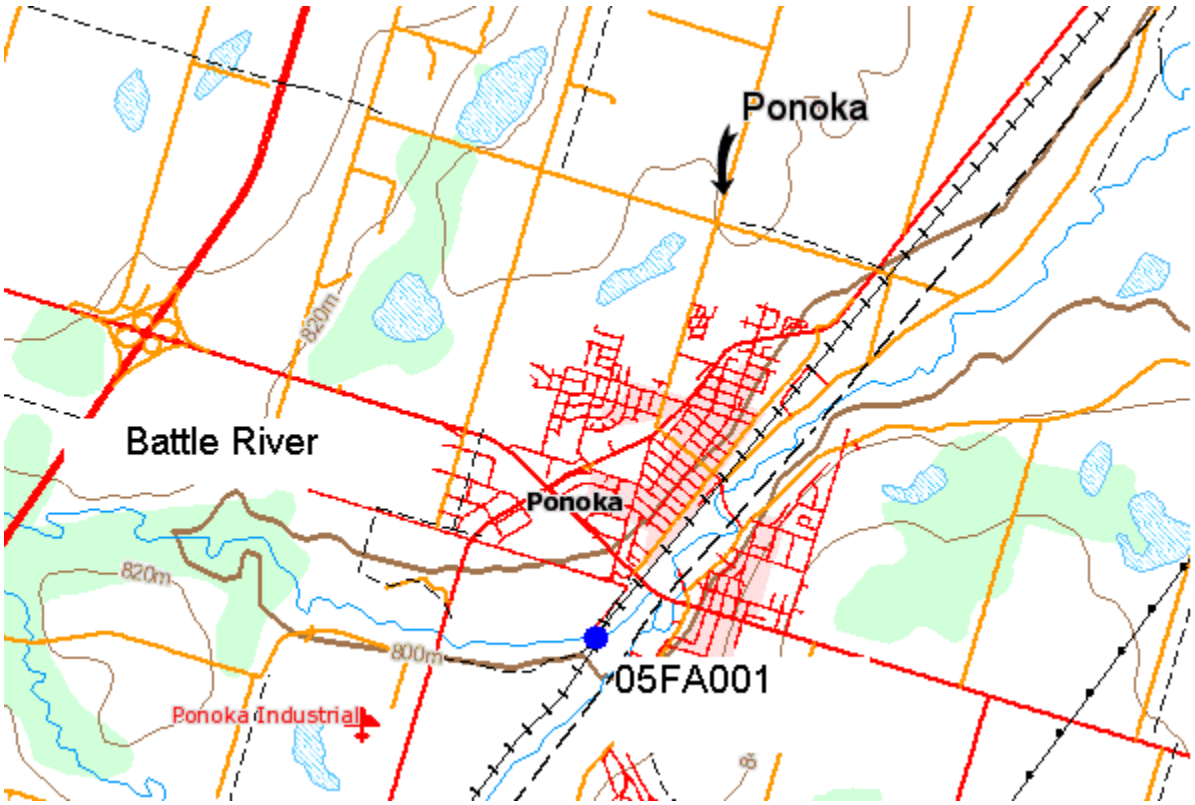
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL USES (cm)
1980	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1981	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1982	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1983	-0.003	-0.003	-0.007	-0.008	-0.007	-0.006	-0.005	-0.009	-0.005	-0.005	-0.004	-0.003	-171582
1984	-0.004	-0.005	-0.006	-0.005	-0.006	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-144774
1985	0.000	-0.003	-0.003	-0.004	-0.002	-0.004	-0.001	-0.003	-0.003	-0.003	-0.002	-0.001	-80022
1986	-0.002	-0.003	-0.003	-0.004	-0.015	-0.015	-0.010	-0.003	-0.004	-0.004	-0.004	-0.002	-179648
1987	-0.008	-0.012	-0.012	-0.004	-0.009	-0.007	-0.010	-0.007	-0.008	-0.009	-0.008	-0.009	-272427
1988	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1989	-0.011	-0.007	-0.009	-0.008	-0.011	-0.011	-0.016	-0.020	-0.016	-0.015	-0.014	-0.009	-385936
1990	-0.019	-0.006	-0.008	-0.007	-0.014	-0.008	-0.010	-0.013	-0.010	-0.010	-0.005	-0.006	-305353
1991	-0.006	-0.008	-0.011	-0.007	-0.009	-0.005	-0.009	-0.005	-0.004	-0.003	-0.002	-0.001	-182510
1992	-0.002	-0.002	-0.002	-0.004	-0.001	-0.001	-0.001	-0.002	-0.003	-0.004	-0.003	-0.003	-66769
1993	-0.003	-0.002	-0.003	-0.003	-0.004	-0.003	-0.001	-0.002	-0.001	-0.003	-0.002	-0.002	-77889
1994	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1995	-0.002	0.000	-0.001	-0.005	-0.003	-0.003	-0.004	-0.003	0.000	-0.001	-0.005	-0.002	-80507
1996	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1997	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1998	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
1999	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
2000	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
2001	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
2002	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
2003	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
2004	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038
												TOTAL	-4425943
MIN	-0.019	-0.012	-0.012	-0.008	-0.015	-0.015	-0.016	-0.020	-0.016	-0.015	-0.014	-0.009	-385936
MAX	0.000	0.000	-0.001	-0.003	-0.001	-0.001	-0.001	-0.002	0.000	-0.001	-0.002	-0.001	-66769
MEAN	-0.005	-0.005	-0.006	-0.005	-0.007	-0.006	-0.006	-0.006	-0.005	-0.006	-0.005	-0.004	-177038

Table F22: Municipal Use Summary

BATTLE RIVER BASIN			
MUNICIPAL USES SUMMARY (1980 - 2004)			
	Average		
	Annual	Total	
Community	Use	Use	Excel File
	(cu.m)	(cu.m)	
Alliance	40385	1009633	Alliance.Uses.xls
Camrose	399878	9996962	Camrose.Uses.xls
Castor	50683	1267071	Castor.Uses.xls
Coronation	0	0	Coronation.Uses.xls
Ferintosh	15292	382292	Ferintosh.Uses.xls
Hardisty	-57120	-1428000	Hardisty.Uses.xls
Killam	-89880	-2247000	Killam.Uses.xls
Lacombe.County	458856	11471395	Lacombe.County.Uses.xls
Lacombe	-785400	-19635000	Lacombe.Uses.xls
Ponoka	-691740	-17293500	Ponoka.Uses.xls
Spady	2601	65032	Spady.Uses.xls
Stettler	-616741	-15418523	Stettler.Uses.xls
Wainright	1050836	26270898	Wainright.Uses.2.xls
Wetaskiwin	-177038	-4425943	Wetaskiwin.Uses.xls
Total	-399387	-9984684	cu.m
		-9985	cu.dam

Urban.Uses.Summary.xls

Figure F2: Hydrometric Station Battle River near Ponoka (05FA001) upstream of Ponoka



http://atlas.gc.ca/site/english/index.html

Appendix G

Coal Lake Uses
(1980 – 2004)

Appendix G: Coal Lake Uses (1980-2004)

Table G1: Battle River near Ponoka (05FA001)
Monthly Natural Recorded Flows (1980 to 2004)

05FA001.NAT
VOL (cu.dam)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	359	221	259	14020	2496	7136	9841	6717	9004	4804	3514	1787
1981	1578	1061	12410	6324	9736	5449	14005	36645	6559	7325	6700	5601
1982	3792	1205	1608	51456	23356	6492	44314	9466	8061	7373	4635	3461
1983	2499	2366	6773	26189	9060	4640	16296	2576	658	922	1113	530
1984	552	736	4371	6031	4997	7965	489	303	3249	2361	1728	1090
1985	854	559	6862	42376	8815	2295	782	1342	1434	1080	1292	503
1986	612	515	14582	6788	23519	3613	27894	10084	1741	5563	2424	1408
1987	937	780	1525	20942	9741	4941	2013	6073	4943	1745	2192	684
1988	173	145	1952	3518	1379	3381	15427	3940	2361	1540	1433	921
1989	534	307	739	36323	12056	3941	2726	2431	1860	2530	2646	1467
1990	1126	542	11944	25330	14131	33256	96620	11627	5542	4436	1205	706
1991	667	1047	3545	27750	21886	16427	22962	8161	2949	2845	1918	1274
1992	1135	1210	19933	10153	9096	8389	2815	1465	1058	815	942	556
1993	514	517	13565	12004	5874	665	1759	957	1111	683	871	597
1994	621	546	8523	8322	3789	3636	2488	1214	1381	1127	629	402
1995	355	274	4104	3262	2381	1250	2165	2476	1297	1640	844	601
1996	682	681	3434	22732	7156	6458	8665	5641	1069	1656	1232	849
1997	674	673	2634	31371	8257	11591	4607	2455	3664	3046	1910	946
1998	919	795	4090	4953	2534	936	16968	1179	1270	1700	974	570
1999	501	654	2128	40329	12581	1610	37520	8053	1946	1176	1601	823
2000	787	540	3873	7892	6883	9825	30407	8631	2553	1943	1234	800
2001	854	539	1781	2997	2600	2038	3118	9896	891	855	1219	1125
2002	362	330	780	15900	6392	2	497	572	250	-4	415	330
2003	142	127	912	43084	11692	789	645	385	273	76	393	187
2004	121	101	854	3161	1983	1151	1899	1642	685	872	864	470
AVERAGE	854	659	5327	18928	8896	5915	14677	5757	2632	2324	1757	1107

RATIO SEP AND OCT TOTAL VOLUME TO NOV TO FEB VOLUME

Year	Jan	Feb	Sept	Oct	Nov	Dec
1980	3%	2%	100%		25%	13%
1981	11%	8%	100%		48%	40%
1982	25%	8%	100%		30%	22%
1983	158%	150%	100%		70%	34%
1984	10%	13%	100%		31%	19%
1985	34%	22%	100%		51%	20%
1986	8%	7%	100%		33%	19%
1987	14%	12%	100%		33%	10%
1988	4%	4%	100%		37%	24%
1989	12%	7%	100%		60%	33%
1990	11%	5%	100%		12%	7%
1991	12%	18%	100%		33%	22%
1992	61%	65%	100%		50%	30%
1993	29%	29%	100%		49%	33%
1994	25%	22%	100%		25%	16%
1995	12%	9%	100%		29%	20%
1996	25%	25%	100%		45%	31%
1997	10%	10%	100%		28%	14%
1998	31%	27%	100%		33%	19%
1999	16%	21%	100%		51%	26%
2000	18%	12%	100%		27%	18%
2001	49%	31%	100%		70%	64%
2002	147%	134%	100%		168%	134%
2003	41%	36%	100%		113%	54%
2004	8%	6%	100%		55%	30%

05FA001.NAT.xls

Table G2: Pipestone Creek Drainage Area at Coal Lake Inlet

Coal Lake Reservoir Near Wetaskiwin (05FA016)
Assumed Pipestone Creek Drainage Area Included

GDA	1220	km^2
EDA	805	km^2

Coal Lake Reservoir Near Wetaskiwin (05FA016) PFRA Addendum #8 Oct 2001
Assumed Pipestone Creek Drainage Area not Included

GDA	175.7	km^2
EDA	65.4	km^2

Pipestone Creek at Coal Lake Reservoir Inlet

GDA	1040	km^2
EDA	740	km^2

Pipestone Creek near Wetaskiwin (05FA012)

GDA	1030	km^2
EDA	733	km^2

EDA Drainage Area Ratio to Extend Pipestone Creek Natural Flows to Coal Lake

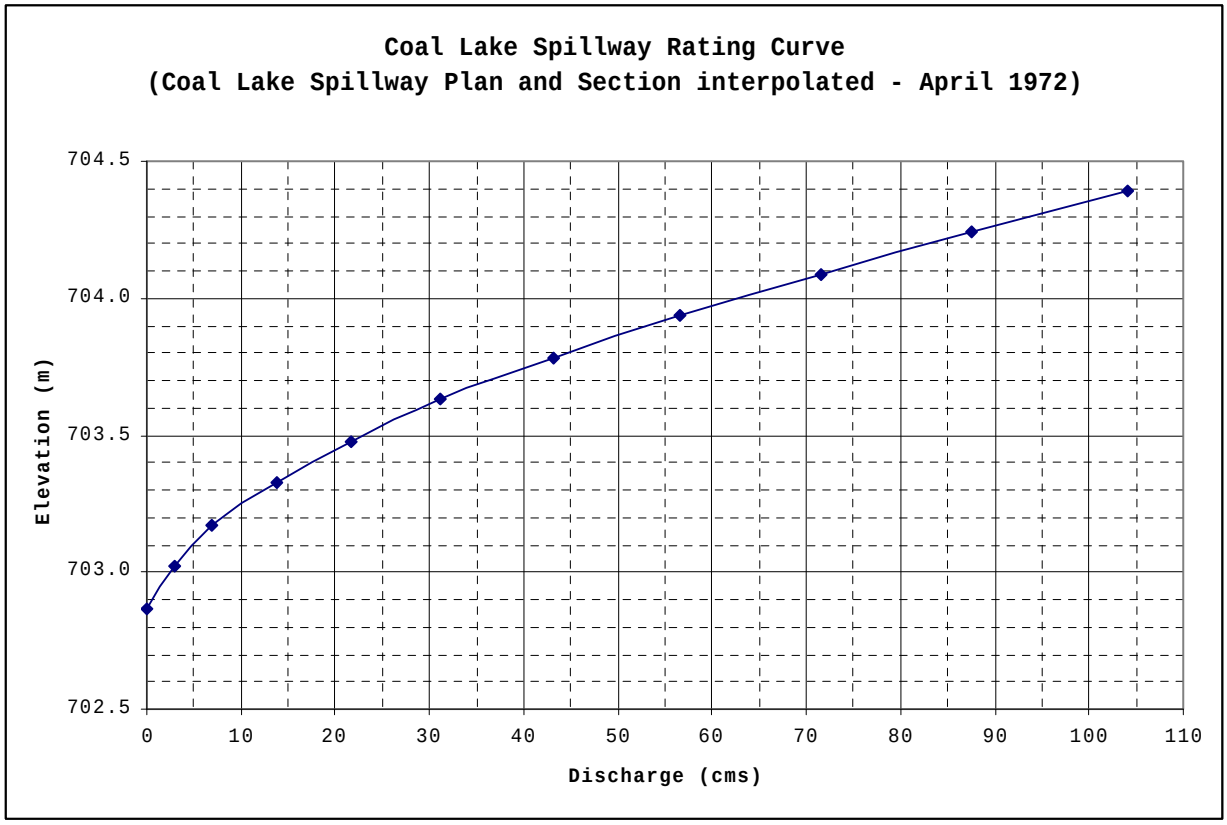
805	Coal Lake Reservoir Near Wetaskiwin (05FA016)
733	Pipestone Creek near Wetaskiwin (05FA012)
1.10	

Table G3: Coal Lake Elevation Discharge Table

Elevation (m)	Discharge (cms)
702.87	0.00
703.02	2.88
703.17	6.92
703.33	13.83
703.48	21.62
703.63	31.13
703.78	43.23
703.94	56.49
704.09	71.48
704.24	87.62
704.39	104.04

Coal.Lake.Capacity.Discharge.xls

Figure G1 – Coal Lake Discharge Rating Curve
(Coal Lake Spillway Plan and Sections Plan Interpolation)



Coal.Lake.Capacity.Discharge.xls

Table G4: Pipestone Creek at Coal Lake Extended Natural Flows – N2 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.134	0.088	0.003	6.515	0.827	0.809	1.416	1.409	3.803	1.483	1.358	0.668	48491
1981	0.039	0.029	3.779	2.421	0.838	0.390	0.284	1.392	0.265	0.087	0.171	0.138	26049
1982	0.126	0.044	0.000	10.760	6.640	2.295	5.917	0.615	0.241	0.280	0.159	0.115	71660
1983	0.112	0.118	0.585	5.815	0.880	1.206	8.487	0.296	0.029	0.043	0.052	0.024	46617
1984	0.042	0.060	1.036	1.748	0.269	0.820	0.124	0.023	0.271	0.166	0.136	0.083	12535
1985	0.030	0.021	1.735	13.698	1.590	0.099	0.183	0.062	0.044	0.045	0.046	0.017	45857
1986	0.025	0.023	3.233	1.857	2.682	0.405	0.672	0.645	0.029	0.267	0.101	0.057	26557
1987	0.016	0.015	0.148	4.539	0.647	0.160	0.055	0.127	0.099	0.020	0.039	0.012	15322
1988	0.003	0.003	0.055	0.821	0.085	0.047	0.120	0.089	0.041	0.028	0.026	0.016	3490
1989	0.027	0.017	0.030	5.026	1.303	0.386	0.492	0.109	0.104	0.122	0.139	0.075	20481
1990	0.006	0.003	1.986	8.648	1.788	1.475	10.545	0.951	0.040	0.012	0.006	0.004	67321
1991	0.015	0.026	0.261	8.035	3.029	0.928	3.806	0.416	0.065	0.066	0.044	0.028	43990
1992	0.062	0.071	5.223	3.304	0.712	0.364	0.089	0.052	0.018	0.085	0.053	0.030	26620
1993	0.025	0.028	1.676	4.692	0.304	0.188	0.123	0.043	0.017	0.071	0.044	0.029	18957
1994	0.039	0.038	0.868	1.945	0.082	0.237	0.585	0.165	0.130	0.031	0.041	0.025	10999
1995	0.011	0.010	0.625	1.064	0.068	0.100	0.085	0.054	0.024	0.070	0.028	0.019	5675
1996	0.015	0.016	0.783	5.956	1.347	0.958	0.417	0.320	0.018	0.044	0.029	0.019	25976
1997	0.020	0.022	0.222	12.308	1.781	2.680	1.601	0.539	0.129	0.070	0.057	0.027	50795
1998	0.020	0.019	0.230	1.476	0.118	0.580	4.687	0.084	0.020	0.046	0.022	0.013	19406
1999	0.015	0.021	0.036	11.154	3.760	0.663	2.189	0.608	0.077	0.019	0.049	0.024	48819
2000	0.008	0.006	0.051	1.340	0.177	0.478	0.400	0.270	0.036	0.013	0.014	0.009	7344
2001	0.033	0.023	0.002	0.664	0.140	0.131	0.151	0.275	0.047	0.022	0.048	0.043	4144
2002	0.042	0.043	0.000	2.460	1.049	0.087	0.073	0.037	0.022	0.009	0.050	0.039	10241
2003	0.023	0.023	0.076	4.563	1.505	0.129	0.088	0.037	0.057	0.003	0.067	0.031	17259
2004	0.005	0.004	0.002	0.689	0.025	0.072	0.198	0.072	0.013	0.051	0.036	0.019	3106
MIN	0.003	0.003	0.000	0.664	0.025	0.047	0.055	0.023	0.013	0.003	0.006	0.004	3106
MAX	0.134	0.118	5.223	13.698	6.640	2.680	10.545	1.409	3.803	1.483	1.358	0.668	71660
MEAN	0.036	0.031	0.906	4.860	1.266	0.627	1.712	0.348	0.226	0.126	0.113	0.063	27109

Table G5: Coal Lake Calculated Weir Discharge and Controlled Releases – R3 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.000	0.000	0.000	5.584	0.763	0.474	1.012	1.157	3.501	1.736	0.803	0.417	40478
1981	0.000	0.000	2.023	2.340	0.697	0.134	0.013	1.776	0.008	0.000	0.000	0.000	18510
1982	0.000	0.000	0.000	4.115	8.999	6.149	5.109	0.794	0.029	0.276	0.286	0.276	68813
1983	0.276	0.306	0.000	3.666	0.849	0.705	7.647	0.560	0.000	0.000	0.000	0.000	37065
1984	0.000	0.000	0.237	1.140	0.049	0.181	0.000	0.000	0.000	0.000	0.000	0.000	4190
1985	0.000	0.000	0.982	14.205	3.810	0.027	0.000	0.000	0.000	0.000	0.000	0.000	49724
1986	0.000	0.000	1.781	2.129	2.298	0.360	0.024	0.582	0.000	0.000	0.000	0.000	19000
1987	0.000	0.000	0.000	2.853	0.464	0.012	0.000	0.000	0.060	0.000	0.000	0.000	8824
1988	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1989	0.000	0.000	0.000	1.933	1.176	0.405	0.000	0.000	0.000	0.000	0.000	0.000	9210
1990	0.000	0.000	0.436	7.976	1.596	1.181	10.698	0.857	0.000	0.000	0.000	0.000	60126
1991	0.000	0.000	0.000	4.876	3.528	1.229	2.987	0.419	0.000	0.000	0.000	0.000	34396
1992	0.000	0.000	3.682	2.877	0.600	0.019	0.000	0.000	0.000	0.000	0.000	0.000	18975
1993	0.000	0.000	0.000	2.905	0.325	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8400
1994	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1995	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
1996	0.000	0.000	0.000	3.750	1.637	0.851	0.776	0.015	0.000	0.000	0.000	0.000	18429
1997	0.000	0.000	1.492	8.678	2.231	1.591	1.896	0.000	0.000	0.000	0.000	0.000	41667
1998	0.000	0.000	0.000	0.000	0.000	0.000	2.054	0.030	0.000	0.000	0.000	0.000	5582
1999	0.000	0.000	0.000	6.512	2.825	0.334	0.933	0.757	0.000	0.000	0.000	0.000	29838
2000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000	0.000	0.000	0.000	83
2001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
2003	0.000	0.000	0.005	1.052	1.435	0.065	0.000	0.000	0.000	0.000	0.000	0.000	6752
2004	0.000	0.000	0.000	0.000	0.000	0.000	0.544	1.137	0.000	0.000	0.000	0.000	4502
MIN	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0
MAX	0.276	0.306	3.682	14.205	8.999	6.149	10.698	1.776	3.501	1.736	0.803	0.417	68813
MEAN	0.011	0.012	0.426	3.064	1.331	0.549	1.349	0.323	0.144	0.080	0.044	0.028	19383

Table G6: Pipestone Creek at Coal Lake
Historic Water Use (U1+U2+U3) from 1980 to 2004 (m^3/s)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN VOL (cu.dam)
1980	0.134	0.088	0.003	0.931	0.064	0.335	0.404	0.252	0.302	-0.253	0.555	0.251	8014
1981	0.039	0.029	1.756	0.081	0.141	0.256	0.271	-0.384	0.257	0.087	0.171	0.138	7539
1982	0.126	0.044	0.000	6.645	-2.359	-3.854	0.808	-0.179	0.212	0.004	-0.127	-0.161	2847
1983	-0.164	-0.188	0.585	2.149	0.031	0.501	0.840	-0.264	0.029	0.043	0.052	0.024	9553
1984	0.042	0.060	0.799	0.608	0.220	0.639	0.124	0.023	0.271	0.166	0.136	0.083	8345
1985	0.030	0.021	0.753	-0.507	-2.220	0.072	0.183	0.062	0.044	0.045	0.046	0.017	-3867
1986	0.025	0.023	1.452	-0.272	0.384	0.045	0.648	0.063	0.029	0.267	0.101	0.057	7557
1987	0.016	0.015	0.148	1.686	0.183	0.148	0.055	0.127	0.039	0.020	0.039	0.012	6498
1988	0.003	0.003	0.055	0.821	0.085	0.047	0.120	0.089	0.041	0.028	0.026	0.016	3490
1989	0.027	0.017	0.030	3.093	0.127	-0.019	0.492	0.109	0.104	0.122	0.139	0.075	11271
1990	0.006	0.003	1.550	0.672	0.192	0.294	-0.153	0.094	0.040	0.012	0.006	0.004	7194
1991	0.015	0.026	0.261	3.159	-0.499	-0.301	0.819	-0.003	0.065	0.066	0.044	0.028	9594
1992	0.062	0.071	1.541	0.427	0.112	0.345	0.089	0.052	0.018	0.085	0.053	0.031	7645
1993	0.025	0.028	1.676	1.787	-0.021	0.188	0.123	0.043	0.017	0.071	0.044	0.029	10558
1994	0.039	0.038	0.868	1.945	0.082	0.237	0.585	0.165	0.130	0.031	0.041	0.025	11001
1995	0.011	0.010	0.625	1.064	0.068	0.100	0.085	0.054	0.024	0.070	0.028	0.019	5676
1996	0.016	0.017	0.783	2.206	-0.290	0.107	-0.359	0.305	0.018	0.044	0.029	0.019	7548
1997	0.020	0.022	-1.270	3.630	-0.450	1.089	-0.295	0.539	0.129	0.070	0.057	0.027	9128
1998	0.020	0.019	0.230	1.476	0.118	0.580	2.633	0.054	0.020	0.046	0.022	0.013	13825
1999	0.015	0.022	0.036	4.642	0.935	0.329	1.256	-0.149	0.077	0.019	0.049	0.024	18982
2000	0.008	0.006	0.051	1.340	0.177	0.478	0.369	0.270	0.036	0.013	0.014	0.009	7261
2001	0.033	0.023	0.002	0.664	0.140	0.131	0.151	0.275	0.047	0.022	0.049	0.043	4146
2002	0.044	0.044	0.000	2.460	1.049	0.087	0.073	0.037	0.022	0.009	0.052	0.040	10257
2003	0.024	0.024	0.071	3.511	0.070	0.064	0.088	0.037	0.057	0.003	0.068	0.031	10516
2004	0.005	0.004	0.002	0.689	0.025	0.072	-0.346	-1.065	0.013	0.051	0.037	0.019	-1396
												TOTAL	193183
MIN	-0.164	-0.188	-1.270	-0.507	-2.359	-3.854	-0.359	-1.065	0.013	-0.253	-0.127	-0.161	-3867
MAX	0.134	0.088	1.756	6.645	1.049	1.089	2.633	0.539	0.302	0.267	0.555	0.251	18982
MEAN	0.025	0.019	0.480	1.796	-0.065	0.079	0.363	0.024	0.082	0.046	0.069	0.035	7727

COAL.LAKE.USES.2.xls

Note: The above uses include Node 05FA012.2

Appendix H

Atco Power Uses
(1980 – 2004)

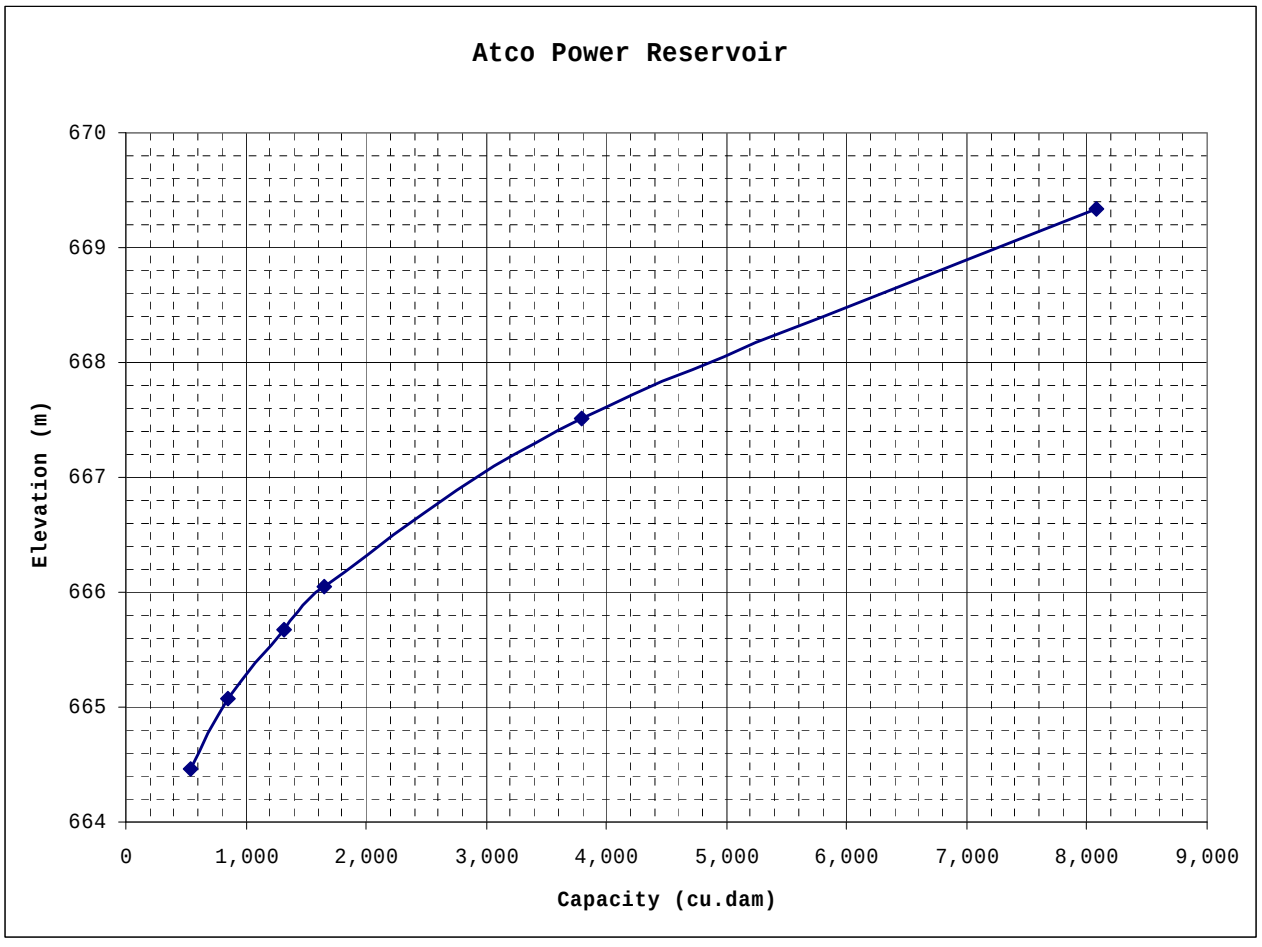
Appendix H: Atco Power Uses (1980-2004)

Table H1: Atco Power Reservoir Capacity Table

Elevation (m)	Capacity (cu.dam)	
664.46	533	
665.07	848	
665.68	1322	
666.05	1649	
667.51	3796	
669.34	8073	
Interpolated from Atco Report		
prepared by Stantec June 2004		
Watrecon report storage capacity		
estimate is 10,485 cu.dam		
pg 70		

Forestburg.(Battle.River).Reservoir.Capacity.xls

Figure H1: Atco Power Reservoir Capacity Curve



Forestburg.(Battle.River).Reservoir.Capacity.xls

Table H2: Atco Power Reservoir Natural Evaporation (mm) from 1980 to 2004

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1980	-18	-15	-7	75	71	-25	86	-23	8	20	6	-46	132
1981	-18	-2	17	58	30	98	49	103	15	1	-4	-9	338
1982	-45	-8	-10	59	50	83	-9	3	12	2	-11	-7	119
1983	-9	-7	9	58	57	-42	64	105	23	16	-16	-20	238
1984	-24	8	14	65	57	43	122	89	-74	9	-18	-23	268
1985	-12	-17	31	33	63	109	94	2	20	1	-12	-12	301
1986	-12	-15	3	41	90	88	-27	102	-20	12	-21	-6	235
1987	-5	-9	-8	53	111	123	47	2	25	26	-4	-12	349
1988	-7	-7	7	89	121	59	106	30	-7	24	-3	-20	391
1989	-22	-10	-1	63	79	47	53	31	43	-4	-11	-14	253
1990	-19	-5	21	49	84	24	7	77	72	12	-14	-13	294
1991	-12	-5	-3	32	23	-15	93	69	59	-20	-4	-12	204
1992	-6	-15	33	48	34	108	34	82	11	1	-4	-24	304
1993	-7	0	-20	14	57	12	17	58	32	4	-19	-10	140
1994	-56	-16	34	64	34	-6	73	29	24	-4	-9	-9	158
1995	-12	3	2	32	72	51	66	-21	59	18	-30	-22	218
1996	-28	-2	-6	15	-5	15	93	80	-36	13	-49	-18	73
1997	-12	2	5	40	53	1	118	80	14	-13	1	0	288
1998	-23	-4	8	40	100	45	93	103	44	8	-12	-12	392
1999	-36	1	4	1	20	47	-52	33	48	12	-11	-6	61
2000	-20	-10	10	16	52	40	72	37	-25	22	-1	-13	181
2001	0	-5	19	49	48	14	21	128	15	5	-9	-9	276
2002	-4	-6	-21	17	101	120	149	39	12	0	-6	-10	391
2003	-32	-21	0	2	34	48	128	95	23	7	-5	-6	275
2004	-31	-3	-5	71	73	66	3	34	19	-17	-4	-31	175
MIN	-56	-21	-21	1	-5	-42	-52	-23	-74	-20	-49	-46	61
MAX	0	8	34	89	121	123	149	128	72	26	6	0	392
MEAN	-19	-7	5	43	60	46	60	55	17	6	-11	-15	242

Table H3: Atco Power Reservoir Natural Evaporation (dam^3) from 1980 to 2004

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (cu.dam)
1980	-43	-35	-16	176	165	-58	201	-54	19	47	14	-107	309
1981	-41	-4	39	136	70	229	114	240	36	3	-9	-21	792
1982	-105	-18	-24	138	117	195	-21	7	29	4	-26	-17	279
1983	-20	-16	22	134	133	-99	150	246	53	37	-38	-47	555
1984	-57	18	33	151	133	100	285	209	-173	21	-42	-53	625
1985	-28	-39	72	78	147	255	220	5	46	3	-27	-29	703
1986	-28	-35	7	98	214	211	-64	245	-48	28	-50	-14	564
1987	-11	-22	-20	127	264	290	109	4	59	60	-8	-28	824
1988	-17	-16	16	209	284	138	248	71	-16	55	-7	-47	918
1989	-52	-23	-3	148	188	112	125	72	100	-10	-26	-33	598
1990	-44	-12	49	115	198	57	16	180	169	27	-33	-30	692
1991	-28	-11	-8	76	56	-36	219	160	137	-47	-10	-27	481
1992	-14	-34	78	112	80	253	79	191	26	3	-10	-55	709
1993	-16	1	-46	33	134	29	40	137	75	9	-43	-24	329
1994	-131	-37	79	149	79	-14	171	68	57	-8	-22	-21	370
1995	-28	6	5	75	168	120	155	-49	138	43	-71	-52	510
1996	-65	-5	-14	36	-12	34	217	188	-83	30	-114	-41	171
1997	-28	5	11	95	124	3	277	187	32	-31	2	0	677
1998	-53	-8	20	94	235	105	217	240	103	18	-27	-27	917
1999	-84	3	9	1	46	110	-121	77	112	28	-25	-14	142
2000	-46	-23	24	38	121	93	169	86	-59	51	-1	-31	422
2001	0	-12	45	115	112	33	50	298	35	12	-21	-22	645
2002	-9	-15	-48	41	239	281	348	90	27	-1	-14	-18	921
2003	-46	-31	1	5	82	115	300	223	54	15	-12	-14	692
2004	-59	-4	-7	135	170	155	7	79	43	-39	-9	-72	399
MIN	-131	-39	-48	1	-12	-99	-121	-54	-173	-47	-114	-107	142
MAX	0	18	79	209	284	290	348	298	169	60	14	0	921
MEAN	-42	-15	13	101	142	108	140	128	39	14	-25	-34	570

Table H4: Atco Power Reservoir Forced and Cooling Tower Evaporation (dam^3) from 1980 to 2004

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (cu.dam)
1980	279	266	346	355	399	596	528	616	622	562	376	279	5224
1981	279	266	346	355	399	596	528	616	622	562	376	279	5224
1982	279	266	346	355	399	596	528	616	622	562	376	279	5224
1983	279	266	346	355	399	596	528	616	622	562	376	279	5224
1984	260	278	346	337	399	596	801	830	487	637	376	279	5626
1985	246	208	295	246	479	731	959	611	544	683	360	367	5729
1986	313	201	378	404	383	394	383	528	848	562	231	222	4847
1987	190	375	450	355	645	861	739	404	671	627	671	654	6642
1988	288	421	694	607	645	715	889	739	671	627	435	279	7010
1989	279	223	246	435	367	715	404	694	861	504	376	388	5492
1990	252	227	295	337	367	715	404	889	625	627	604	279	5621
1991	246	266	346	355	236	596	739	528	371	694	285	246	4908
1992	254	611	637	625	694	511	404	528	371	383	285	246	5549
1993	279	223	295	293	383	596	383	616	371	627	632	450	5148
1994	327	295	295	607	383	715	404	739	625	562	632	327	5911
1995	252	351	450	435	399	861	889	616	625	450	376	279	5983
1996	337	236	637	293	627	596	889	404	371	383	376	279	5428
1997	327	590	450	285	383	861	889	404	625	383	285	295	5777
1998	279	590	295	607	645	861	404	528	371	562	632	246	6020
1999	252	223	654	355	694	671	383	694	371	627	285	295	5504
2000	288	231	252	293	367	596	739	616	371	686	632	279	5350
2001	297	223	295	607	367	596	404	715	371	450	244	327	4896
2002	388	223	279	285	645	391	528	889	671	637	285	246	5467
2003	252	351	246	355	383	596	528	528	671	450	316	388	5064
2004	608	576	562	518	509	544	509	509	622	509	544	696	6706
MIN	190	201	246	246	236	391	383	404	371	383	231	222	4847
MAX	608	611	694	625	694	861	959	889	861	694	671	696	7010
MEAN	293	319	391	402	464	644	591	619	560	557	415	327	5583

Table H5: Atco Power Reservoir Change in Storage Volume (dam^3) from 1980 to 2004

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (cu.dam)
1980	557	-29	-516	869	-732	169	71	-14	224	-187	-219	-236	-43
1981	-192	359	628	-139	-244	-200	-45	613	-512	-30	27	-85	180
1982	-121	-36	100	1297	-684	-470	802	-731	-11	2	-66	-136	-54
1983	-56	-10	597	139	-53	306	-356	-513	-123	-87	89	-119	-186
1984	-31	-121	431	-20	-138	83	-436	-761	634	178	356	0	175
1985	-156	707	76	221	342	157	-606	664	-364	-178	284	219	1366
1986	18	136	710	-470	182	-422	364	-167	-109	-29	-44	-92	77
1987	-67	-240	589	218	-325	-368	-551	494	-1161	-413	1542	187	-95
1988	-445	-358	70	951	-331	214	-28	-2	-46	-4	55	-470	-394
1989	-558	-64	200	1470	-422	-738	-1044	-207	309	57	797	348	148
1990	-28	-18	342	-45	172	173	-474	-1073	43	111	-37	-204	-1038
1991	-208	4	983	784	-51	-231	106	-173	-761	-462	52	-84	-41
1992	195	152	86	33	15	18	28	-202	-100	-905	438	353	111
1993	64	-235	1339	64	-249	107	14	-321	-499	-349	335	378	648
1994	14	-727	1389	-256	-114	-114	-14	-71	-299	-777	363	-477	-1083
1995	-228	-221	1916	-21	-157	-14	-235	235	-271	-826	36	-228	-14
1996	-135	-121	1596	594	-501	342	-570	-242	-406	-499	370	-292	136
1997	-199	-36	2411	109	-782	157	-321	-142	-14	-769	-100	-356	-42
1998	-64	-93	299	1211	-192	235	171	-385	-278	-912	36	-214	-186
1999	-64	-128	1909	782	-668	-413	499	-406	-1062	-150	-28	-157	114
2000	-150	-142	2582	-830	-50	28	150	257	-286	-976	-271	-157	155
2001	-264	-292	36	1560	128	164	57	-28	-1140	-541	-150	-114	-584
2002	-463	-584	-805	4162	-223	-463	-869	-577	-684	-755	-492	-670	-2423
2003	-506	-457	2532	3653	-218	-349	-777	-748	-712	-641	-627	-677	473
2004	-475	-480	426	764	21	24	-17	1567	-93	-100	634	214	2485
MIN	-558	-727	-805	-830	-782	-738	-1044	-1073	-1161	-976	-627	-677	-2423
MAX	557	707	2582	4162	342	342	802	1567	634	178	1542	378	2485
MEAN	-142	-121	797	684	-211	-64	-163	-117	-309	-370	135	-123	-5

Table H6: Atco Power Reservoir Uses (m^3/s) from 1980 to 2004

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL (cu.dam)
1980	0.296	0.081	-0.069	0.540	-0.062	0.273	0.299	0.205	0.334	0.158	0.066	-0.024	5492
1981	0.017	0.257	0.378	0.136	0.084	0.241	0.223	0.548	0.056	0.200	0.152	0.064	6195
1982	0.020	0.088	0.157	0.691	-0.063	0.124	0.488	-0.040	0.247	0.212	0.109	0.047	5445
1983	0.076	0.099	0.360	0.243	0.179	0.310	0.120	0.130	0.213	0.191	0.165	0.042	5593
1984	0.065	0.069	0.302	0.181	0.147	0.301	0.243	0.104	0.366	0.312	0.266	0.084	6427
1985	0.024	0.362	0.165	0.210	0.361	0.441	0.214	0.478	0.087	0.190	0.238	0.208	7797
1986	0.113	0.125	0.409	0.012	0.291	0.071	0.255	0.226	0.266	0.209	0.053	0.043	5486
1987	0.042	0.047	0.380	0.270	0.218	0.302	0.111	0.337	-0.166	0.102	0.851	0.304	7372
1988	-0.065	0.019	0.292	0.682	0.223	0.411	0.414	0.301	0.235	0.253	0.186	-0.089	7532
1989	-0.124	0.057	0.166	0.792	0.050	0.034	-0.193	0.209	0.490	0.206	0.443	0.262	6238
1990	0.067	0.081	0.256	0.157	0.275	0.364	-0.020	-0.001	0.323	0.286	0.206	0.017	5274
1991	0.003	0.107	0.493	0.469	0.090	0.127	0.397	0.193	-0.098	0.069	0.127	0.050	5348
1992	0.162	0.291	0.299	0.297	0.295	0.302	0.191	0.193	0.115	-0.194	0.275	0.203	6371
1993	0.122	-0.005	0.593	0.150	0.100	0.282	0.163	0.161	-0.020	0.107	0.356	0.300	6126
1994	0.078	-0.194	0.659	0.193	0.130	0.226	0.209	0.275	0.148	-0.083	0.375	-0.064	5197
1995	-0.001	0.056	0.886	0.188	0.153	0.373	0.302	0.299	0.190	-0.125	0.132	0.000	6477
1996	0.051	0.044	0.828	0.356	0.043	0.375	0.200	0.130	-0.046	-0.032	0.244	-0.020	5732
1997	0.037	0.231	1.072	0.189	-0.103	0.394	0.315	0.167	0.248	-0.156	0.072	-0.023	6410
1998	0.060	0.202	0.229	0.738	0.256	0.463	0.296	0.143	0.076	-0.124	0.247	0.002	6749
1999	0.039	0.041	0.961	0.439	0.027	0.142	0.284	0.136	-0.223	0.189	0.089	0.047	5760
2000	0.035	0.026	1.067	-0.193	0.164	0.277	0.395	0.358	0.010	-0.089	0.139	0.034	5931
2001	0.012	-0.033	0.140	0.881	0.227	0.306	0.191	0.368	-0.283	-0.029	0.028	0.071	4958
2002	-0.031	-0.155	-0.214	1.731	0.247	0.081	0.002	0.150	0.005	-0.044	-0.085	-0.165	3965
2003	-0.112	-0.057	1.037	1.548	0.092	0.140	0.019	0.001	0.005	-0.066	-0.125	-0.113	6228
2004	0.027	0.037	0.366	0.547	0.262	0.279	0.186	0.805	0.221	0.138	0.451	0.313	9591
												TOTAL	153694
MIN	-0.124	-0.194	-0.214	-0.193	-0.103	0.034	-0.193	-0.040	-0.283	-0.194	-0.125	-0.165	3965
MAX	0.296	0.362	1.072	1.731	0.361	0.463	0.488	0.805	0.490	0.312	0.851	0.313	9591
MEAN	0.041	0.075	0.449	0.458	0.147	0.266	0.212	0.235	0.112	0.075	0.202	0.064	6148

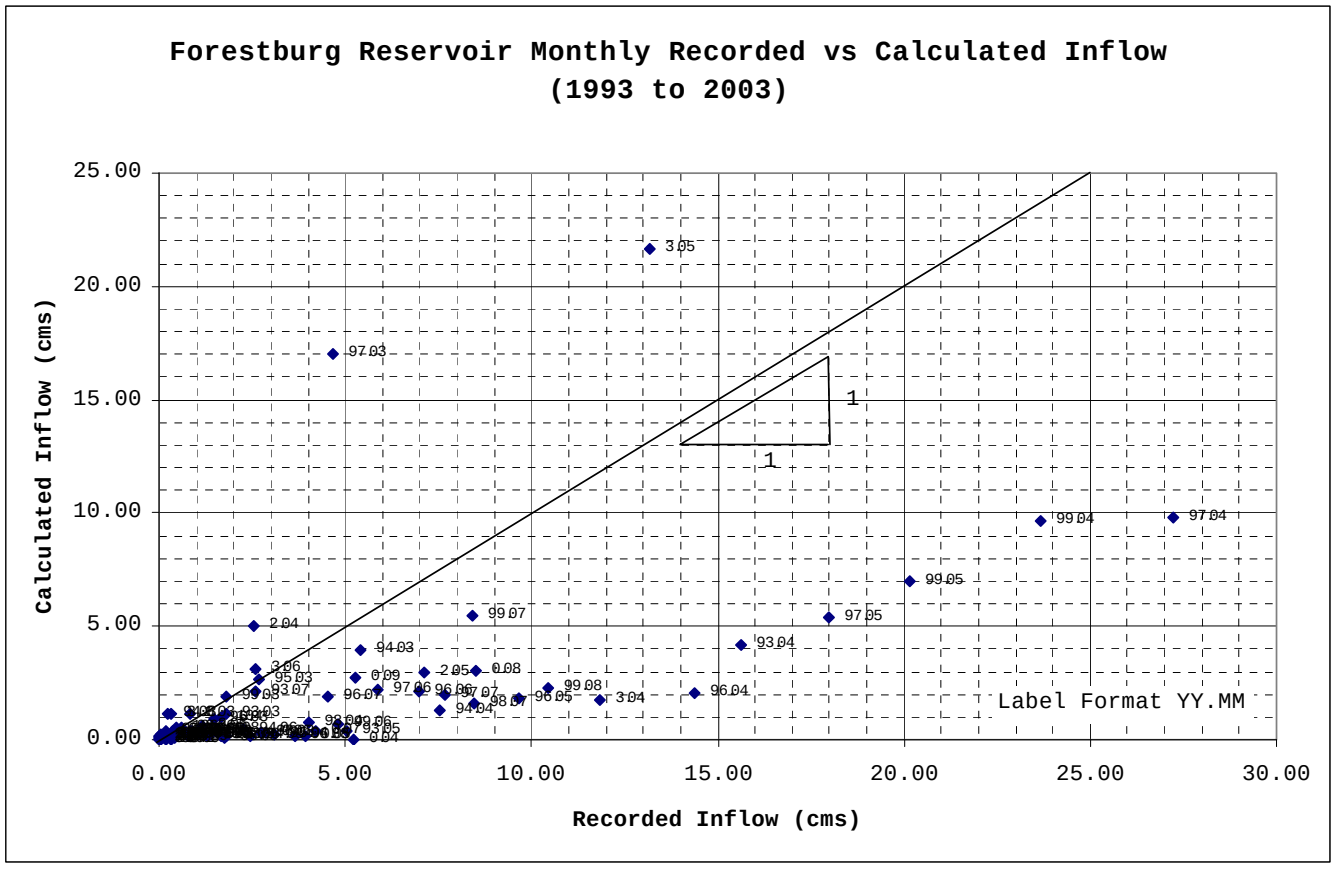
FORESTBURG.RES.USES.2.xls

Atco Power Reservoir Calculated vs Recorded Inflow

There are two equations which may be used to calculate the Atco Power forced evaporation. The application of Equation 1 was tested by comparing the calculated reservoir inflow, provided by Atco Power, to the recorded inflow.

Atco Power calculated the reservoir inflow as the sum of the recorded discharge and reservoir evaporation loss. The recorded inflow was taken as the sum of the gauged flows at hydrometric stations Battle River near Forestburg (05FC001), Bigknife Creek near Gadsby (05FC002), and Redwillow Creek near Red Willow (05FC005). The three hydrometric stations are located upstream of the Atco Power Reservoir. The mean monthly calculated and recorded inflow from 1993 to 2003 were plotted in Figure H.2.

Figure H2: Forestburg Reservoir Recorded vs Calculated Inflow



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The results show the calculated inflow consistently lower than the recorded inflow. The calculated inflow rarely exceeds 10 m^3/s with most points plotting below 5 m^3/s. The recorded inflow shows a significant number of metered flows from 5 m^3/s to nearly 30 m^3/s. The results suggest a significant volume of water is lost between the hydrometric stations and the Atco Power Reservoir with no other significant uses, other than Atco Power. Ideally the calculated inflow should better approximate the recorded inflow.

Assuming the above analysis is correct, the discrepancy may be the result of incorrect gauged readings at the hydrometric stations and problems with the Atco Power Reservoir estimated discharge, evaporation calculations, water level records and/or the area/capacity table. The weir discharge is the most significant variable in the calculate inflow. If the recorded flows upstream of the reservoir were taken into consideration, a reservoir water balance could improve the accuracy of the estimated outflow.

Appendix I

Wetland Project Use - Methodology

Appendix I: Wetland Project Use - Methodology

Table I1: Wetland Project Licenses

Apv Id	Priority Date	Expiry Date	Specific	Quantity (cu.m)	Cons (cu.m)	Losses (cu.m)	Return (cu.m)	Irr Area (ha)	FSL Vol (cu.dam)	FSL Area (ha)
23818	1996-07-16		WTLNDS	8630	0	8630	0	0	38.0	8.4
23820	1996-07-31	1998-02-21	WTLNDS	14800	0	14800	0	0	28.7	6.6
24026	1995-04-10		WTLNDS	32070	0	32070	0	0	75.2	14.6
25366	1992-05-26		WTLNDS	34530	0	34530	0	0	111.0	20.1
25541	1992-02-28		WTLNDS	22200	0	22200	0	0	99.9	18.5
28334	1988-05-12		WTLNDS	22200	0	22200	0	0	21.4	5.2
28483	1988-02-08		WTLNDS	44410	0	44410	0	0	62.6	12.6
28527	1988-01-06		WTLNDS	48110	0	48110	0	0	77.1	14.9
28589	1987-11-19		WTLNDS	171450	0	171450	0	0	298.4	45.3
28675	1987-08-04		WTLNDS	59200	1230	57970	0	0	101.9	18.8
28728	1987-05-22		WTLNDS	23440	0	23440	0	0	23.5	5.6
28729	1987-05-22		WTLNDS	23100	0	23100	0	0	30.4	7.0
28730	1987-05-22		WTLNDS	20970	0	20970	0	0	43.5	9.3
28870	1987-01-26		WTLNDS	22200	0	22200	0	0	22.2	5.4
29254	1986-02-28		WTLNDS	27140	0	27140	0	0	105.6	19.3
29338	1986-01-27		WTLNDS	45640	0	45640	0	0	112.6	20.4
29567	1985-05-29		WTLNDS	85110	0	85110	0	0	85.1	16.2
29640	1985-05-09		WTLNDS	40710	0	40710	0	0	62.0	12.5
29882	1984-12-18		WTLNDS	527930	0	527930	0	0	603.1	9.9
30298	1984-02-20		WTLNDS	416920	0	416920	0	0	678.9	11.1
30446	1983-12-01		WTLNDS	103610	0	103610	0	0	160.4	27.2
30895	1982-10-21		WTLNDS	43170	0	43170	0	0	51.8	10.8
31028	1982-05-27		WTLNDS	17270	0	17270	0	0	28.4	6.6
31200	1983-04-05		WTLNDS	129520	0	129520	0	0	328.1	48.9
31241	1987-06-03		WTLNDS	172690	0	172690	0	0	269.5	41.6
31547	1980-04-10		WTLNDS	51810	0	51810	0	0	51.8	10.8
31654	1985-10-31		WTLNDS	107310	0	107310	0	0	108.1	19.7
34256	1986-10-31		WTLNDS	117180	0	117180	0	0	225.5	36.0
34686	1981-10-09		WTLNDS	56740	0	56740	0	0	98.7	18.3
34989	1983-02-08		WTLNDS	1255680	64140	503260	688280	27.88	2696.4	37.3
35679	1981-04-02		WTLNDS	488460	0	488460	0	0	605.6	10.0
35713	1981-03-23		WTLNDS	727750	0	727750	0	0	2960.4	40.4
35736	1981-03-18		WTLNDS	172690	0	172690	0	0	224.5	35.8
36112	1970-06-29		WTLNDS	16040	0	16040	0	0	30.8	7.0
36125	1970-06-03		WTLNDS	7400	0	7400	0	0	7.4	2.2
36127	1970-06-03		WTLNDS	12330	0	12330	0	0	71.5	14.0
36130	1970-06-03		WTLNDS	41940	0	41940	0	0	93.7	17.5
36142	1969-05-01		WTLNDS	45640	0	45640	0	0	172.7	28.9
36147	1968-04-26		WTLNDS	139380	0	139380	0	0	333.0	49.5
36348	1939-09-28		WTLNDS	50570	0	50570	0	0	72.8	14.2
36456	1972-04-05		WTLNDS	66610	0	66610	0	0	89.1	16.8
36564	1989-08-22		WTLNDS	399640	199820	149250	50570	87.41	399.6	57.5
36599	1972-03-15		WTLNDS	296040	0	296040	0	0	974.5	15.4
72639	1998-07-16	2000-03-26	WTLNDS	13000	0	13000	0	0	25.3	6.0
72639	1998-07-16	2000-03-26	WTLNDS	14000	14000	0	0	0	27.2	6.4
72639	1998-07-16	2000-03-26	WTLNDS	17000	0	17000	0	0	32.9	7.4
72639	1998-07-16	2000-03-26	WTLNDS	36000	0	36000	0	0	68.2	13.5
73287	1999-04-15	2010-02-07	WTLNDS	42000	0	42000	0	0	79.3	15.3
76785	1998-06-09		WTLNDS	59000	0	59000	0	0	110.3	20.0
80634	1999-06-11		WTLNDS	7740	7740	0	0	0	15.3	4.0
81007	1999-09-16		WTLNDS	3000	0	3000	0	0	6.1	1.9

Wetlands.xls

Note: FSL volume (red) filled using Figure I2
FSL area (blue) filled using Figure I1

Figure I1

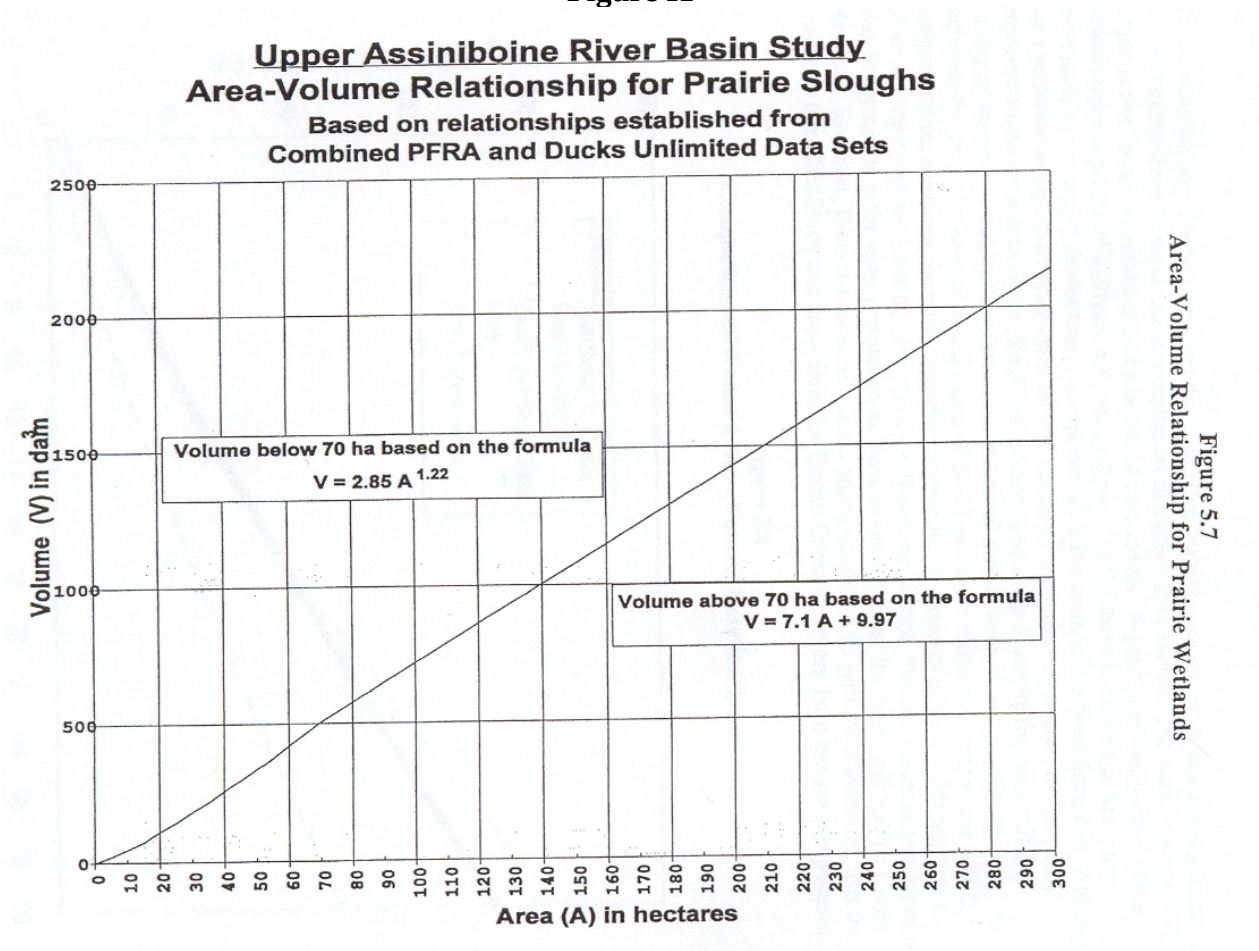
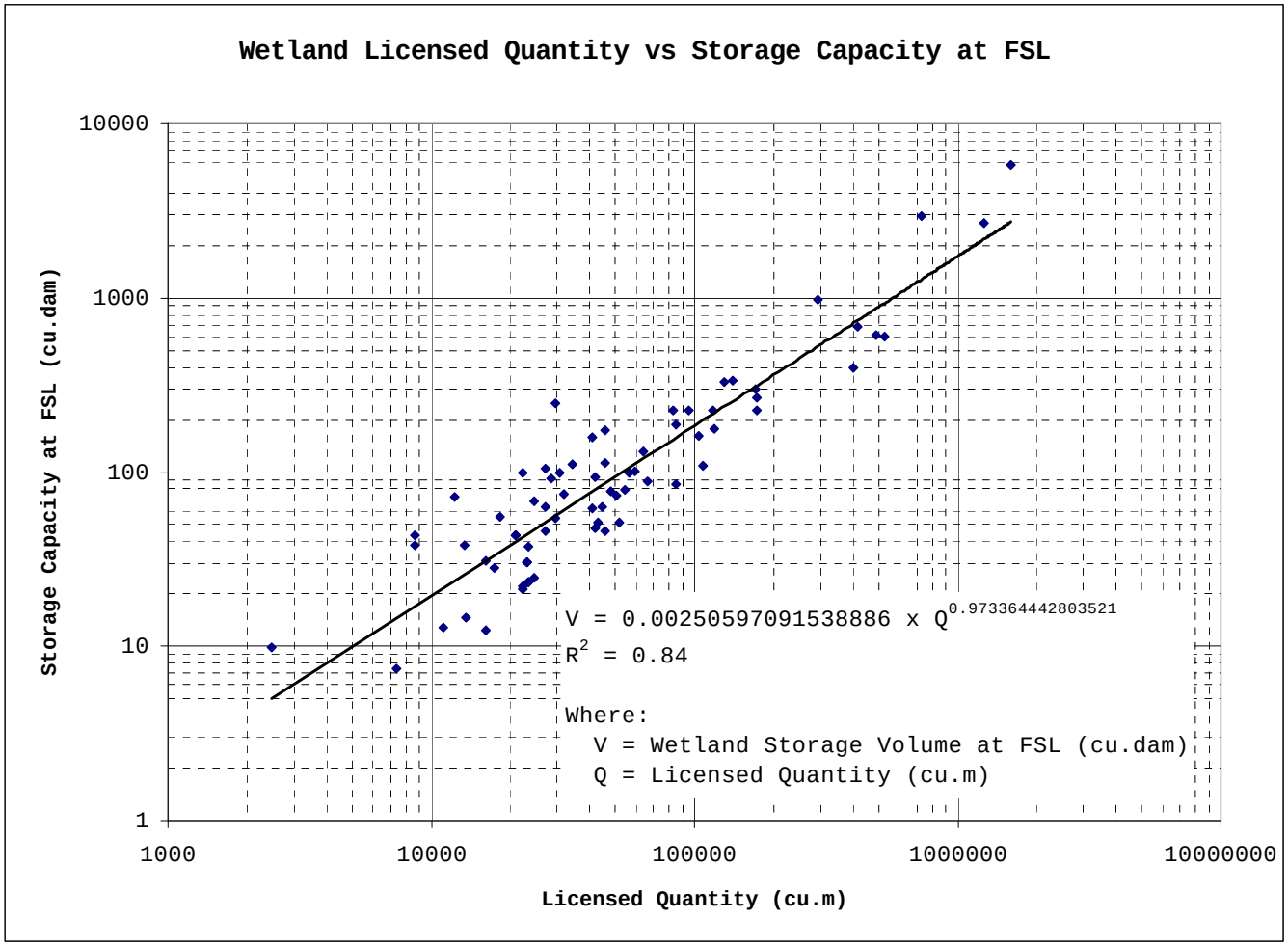


Figure 5.7
Area-Volume Relationship for Prairie Wetlands

Upper Assinibonine River Basin Study Main Report
http://www.swa.sk.ca/publications/documents/UARBS%20Drainage%20&%20Flood%20Control%20Report.pdf

Figure I2: Battle River Basin Wetland Projects
Licensed Quantity vs Storage Capacity at FSL



Wetlands.xls

Appendix J

Meyers and Morton's Gross Evaporation Correlation Equations

Appendix J: Meyers and Morton's Gross Evaporation Correlation Equations

Figure J1: Meyers and Morton Annual Gross Evaporation PFRA Comments

From: "Martin, Fred" <martinf@AGR.GC.CA>
To: "Terry Chamulak" <Terry.Chamulak@swa.ca>
Date: 16/05/2005 8:09 am
Subject: RE: Evaporation Data

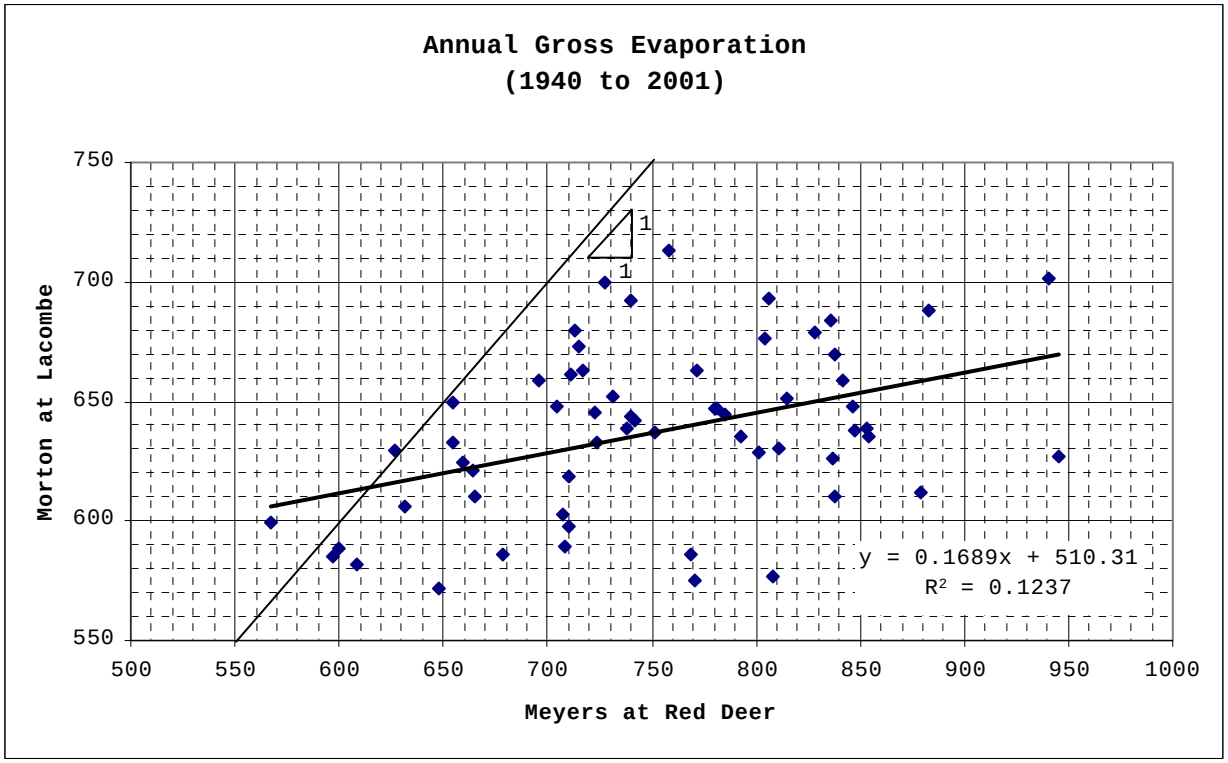
Hi Terry!

Sorry. I have not correlated Meyer evaporation estimates with Morton. We have never had the need to utilize any such relationship as all our studies are based on the Meyer determination of gross evaporation. However, I am attaching a report that was prepared by Ron Hopkinson that assessed the two methods. It is not what you are specifically looking for but it may give you some insight.

I have also attached a copy of the latest report (Hydrology Report #143) on gross evaporation. I will forward previous related reports by mail. (Previous reports were provided to Alex Banga.)

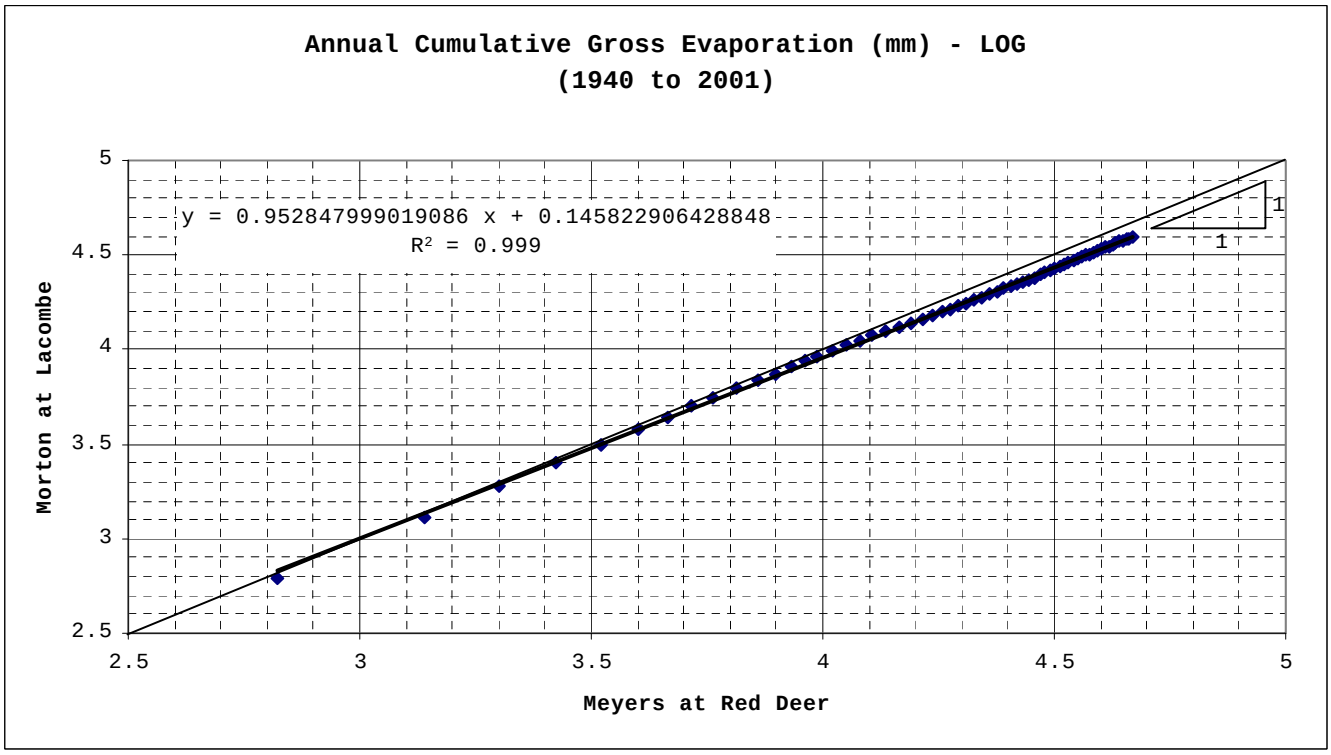
Fred Martin

Figure J2: Meyers and Morton Annual Gross Evaporation Correlation



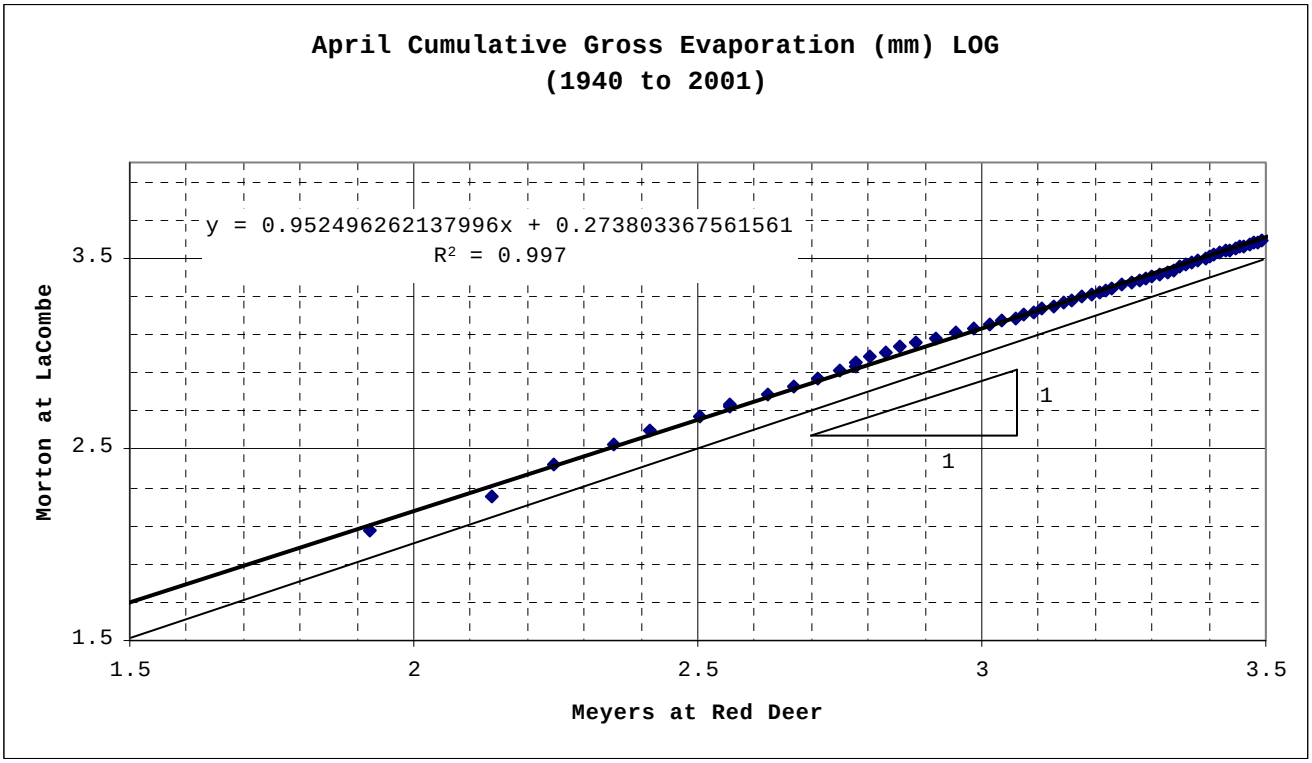
Battle.River.Gross.Evaporation.B.xls

Figure J3: Meyers and Morton Annual Cumulative Gross Evaporation Correlation



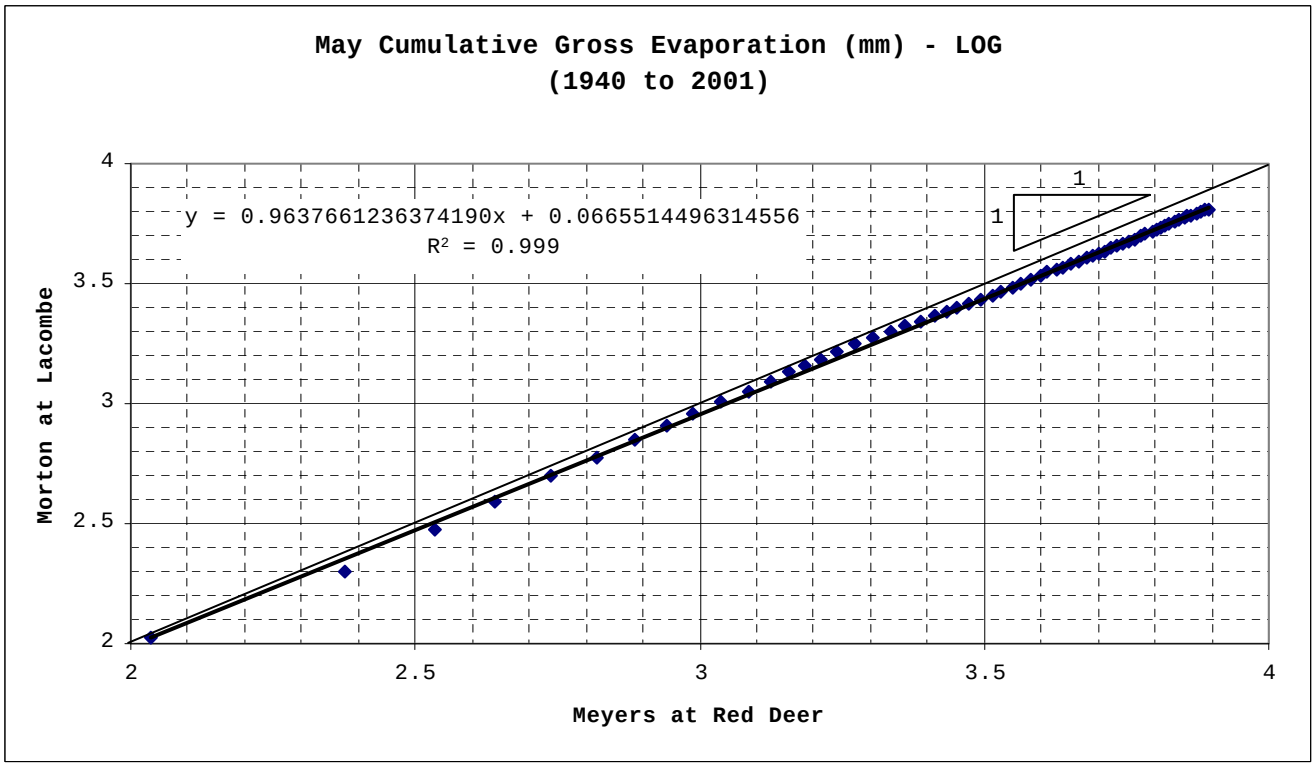
Battle.River.Gross.Evaporation.B.xls

Figure J4: Meyers and Morton April Cumulative Gross Evaporation Correlation



Battle.River.Gross.Evaporation.B.xls

Figure J5: Meyers and Morton May Cumulative Gross Evaporation Correlation



Battle.River.Gross.Evaporation.B.xls

Figure J6: Meyers and Morton June Cumulative Gross Evaporation Correlation

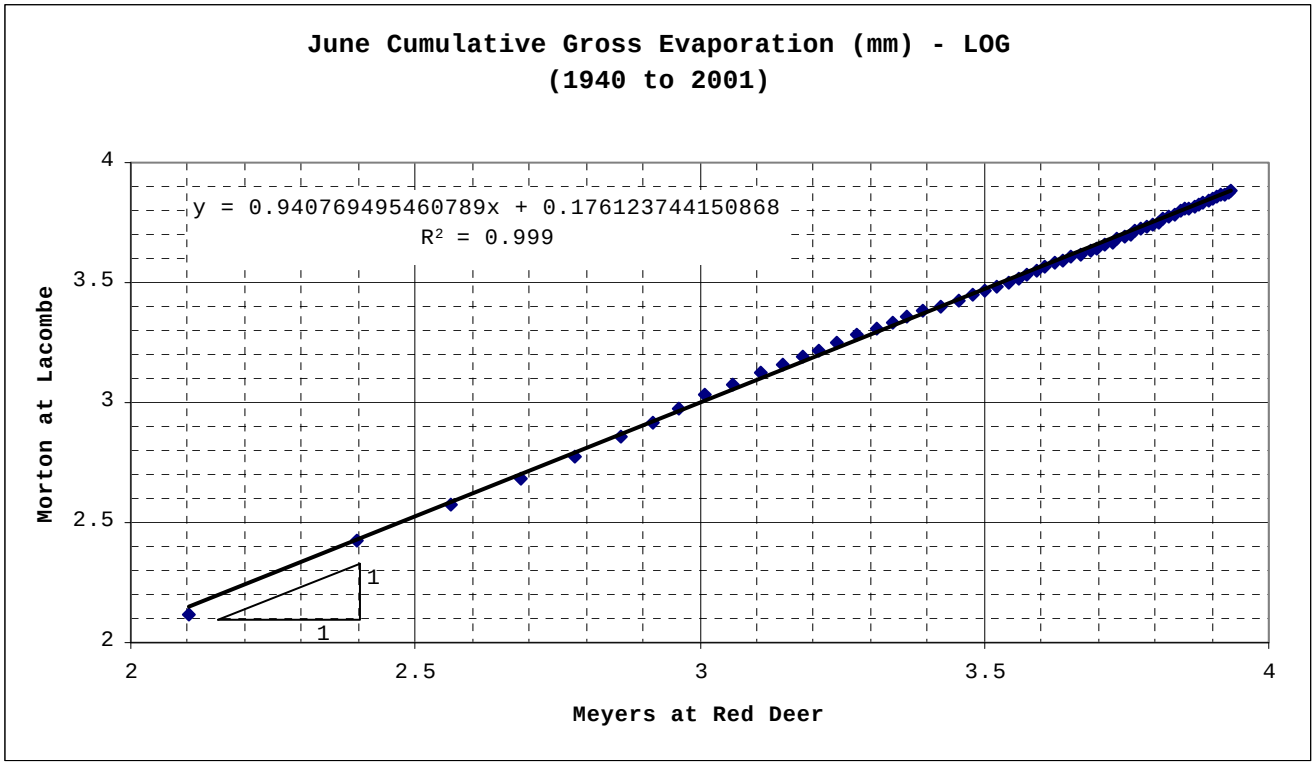


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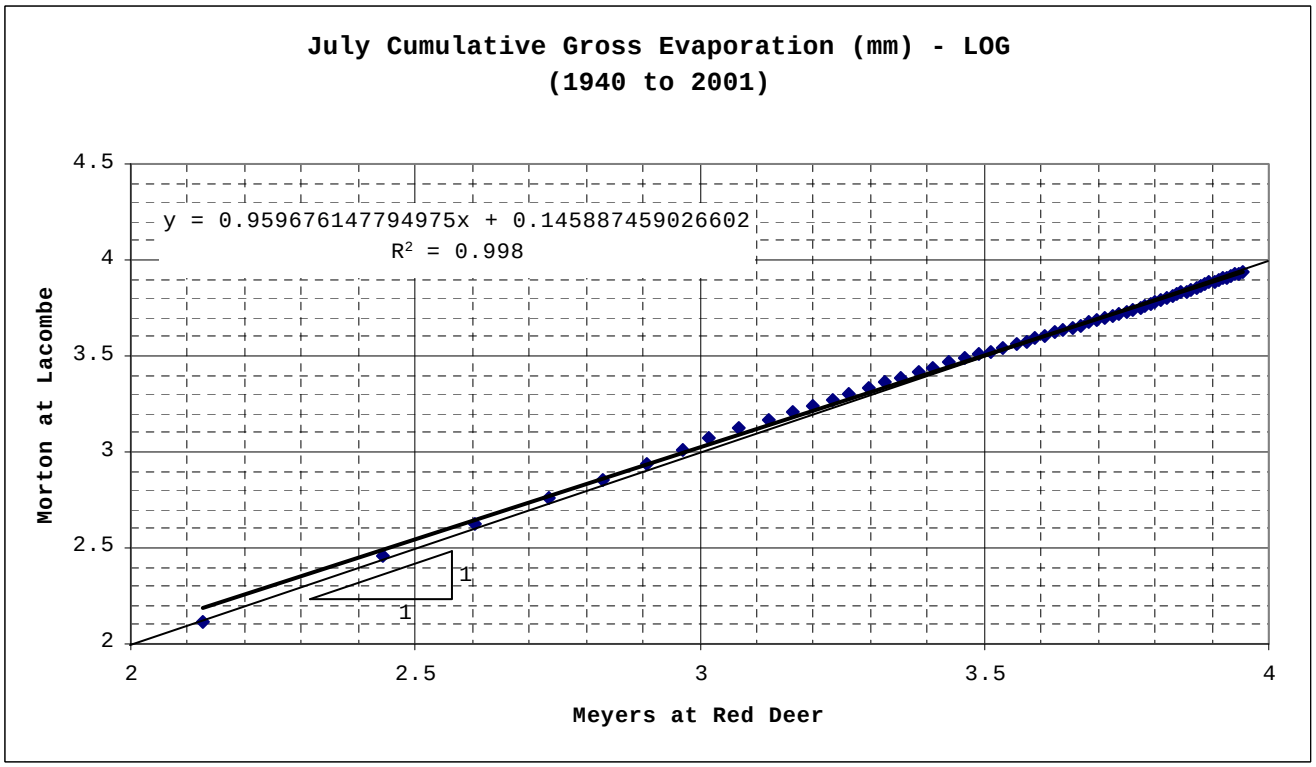
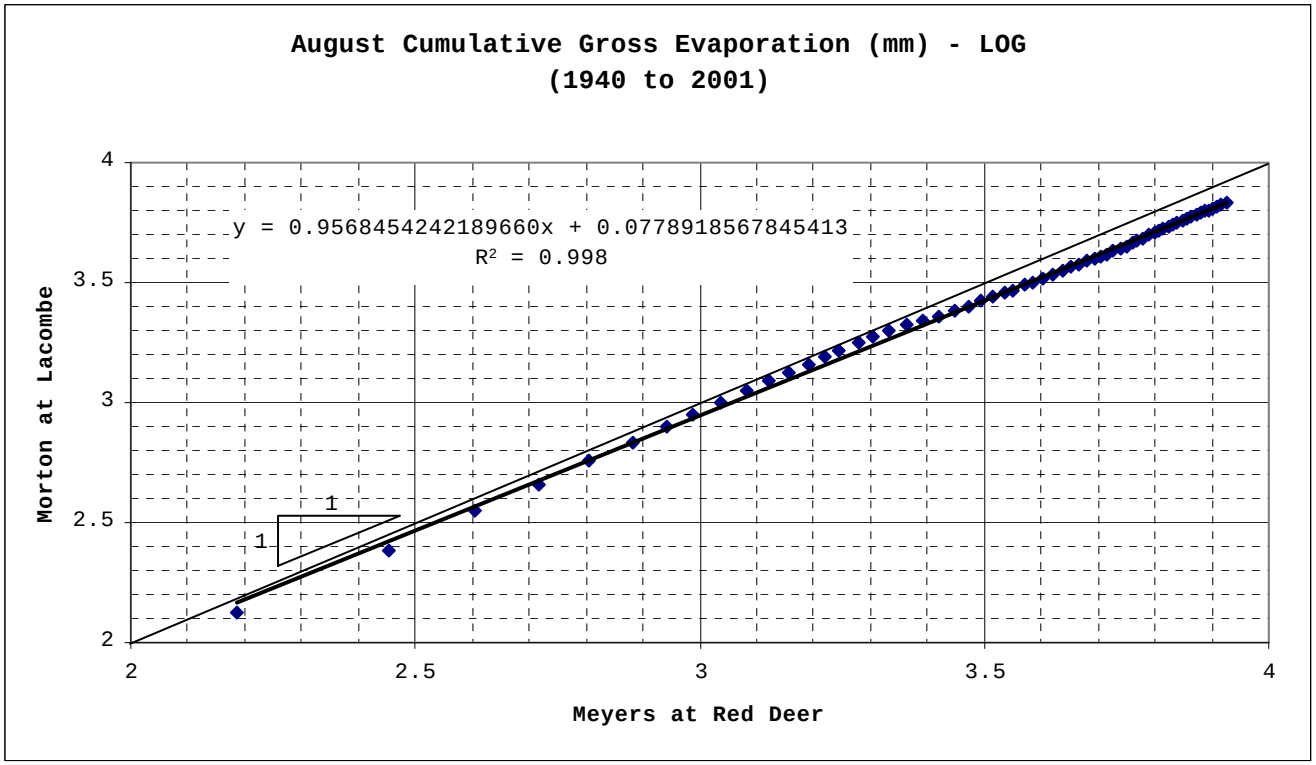
Figure J7: Meyers and Morton July Cumulative Gross Evaporation Correlation



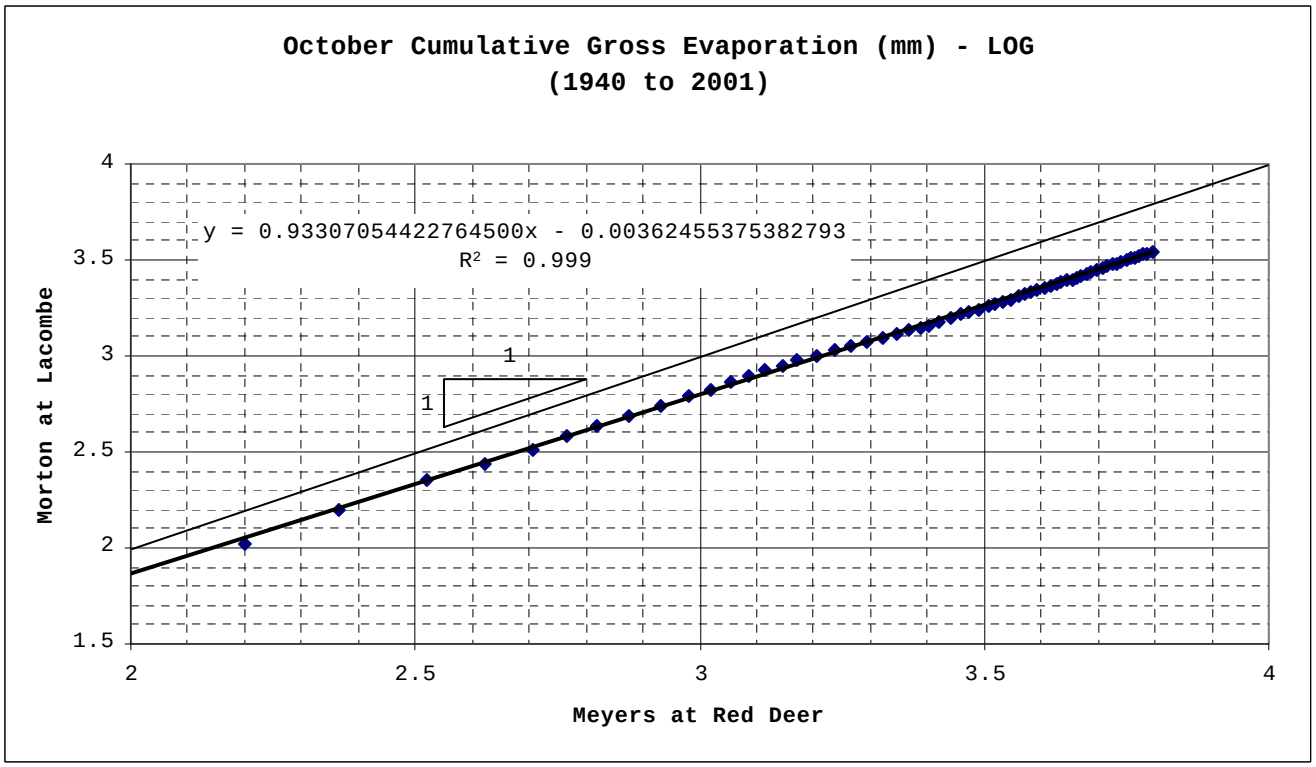
Battle.River.Gross.Evaporation.B.xls

Figure J8: Meyers and Morton August Cumulative Gross Evaporation Correlation



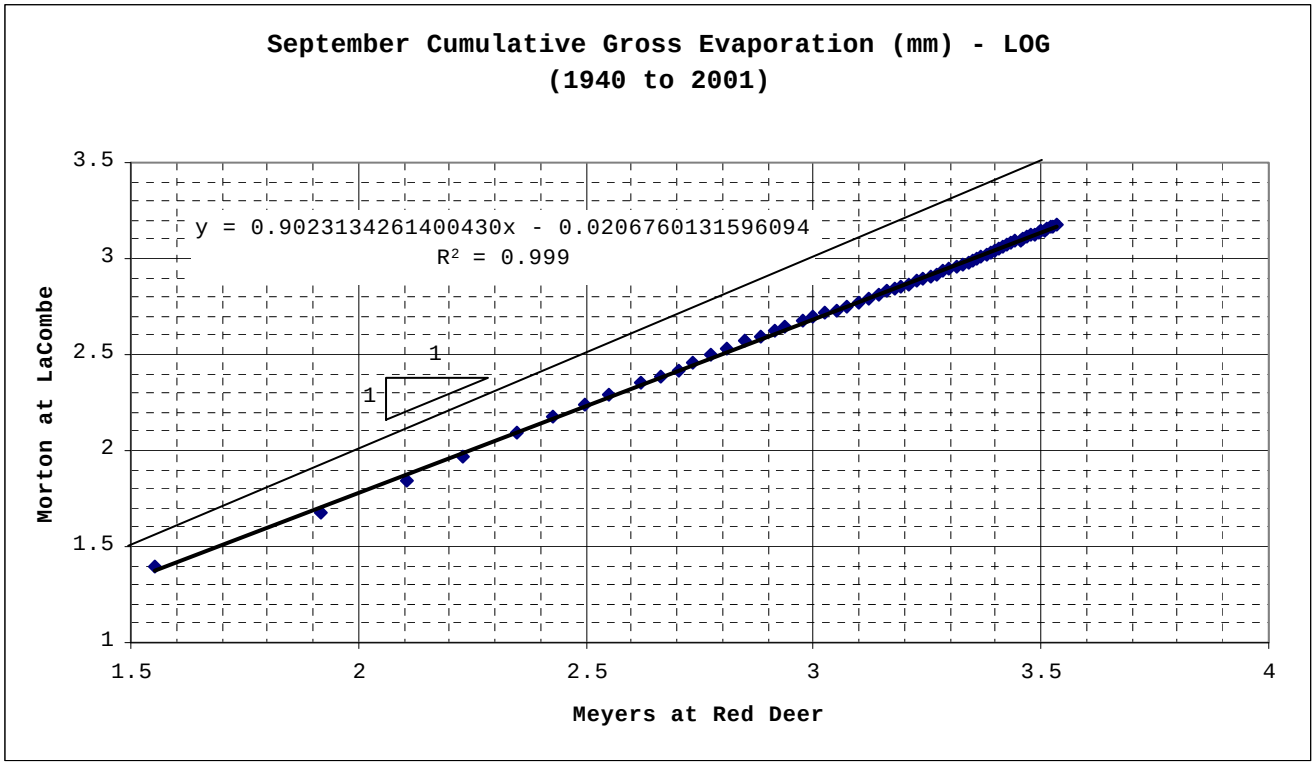
Battle.River.Gross.Evaporation.B.xls

Figure J9: Meyers and Morton September Cumulative Gross Evaporation Correlation



Battle.River.Gross.Evaporation.B.xls

Figure J10: Meyers and Morton October Cumulative Gross Evaporation Correlation



Battle.River.Gross.Evaporation.B.xls

Appendix K

Battle River Basin
Water Demand Map

Appendix K: Battle River Basin Water Demand Map

Battle River Drainage Basin
Water Demands

N

Saskatchewan Watershed Authority

Alberta

Saskatchewan

Legend

- Gauging Station (Stream)
- Gauging Station (Lake)
- Battle River Watershed
- Hydrometric Station Drainage Area
- Effective Drainage Area
- Water Approval Id Location
- Rivers
- Lakes
- Communities

Location Map

Battle River Drainage Basin

0 10 20 40 60 80 Kilometers

0 5 10 20 30 40 Miles

Produced by Saskatchewan Watershed Authority utilizining Gross and Effective Drainage area data provided by PFRA and Water Approval data provided by Alberta Environment.
Base data provided by the Spatial Data Warehouse
Datum: NAD 83, UTM 13 (extended)
Map Date: October 13, 2005
File Name: Battle_River_Water_Demand.mxd
PDF Name: Battle_River_Water_Demand.pdf

Prairie Provinces Water Board
2365 Albert Street, Room 300
Regina, Saskatchewan
S4P 4K1

PPWB Web Site address:
http://www.pnr-rpn.ec.gc.ca/water/fa01/index.en.html