TECHNICAL REPORT TO THE

PPWB COMMITTEE ON HYDROLOGY

NATURAL

FLOW

PIPESTONE CREEK

AT THE SASKATCHEWAN-MANITOBA BOUNDARY

PPWB Report № 116

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DECEMBER, 1992

SYNOPSIS

The average annual natural flow of Pipestone Creek at the Saskatchewan-Manitoba boundary is 43 200 dam^3. The average annual flow at the present (1988) level of development at 43 100 dam^3 is only 100 dam^3 less than the average annual natural flow. The average annual drainage from Kipling Marsh at the present level of development is 3 540 dam^3. The largest consumptive use in the Saskatchewan portion of the basin is evaporation from Moosomin Reservoir at 1 660 dam^3 at the present level of development.

A computer program was developed which calculates Pipestone Creek monthly natural flows based on the configuration of the basin, recorded flows, net evaporation rates, and information on water uses in the basin. Depletions are calculated for a number of the larger projects in the basin. These depletions are based on the estimated natural inflows to the projects. Similarly, drainage from a number of drainage projects are calculated based on estimated natural flow tributary to each project.

The average quantity of water delivered to Manitoba in excess of the 50 percent of natural flow commitment is 22 300 dam^3 at the present level of consumptive use (including drainage). In five years out of forty-five simulated (1943/44 to 1987/88), the flows at the present level use (including drainage) would have been less than a 50 percent share of the natural flow at the Saskatchewan-Manitoba boundary. However, the deficits could have been alleviated by release of water stored in Moosomin Reservoir.

ACKNOWLEDGEMENTS

The Pipestone Creek natural flow study was conducted by B.W. Oegema. The study was carried out under the direction of A.B. Banga, Manager of the Hydrology Branch. The final text was reviewed by R.L. Kellow, Executive Director of the Prairie Provinces Water Board (PPWB), and the members of the Committee on Hydrology whose constructive comments are gratefully acknowledged.

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1.1 BACKGROUND

In 1979, the Pipestone Creek was one of a series of twenty interprovincial basins identified for study following the completion of natural flow studies for the North Saskatchewan, South Saskatchewan, Saskatchewan, Churchill, and Qu'Appelle basins in 1977. The objective of the 1979 study [1] was to update and improve the natural flow estimates for the Pipestone Creek derived in the course of the Souris River Basin Study [2].

An ad-hoc Pipestone Creek Sub-Committee was formed in 1984 to conduct a field investigation of the Pipestone Creek basin, to review the existing natural flow calculation procedure and to make recommendations to the Committee on Hydrology (COH) on how the existing monitoring procedure and natural flow calculation may be improved. Their report [3] contained four recommendations. Firstly, two new hydrometric stations should be established, one upstream of Moosomin Reservoir on Pipestone Creek and the other on Little Pipestone Creek. A station on Pipestone Creek above Moosomin Reservoir was subsequently established in 1987. A suitable gauging site could not be found on Little Pipestone Creek for the second station. The second recommendation was that flow routing and channel losses be considered in the natural flow calculations. The third and fourth recommendations were that minor project uses in Saskatchewan be reduced in drier years in recognition of the fact that they likely do not receive their full licensed allocation in those years, and that a computer program be developed to compute natural flows. In 1988, the Secretariat of the PPWB developed a computer program to compute monthly natural flow for Pipestone Creek [4].

The Task Force on Apportionment of Flows in Pipestone Creek was formed in 1986 to define operational procedures for Moosomin Reservoir that would be acceptable to Saskatchewan and meet Manitoba's requirements for equitable apportionment at the Saskatchewan-Manitoba boundary. The Task Force report [5] presented interim operating guidelines for the reservoir. The guidelines were termed as "interim" because they were based on a variable Full Supply Level (FSL), i.e. use of flashboards during the summer months, and the natural flow arrays used (from the 1979 natural flow study) were judged to be unsatisfactory and in need of updating.

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1.2 PURPOSE OF STUDY

This Pipestone Creek natural flow study is a result of a recommendation made in the report by the Task Force on Apportionment of Flows in Pipestone Creek [5]. The primary objective of this study was to develop an array of natural flows for the Pipestone Creek at the Saskatchewan-Manitoba boundary.

The geography of the Pipestone Creek basin in Saskatchewan is described in Chapter 2. Water uses within the basin, and the derivation of natural flows at the Saskatchewan-Manitoba boundary, are discussed in Chapters 3 and 4 respectively. An analysis of the ability of the basin flows to meet apportionment at the present level of use (1988) is presented in Chapter 5. Chapter 6 offers conclusions and recommendations based on the findings of this study. Tables and arrays of water use are given in Appendix A. The recorded and natural streamflow arrays are presented in Appendix B.

A computer program was developed to calculate natural flow in Pipestone Creek. Appendix C, entitled "Pipestone Creek Natural Flow Model Documentation and Users Manual", provides a detailed description of the procedures and assumptions made in calculating the natural flows presented in this study and describes the procedures required to use the Natural Flow Model, the formats required for the various input files, and the format of the output files.

2.0 BASIN GEOGRAPHY

Pipestone Creek originates in the Weed Hills north of Moose Mountain Hills and south of Grenfell in southeastern Saskatchewan. The creek flows north from its origin for about 8 km before entering a glacial meltwater channel and flowing in an easterly direction for approximately 40 km to Pipestone Lake. From Pipestone Lake, the creek continues east along the northern edge of the Moose Mountain Hills for approximately another 40 km until it reaches Moosomin Reservoir south of the Town of Moosomin. From Moosomin Reservoir, the creek flows southeasterly for approximately 48 km before crossing into Manitoba.

Figure 1 shows two major tributaries to Pipestone Creek and a number of smaller tributaries. Montgomery Creek originates in the Moose Mountain Hills and flows north to join Pipestone Creek just below Pipestone Lake. Little Pipestone Creek also originates in the Moose Mountain Hills and flows northeast to join Pipestone Creek at Moosomin Reservoir. Downstream of Moosomin Reservoir, the basin narrows to a width between 5 km and 10 km and remains narrow into Manitoba.

The gross drainage area of the Pipestone Creek basin at the Saskatchewan-Manitoba boundary is 3 858 km^2. The effective drainage area at the interprovincial boundary is 1 338 km^2 or about 35 percent of the gross drainage area. Gross and effective drainage areas for key points and major projects in the basin are provided in a table on Figure 1.

The annual natural flow regime of Pipestone Creek is typical of a prairie stream. Snowmelt in the spring generally causes the annual peak flow. On average, 69 percent of the annual flow occurs during the months of March, April and May. The summer, fall and winter months account for 21, 7 and 3 percent of the annual flow, respectively.

precipitation was quite high at 767 mm. The array of monthly net evaporation is given in Table A-1.

Storage change effects were based on recorded and estimated beginning-of-month water levels. Missing levels were interpolated between the last recorded level prior to the beginning of the month and the next recorded level. The array of first-of-month levels is given in Table A-2.

Monthly net evaporation losses from the reservoir were estimated by multiplying the net evaporation in millimetres by the reservoir surface area corresponding to the average reservoir elevation for the month. Monthly average water levels have been published by Water Survey of Canada (WSC) since 1974. Monthly average water levels prior to 1974 are not published because of missing daily records. The missing monthly average water levels were estimated by interpolating missing daily values and then averaging the recorded and interpolated daily values for the month. The array of monthly average water levels is given in Table A-3. For months in which no daily levels were recorded, the average monthly level is the average of the first-of-month levels in Table A-2 of that month and the subsequent month. The average annual net evaporation from the reservoir from 1956 to 1987 is 1 890 dam^3. The array of net evaporation volumes for the study period is given in Table A-4.

The storage capacity and surface area of Moosomin Reservoir were based on the area/capacity curves dated August 18, 1987 (Figure 2) which are based on PFRA data. The Pipestone Creek Sub-Committee stated in their report [3] that these curves "may not be sufficiently accurate for determining relatively small storage changes as required for monthly natural flow calculations for apportionment purposes." No new information is available to improve these curves and a bathometric survey of the reservoir was beyond the scope of this study.

This study assumed that there is no groundwater inflow into Moosomin Reservoir. The bedrock underlying the reservoir slopes northward to the Rocanville Valley formation and lies below approximately 40 m to 45 m of glacial drift [7]. Due to the depth of the glacial drift, groundwater losses were assumed to be small relative to other water uses within the basin. This assumption is supported by the May, 1976 PPWB report "Determination of Natural Flows for Apportionment Purposes" [8]. The Pipestone Creek Sub-Committee also felt that it was unlikely that there was groundwater inflow to the reservoir [3].

3.0 BASIN WATER USE

In calculating the natural flows in a stream, the recorded flows at hydrometric gauging sites are adjusted based on known or estimated water uses within the basin. In the Pipestone Creek basin there are two major projects, each having annual diversions of over a thousand cubic decametres. They are the Moosomin Reservoir, constructed in the mid-1950s, and the Kipling Marsh flood control project, first constructed in the mid-1950s and reconstructed in the early 1970s.

Improvements in natural flow calculations can be made by using an estimate of the actual diversion rather than the licensed diversion for water use projects. For projects supplied by a small tributary or drainage area, the actual diversion can be substantially less than the licensed diversion in dry years. The Pipestone Creek Sub-Committee recognized this problem in their report [3] where they state "Perhaps minor water uses could be reduced in dry years when there is judged to be insufficient water in the basin to supply the full licensed use." The effort required to do this for every licensed use as suggested by the Sub-Committee could be quite substantial. However, for this study the effort was judged to be worthwhile for several projects in the basin in addition to Moosomin Reservoir and Kipling Marsh.

3.1 MOOSOMIN RESERVOIR

Moosomin Dam was constructed on Pipestone Creek in 1953 and 1954 by the Prairie Farm Rehabilitation Administration (PFRA) to form Moosomin Reservoir. The reservoir, with a capacity of 11 156 dam^3 at a FSL of 543.91 m, filled for the first time in the spring of 1955. Its purpose was to provide water for municipal, domestic and irrigation uses. The reservoir is also used for recreation and it supplies water for downstream uses (domestic, stockwatering, and municipal) in dry years.

Water uses charged directly to this project are net evaporation and storage change effects. Net evaporation from the reservoir is based on estimated gross evaporation at Broadview Synoptic Station (AES No. 4010879 and 4010880) as calculated by PFRA [6] and on recorded precipitation at Moosomin Climate Station (AES No. 4015360). Recorded precipitation at Whitewood Climate Station (AES No. 4018880) was used directly to replace missing precipitation records at Moosomin. A transfer factor of 1.126 was applied to the Broadview gross evaporation based on a map of gross evaporation isopleths published by PFRA [6]. The isopleths show a 1951-1980 mean annual gross evaporation of 808 mm at Broadview versus approximately 910 mm at Moosomin. The average annual net evaporation at the Moosomin Reservoir site from 1943 to 1988 is 427 mm, with a minimum of 26 mm in 1975 and a maximum of 904 mm in 1961. In 1975, the gross evaporation was below average at 793 mm while the

3.2 KIPLING MARSH

The Kipling Marsh is a low lying area directly north of the Town of Kipling with its contributing area to the south and southwest of the town. In the early to mid-1950s, high marsh levels led to the construction of a ditch in 1956. The ditch apparently carried water in 1956, 1958, and 1959, but there are no records of the flow rates or durations. In 1972, a more extensive system of drainage ditches was constructed to drain the marsh. Pumps were installed in order to lift the water over the natural divide and drain it into Pipestone Lake.

The natural spill elevation for the marsh is at about 658.4 m. If the marsh were to fill to this elevation, the Town of Kipling, Highway No. 48, and the C.P.R. would all be flooded. With the ditches in place, the overflow elevation is now 652.0 m. The area/capacity curves for the marsh cover the range from elevation 649.8 to 651.4 m. By extrapolation, the marsh will hold 13 400 dam^3 with a flooded area of 1 320 hectares at elevation 651.7 m. Extrapolation of the curve beyond 651.7 m is difficult. Given the large storage and surface area at that elevation, and the fact that an additional 6.7 m of storage would be available under natural conditions, it was assumed that under natural conditions the marsh would not contribute to flows in the Pipestone Creek.

Records of the pumping duration and/or marsh levels have been kept from 1972 to date. From these, the volumes of water pumped from the marsh were calculated. Pumping was assumed to begin in April and continue until the volume for that year had been pumped. The volume pumped in any month was governed by the maximum pumping rate of 2.02 m^3/s. Table 1 gives the monthly and annual estimated volumes. The average annual pumped drainage volume for the period 1972 to 1988 is 3 150 dam^3.

TABLE 1

KIPLING MARSH DRAINAGE VOLUMES

Year	dam^3				
	April	May	June	July	Total
1972	2 082				2 802
1973					0
1974	5 225	982			6 207
1975	5 225	5 401	1 392		12 018
1976	5 225	5 401	5 225	2 765	18 616
1977					0
1978					0
1979	4 690				4 690
1980					0
1981					0
1982	363				363
1983	2 960				2 960
1984					0
1985	4 650				4 650
1986	1 740				1 740
1987	153				153
1988					0
Average	1 901	693	389	163	3 146

3.3 PIPESTONE LAKE

Pipestone Lake was a natural lake until the construction of a dam across its outlet in 1938. The purpose of raising the lake was to provide water for domestic and stockwatering use downstream. Of the licensed diversion of 1 850 dam^3, 1 505 dam^3 was allocated to these uses and the remaining 345 dam^3 was allocated

to evaporation. There are no records to indicate that any releases have ever been made specifically for any purpose. The riparian outlet is no longer operable and its invert is only 30 cm below the current spill channel invert. There are no licensed direct uses from the lake. In calculating natural flow, the use charged to this project is the increased evaporation loss due to the increased surface area of the raised lake. Also charged to this project are the differences in storage changes between historic and natural conditions.

The dam was constructed with a spillway channel in the south abutment. The spill control was a timber pile wall with the crest at elevation 590.91 m. Over the years, the timber pile wall decayed to the point that it is no longer evident. The spillway is now simply a channel through the sandy soil of the abutment, which has eroded over the years. In 1969, the invert of the spillway channel was measured to be at elevation 590.69 m. In 1989, the spillway crest was found to be at elevation 590.64 m. In calculating natural flows, the FSL was modelled at the original crest level for the years prior to 1969, and at the 1969 level from 1969 to 1988. The FSL of the natural lake was 589.73 m.

Net evaporation was calculated based on the gross evaporation at Broadview Synoptic Station (AES Station Nos. 4010879 and 4010880) as estimated by the PFRA [6] and on recorded precipitation at Broadview as published by AES. A transfer factor of 1.000 was applied to both the gross evaporation and precipitation. The resulting array of net evaporation is given in Table A-5. The average annual net evaporation for the period 1943 to 1988 is 389 mm with a maximum of 864 mm in 1961. The minimum of -12.1 mm in 1954 is due largely to the recorded June precipitation of 239 mm at Broadview. In fact, 1954 was the wettest year at Broadview for the period 1911 to 1988 with 711 mm of precipitation.

In order to quantify the evaporation and storage change effects due to raising Pipestone Lake, the natural flow model simulated the natural lake with estimated natural inflows and the raised lake with estimated historic inflows. A more detailed discussion of how the use charged to Pipestone Lake was calculated can be found in Section 3.4 of Appendix C. The average annual historic net depletion to flows in Pipestone Creek due to the raising of the lake and all the projects upstream of the lake is -832 dam^3 (the negative indicates a net increase in flow over natural conditions). The array of net depletions is given in Table A-6.

As part of the Pipestone Creek Sub-Committee study in 1985, PFRA revised the original flooded area and capacity curves for Pipestone Lake based on re-delineation of the contours on the 1938 topographic survey of the lake. The resulting curves are shown on Figure 3.

3.4 GRENFELL DIVERSION

In 1958, the Town of Grenfell constructed the Brown Hill Reservoir south of the town. To increase the reliability of the water supply to the reservoir, a diversion structure was placed on the Pipestone Creek and a ditch constructed from the diversion to the reservoir. The licensed annual diversion for the reservoir is 253 dam^3. The diversion from Pipestone Creek has an effective drainage area of 23.9 km^2 and a gross drainage area of 119.2 km^2, as shown on Figure 4.

The monthly depletion due to this project was estimated by multiplying the natural flow calculated at station 05NE003 for the years 1960-73, and 1987-88, or at station 05NE001 for the years 1959, and 1974-86 by the contributing drainage area ratio to the Grenfell diversion. As described in more detail in Section 3.9 of Appendix C, the calculation of natural flow at these two stations is done iteratively because the diversion to Grenfell both depends on and influences the natural flow at these two stations. The depletion was not allowed to exceed the licensed diversion of 253 dam^3 in any one year. The estimated monthly and annual diversions for the period 1959 to 1988 are given in Table A-7. The average annual diversion from 1959 to 1988 was estimated to be 199 dam^3. The minimum diversion was estimated to be 3 dam^3 in 1961.

3.5 IRRIGATION

There are two substantial private irrigation projects (diversions exceeding 100 dam^3) in the vicinity of Moosomin Reservoir (see Figure 1). Project No. 14504 withdraws water directly from Moosomin Reservoir. This project was authorized in 1982 and has an authorized diversion of 451 dam^3. This project was assumed to withdraw the entire 451 dam^3 each year. The withdrawals were assumed to be made equally in the months of May, June and July and were included in the sub-basin water use file (Table A-15). Given the relatively large licensed diversion of this project, monitoring the actual monthly water use would improve natural flow calculations.

Irrigation Project No. 14251 is located on a tributary just north of Moosomin Reservoir in NW 17-13-31 W1 (see Figure 1). This project was licensed in 1981 with a diversion of 138 dam^3 from a drainage area of 7.8 km^2. In dry years, it is not likely that full allocation would be available. The Pipestone Creek Sub-Committee reported [3] that the owner of this project had insufficient water for irrigation in 1982 and 1984, although the estimated diversion in 1982 is shown to be 127 dam^3 (Table A-8).

The monthly depletion due to this project was estimated by multiplying the local natural inflow between stations 05NE003 and 05NE001 for the years 1987 and

1988, or the natural flow at station 05NE001 for the years 1981-86 by the contributing drainage area ratio to the project. As described in more detail in Section 3.9 of Appendix C, the calculation of natural flow at the station 05NE001 is done iteratively because the diversion to this project both depends on and influences the natural flow at this station. The depletion was not allowed to exceed the licensed diversion of 138 dam^3 in any one year. The estimated monthly and annual diversions from 1981 to 1988 are given in Table A-8. The average annual diversion was estimated to be 97 dam^3. The minimum diversion was estimated as 28 dam^3 in 1981. Table A-8 shows that in three out of the eight years modelled, the project received less than half its licensed allocation.

3.6 DRAINAGE

In addition to the Kipling Marsh drainage project, there are three other drainage projects affecting flows in the Pipestone Creek basin. Drainage of sloughs and low lying areas by individual landowners was not considered in this study.

The most upstream of the three projects is the Silverwood Conservation Area No. 34 project. This project drains 3.76 km^2 that would otherwise not be in the effective drainage area of Pipestone Creek. The project was constructed during the 1950s and drains directly into Pipestone Lake. The monthly flow contributions due to this project for the years 1960-73 and 1987-88 were estimated by multiplying the unit natural inflow above station 05NE003 by the contributing drainage area to the project. For the years 1958-59 and 1974-86 the contribution was estimated by multiplying the contributing drainage area ratio by the natural flow at station 05NE001.

The second project was developed in association with the construction of Highway No. 8 south of Moosomin in the mid-1950s. The ditch drains an area of 3.23 km^2 that would not otherwise be in the Pipestone Creek basin effective drainage area. The ditch drains directly into Moosomin Reservoir. This project and the Silverwood project were assumed to begin operation in 1958. The monthly flow contributions due to this project for the years 1960-73 and 1987-88 were estimated by multiplying the local natural inflow between station 05NE003 and 05NE001 by the contributing drainage area ratio to the project. For the years 1958-59 and 1974-86, the contribution was estimated by multiplying the contributing drainage area ratio by the natural flow at station 05NE001.

The third project is the Moosomin Conservation Area No. 3 project completed in early 1978. This project drains 11.1 km^2 that would not otherwise be in the Pipestone Creek basin effective drainage area. The ditch system drains into Pipestone Creek approximately 2 km downstream of the Highway No. 8 crossing. The monthly flow contributions due to this project for the period 1978 to August

1982 were estimated by multiplying the local natural inflow between stations 05NE001 and 05NG003 by the contributing drainage area to the project. The monthly flow contributions due to this project for the period September 1982 to 1988 were estimated by multiplying the local natural inflow between stations 05NE001 and 05NG024 by the contributing drainage area to the project.

The contributing drainage areas for these three projects were reduced in high flow years since some of the drained area would have contributed to the natural flow even without ditching. The calculation of the contributing drainage area for these projects is discussed in more detail in Appendix C. To calculate natural flows, the drainage volumes were subtracted from the recorded flows. The calculation of natural flow at these stations was done iteratively because the contributions from these projects both depend on and influence the natural flow at these stations. The average annual drainage volumes from 1958 to 1988 were 37 dam^3 for the Silverwood project, and 41 dam^3 for the Highway No. 8 drainage project. The average annual drainage volume for the Moosomin project from 1978 to 1988 was 165 dam^3. The arrays of monthly contributions from these projects are given in Tables A-9 through A-11.

3.7 MUNICIPAL WATER SUPPLY

The water supply for the Town of Moosomin (population of 2,580 in 1988) is from two wells adjacent to Moosomin Reservoir. The first of the two wells was installed in 1968, the second was installed in 1987. The wells are registered as groundwater projects, however their proximity to the reservoir and their shallow depth (2.4 m) suggest that the wells are largely charged by the reservoir. Therefore, all of the town water supply was assumed to be from surface water in Moosomin Reservoir. No town water use from the Pipestone Creek basin was assumed to occur prior to 1968.

Monthly Town of Moosomin water consumption records were available starting in January, 1981 from Saskatchewan Environment and Public Safety. Annual consumption figures were available for 1971 to 1979. Missing data for annual consumption were estimated based on Saskatchewan Health population records and observed trends in annual per capita consumption. On this basis, per capita consumption was assumed to be 250 litres per day for 1968 to 1970 and 420 litres per day for 1980. The monthly distribution of annual consumption for the years 1968 to 1980 was based on the average 1981 to 1988 monthly distribution shown in Table 2. The array of monthly town water consumption is given in Table A-12.

TABLE 2 AVERAGE MONTHLY DISTRIBUTION OF THE TOWN OF MOOSOMIN WATER CONSUMPTION 1981 - 1988	
Month	Percent
January	7.4
February	7.3
March	7.8
April	8.2
May	8.9
June	10.2
July	11.0
August	9.6
September	8.2
October	7.4
November	6.9
December	7.1
TOTAL	100.0

3.8 OTHER USES

Information on other licensed projects within the effective drainage area was obtained from the Registrar's office of Sask Water. Projects outside of the effective drainage area are not listed in the tables and were not considered in this study. Tables A-13 through A-16 list these projects according to sub-basin. Tables A-17 through A-20 give the arrays of monthly water use for each sub-basin. The minor use in the sub-basin between stations 05NE001 and 05NG024 is 3 dam^3 in April for each year of the study period.

Irrigation projects withdrawing water from Moosomin Reservoir or directly from the creek were assumed to withdraw their entire licensed diversion each year with equal withdrawals in the months of May, June and July. Backflood irrigation

projects and domestic and wildlife projects located on small runs and tributaries were assumed to withdraw their entire licensed diversion in April of each year.

The Moosomin Golf Club water use was treated as an irrigation use except for the monthly distribution of its use. The monthly distribution of the water use was assumed to be as shown in Table 3. Sask Water files on this unlicensed project indicate the club has been withdrawing water from the creek downstream of Moosomin Reservoir and from the reservoir since 1971. Records of power consumption and pump operation are available starting in 1985. The annual water use was estimated from these records. For the period 1971 to 1984, water use was assumed to be equal to the 1985 to 1988 average use of 57.2 dam^3. Table 4 shows the 1985 to 1988 estimated annual use.

Water use in the Manitoba portion of the basin was required in order to naturalize the recorded flows near Pipestone, Manitoba. Water use information was obtained from the Souris River Basin Study [2] for the years 1943 to 1974. The Water Rights Section of Manitoba Natural Resources indicated that there are currently three licensed irrigation projects above station 05NG003 with a total allocation of 160 dam^3. The water use array given in Table A-21 was derived from these sources.

TABLE 3

MOOSOMIN GOLF CLUB
ASSUMED MONTHLY DISTRIBUTION OF WATER USE

Month	Percent
May	10
June	20
July	25
August	20
September	15
October	10
TOTAL	100

TABLE 4 MOOSOMIN GOLF CLUB ANNUAL WATER USE	
Year	Water Use (dam^3)
1985	39.2
1986	57.1
1987	65.6
1988	66.7
Average	57.2

4.0 NATURAL FLOW CALCULATIONS

4.1 AVAILABLE STREAMFLOW RECORDS

There are currently four streamflow stations in the Pipestone Creek basin. Table 5 lists the stations, their location, drainage areas and dates of operation. The drainage areas were taken from "Addendum No. 5 to Hydrology Report No. 104, The Determination of Gross and Effective Drainage Areas in the Prairie Provinces" [9].

As shown in Table 5, station 05NE003 was first established in 1960 but was discontinued in 1974. A report to the PPWB "Natural Flow Procedures and Hydrometric Networks - A Handbook for Small Interprovincial Streams" [10] recommended this station (proposed at the time of the report) be designated as a Board station. This recommendation was approved by the COH at meeting No. 48. In 1985 and 1986, the Canada Water Resources Branch (CWRB) in Regina, reported that they believed the flow measurements during periods of low flow were not accurate. However, the station was re-established in March, 1987 and efforts were made to maintain an artificial gravel control to improve the accuracy of low to medium streamflow records. Recorded flows from this station were assumed to be sufficiently accurate for the purposes of this study.

Station 05NE001 has recorded flows below Moosomin Reservoir since 1958. It is operated for the eight months March to October.

Station 05NG024 was established in August 1982 for year-round operation. The natural flow procedures and hydrometric networks report [10] indicates that records from this site are of good quality at low and medium flows but that records are unreliable at high flows due to the angle of flow at the bridge measurement site. Since the writing of that report, a cableway has been constructed downstream of the gauge site for measuring high flows.

Station 05NG003 has recorded flows near Pipestone, Manitoba since 1943 with twelve month operations since 1956.

The arrays of recorded flows for each station are given in Tables B-1 through B-4.

TABLE 5

STREAMFLOW STATIONS IN THE PIPESTONE CREEK BASIN

Station Number	Station Name	Location	GDA (km^2)	EDA (km^2)	Station Type	Dates of Operation From	To
05NE001	Pipestone Creek near Moosomin	Lat. 50°02'40"N Lon. 101°40'33"W	3647.5	1217.8	Automatic/Seasonal Recording	03/58	
05NE003	Pipestone Creek above Moosomin Lake	Lat. 50°09'07"N Lon. 101°50'06"W	2734.0	655.0	Automatic/Seasonal Recording Seasonal	03/60 03/87	10/73
05NG003	Pipestone Creek near Pipestone	Lat. 49°35'40"N Lon. 100°56'30"W	4203.0	1559.7	Automatic/Seasonal Recording Seasonal Annual	05/36 04/43 04/56	06/36 10/55
05NG024	Pipestone Creek near the Saskatchewan Boundary	Lat. 49°50'28"N Lon. 101°23'48"W	3863.0 3863.0	1342.9 1342.9	Automatic/Annual Recording	09/82	

4.2 ROUTING AND CHANNEL LOSSES

Routing of depletions was not done in this study primarily because assumptions were made as to the month in which the depletion would occur. Routing factors to adjust the depletion for travel times of a few days do not seem justified when the month in which the depletion occurred was assumed in the first place.

Significant channel losses have been observed in some years in the reach of Pipestone Creek from Moosomin Reservoir to the Saskatchewan-Manitoba boundary. With the installation of the station 05NG024 in August 1982, the occurrence and magnitude of these losses can readily be determined by comparing recorded flows at the boundary with recorded flows below Moosomin Reservoir. No net losses between the two stations have been observed during the spring runoff period as any losses that might occur are more than offset by local inflow. Net losses have been observed during the summer and fall months with the largest net losses generally associated with fall reservoir releases when the stream bed is initially dry.

From June to October, 1984, the recorded flow volume below Moosomin Reservoir was 1 663 dam^3 of which only 932 dam^3 passed into Manitoba, a net loss of 731 dam^3 or 44 percent of the volume released from the reservoir. From June to October, 1988, 920 dam^3 was released from Moosomin Reservoir while only 401 dam^3 crossed into Manitoba, a net loss of 519 dam^3 or 56 percent of the volume released. In both years, little or no flow occurred during the summer, allowing the stream channel to dry up. A net loss of 266 dam^3 was observed in the fall of 1982 even though an average flow of 0.113 m^3/s was maintained throughout the summer months of June, July, and August below Moosomin Reservoir. Net channel losses in these and other years are shown on Table 6.

TABLE 6

OBSERVED NET CHANNEL LOSSES BELOW MOOSOMIN RESERVOIR

Year	Period	Release	Flow at Boundary	Flow Near Pipestone, MB	Loss to Boundary	Loss to Pipestone, MB
1958	Aug-Oct	2287	-	1679	-	608
1959	Aug-Oct	727	-	974	-	-247
1960	Jun-Oct	8987	-	4812	-	4175
1961	Aug-Oct	250	-	24	-	226
1962	Aug-Oct	11	-	626	-	-615
1963	Aug-Oct	1279	-	2604	-	-1325
1964	Aug-Oct	1135	-	3839	-	-2704
1965	Aug-Oct	3466	-	7075	-	-3609
1966	Aug-Oct	628	-	2484	-	-1856
1967	Aug-Oct	686	-	295	-	391
1968	Jun-Oct	660	-	484	-	176
1969	Aug-Oct	579	-	2646	-	-2067
1970	Aug-Oct	3087	-	4430	-	-1343
1971	Aug-Oct	1131	-	4716	-	-3585
1972	Aug-Oct	2322	-	3028	-	-706
1973	Aug-Oct	2329	-	3063	-	-734
1974	Aug-Oct	1659	-	1823	-	-164
1975	Aug-Oct	24228	-	23070	-	1158
1976	Aug-Oct	10225	-	10510	-	-285
1977	Aug-Oct	2088	-	559	-	1529
1978	Aug-Oct	1918	-	1233	-	685
1979	Aug-Oct	1973	-	1299	-	674
1980	Jun-Oct	1418	-	992	-	426
1981	Jun-Nov	1131	-	74	-	1057
1982	Sep-Oct	1342	1076	852	266	490
1983	Jul-Oct	1703	1553	2762	150	-1059
1984	Jun-Oct	1663	932	807	731	856
1985	Jun-Oct	1423	1670	3676	-247	-2253
1986	Aug-Nov	3209	3321	2836	-112	373
1987	Aug-Nov	1312	1323	2087	-11	-775
1988	Jun-Oct	920	401	93	519	827

The above losses are incorporated implicitly in the interpolation of natural flows between stations 05NE001 and 05NG003 and in the recorded flow at station 05NG024, so that no special programming was required to address them. Channel loss corrections were not developed nor applied to depletions calculated in the natural flow model.

4.3 NATURAL FLOWS FOR PERIOD OF RECORD

Natural flows were calculated for each streamflow station for the periods that they have been in operation using the project depletion method. These arrays are given in Tables B-5 through B-8. Historic net depletions to each of the four stations are given in Tables A-21 through A-24.

The depletions given in Tables A-21 through A-24 are generally the sum of all upstream uses with flow contributions from drainage projects treated as negative depletions. To get natural flows, these sums were then added to the recorded station flows (Tables B-1 through B-4). If the resulting natural flow was less than zero, the natural flow was set equal to zero and the depletion adjusted to be equal to the recorded flow but of opposite sign.

Natural flows at the Saskatchewan-Manitoba boundary are equal to the natural flow at station 05NG024 for the period during which that station has been operated. For the period 1958 to August 1982, natural flows at the boundary were estimated by interpolating between the natural flows at station 05NE001 and at station 05NG003. From 1943 to 1957, natural flows at the boundary were estimated based on the natural flow at station 05NG003 multiplied by the ratio of contributing drainage areas. The monthly natural flows are given on Table B-9. The average annual flow volume for the study period is 43 200 dam^3.

The transfer of winter flows from station 05NG003 to the boundary from 1956 to 1981 is premised on the assumption that the natural flows at these two points are proportional to the ratio of effective drainage. Implicit in this assumption is an assumption that the flow is derived from surface runoff. The frequency of zero natural flow during the fall months above Moosomin Reservoir (Table B-5) would suggest that some source other than surface runoff is responsible for the estimated winter natural flows at the boundary. It is more reasonable that the observed winter flows, on which the natural flows are based, are derived from one or more of the three following sources: leakage and/or seepage from Moosomin Reservoir, groundwater inflow between Moosomin Reservoir and station 05NG024 since 1982 and station 05NG003 prior to 1982, and drainage of water stored in the Pipestone Creek channel. A detailed inspection of the dam and outlet works should be carried out to determine the magnitude of seepage and leakage from the reservoir. Similarly, a detailed hydrogeologic investigation of the Pipestone Creek Valley from Moosomin Reservoir and the Saskatchewan-Manitoba boundary would establish the groundwater regime of that reach. It would also assist in determining what interaction, if any, there is between the reservoir and groundwater. If the recorded winter flows at station 05NG003 are largely made up of groundwater inflow below the Saskatchewan-Manitoba boundary, then transferring those flows to the boundary is not valid.

Recorded flows for the winter months are available at Pipestone Creek near Pipestone (05NG003) since 1956, and at the boundary since 1982. These recorded flows were adjusted for known depletions, primarily storage changes at Moosomin Reservoir and Town of Moosomin water consumption. Winter natural flows calculated at station 05NG003 from 1956 to 1981 were transferred to the boundary using effective drainage area ratios. The resulting natural flows show five years from 1956 to 1988 had zero flow in January and February; 1958-60, 1962, and 1979.

Since Moosomin Reservoir elevations are not recorded over the winter, the storage changes had to be interpolated using the November 1 and March 1 elevations. The calculation of natural flows for the winter months could be improved if observations were made of Moosomin Reservoir elevations at least monthly during the winter.

4.4 ESTIMATION OF MISSING FLOWS

4.4.1 Missing Values for March, April and October

Missing natural flows at the Saskatchewan-Manitoba boundary for the months of March, April and October were estimated using the natural flows of Gainsborough Creek [11] and Antler River [12] and a correlation analysis. The natural flows for the Antler River are based on flows recorded since 1943 at Antler River near Melita (05NF002). The natural flows for Gainsborough Creek are based on recorded flows at Gainsborough Creek near Lyleton (05NF007) since 1956 and Gainsborough Creek near Melita (05NF003) since 1943. Table 7 gives the results of the correlation analysis between Gainsborough Creek, Antler River, and Pipestone Creek for the months of March, April and October.

TABLE 7

ESTIMATION OF MISSING NATURAL FLOWS PIPESTONE CREEK AT THE SASKATCHEWAN - MANITOBA BOUNDARY

Month	Equation	Correlation Coefficient (R)	Years Extended
March	$227.9 * (V_{NF7})^{0.3922}$	0.71	43, 46, 48, 53, 55, 56
April	$23.45 * (V_{NF2})^{0.7119}$	0.94	48
October	$971 + 1.245 * (V_{NF2})$	0.67	48
Winter	$938 + 0.7470 * (V_{OCT})$	0.63	43/44 - 55/56, 88
November	0.482 * Winter	N/A	43-53, 55, 88
December	0.215 * Winter	N/A	43-53, 55, 88
December	$0.416 * (\text{Winter} - V_{NOV})$	N/A	54
January	0.158 * Winter	N/A	44-54, 56
January	$0.306 * (\text{Winter} - V_{NOV})$	N/A	55
February	0.145 * Winter	N/A	44-54, 56
February	$0.278 * (\text{Winter} - V_{NOV})$	N/A	55

LIST OF SYMBOLS

V_{NF7}	Monthly natural flow volume (dam^3) at Station 05NF007
V_{NF2}	Monthly natural flow volume (dam^3) at Station 05NF002
V_{OCT}, V_{NOV}	Pipestone Creek natural flow volume (dam^3) for October and November respectively
Winter	Sum of natural flow volumes for November through February

4.4.2 Missing Winter Flows

Total winter flow volumes from 1943/44 to 1955/56, and 1988 were estimated based on the correlation of winter flow volume (November through February) to the flow volume of the preceding October for the years 1956/57 through 1987/88. The resulting equation for winter flow is given in Table 7. This relationship was chosen over correlations between October alone, October plus September, and the logarithmic transform of the winter volume to the transforms of October alone, October and September, and October plus September.

It should be noted that the equation for estimating winter flows is based on natural flows for the period after Moosomin Reservoir was constructed. If seepage and/or leakage has biased the recorded flows from which the winter natural flows are derived, then the intercept of 938 may also be biased and the estimated winter flows using the equation may be too high. This reinforces the need to investigate the source of the recorded winter flows at the Saskatchewan-Manitoba boundary as suggested in section 4.3. If seepage and/or leakage is found to be significant, then the estimated winter natural flows should be adjusted downward for the entire study period.

The total winter volume was then distributed to the four winter months of November through February using the distribution of observed winter flows from 1956/57 through 1987/88.

4.5 COMPARISON TO PREVIOUS STUDY

The natural flow estimates in Table B-9 were compared to the results of the 1979 natural flow study. The average annual flow for the comparable period 1944 to 1977 is 7.2 percent higher (49 800 dam^3 versus 46 400 dam^3 in the 1979 study). The annual flows calculated in this study range from 39 percent smaller to 64 percent larger than the corresponding values from the 1979 study, though most of the years are between 5 percent and 15 percent larger. The comparison of annual flow volumes is shown on Figure 5.

The flow volume for 1944 is 39 percent less than in the 1979 study primarily because of much smaller January, February, March, and July flows. The volume for 1948 is 64 percent larger than in the 1979 study due to a much higher estimate of the missing April flow in the present study (14.0 m^3/s vs. 3.39 m^3/s in the 1979 study).

To rationalize the validity of the April, 1948 flow value, the ratios of recorded or estimated April to May flow volumes in 1948 were calculated at several streamflow stations in the region and compared to the ratios from this study and the 1979 study. The date of the recorded peak daily flow was also noted.

Station	Ratio of April/May Flow	Date of Peak Flow
Pipestone Cr. at the SK/MB bdry (Current Study)	1.51	N/A
Pipestone Cr. at the SK/MB bdry (1979 Study)	0.36	N/A
Souris R. near Sherwood	0.56	April 29
Souris R. near Estevan	1.68	April 24
Antler R. near Melita	1.36	April 26
Gainsborough Cr. near Melita	2.34	April 25

It is evident that the runoff in April of 1948 in the region occurred late in April with the bulk of the flow occurring in April at sites with smaller drainage areas. In contrast, the Souris River near Sherwood site, with larger area and longer travel time, had more flow in May than in April. For Pipestone Creek, the estimation of an April flow larger than the May flow in 1948 seemed reasonable.

The average monthly flows at the Saskatchewan-Manitoba boundary for the two studies are compared in Figure 6. Average monthly flows for April through September are higher in the current study. Average monthly flows in March and October are marginally lower. Winter flows are marginally higher in the current study (2 190 dam^3 compared to 2 030 dam^3 in the 1979 study).

5.0 PRESENT USE ANALYSIS

An analysis was made to determine whether the present (1988) use flow of the Pipestone Creek at the Saskatchewan-Manitoba boundary would have been less than 50 percent of the natural flow, under the terms of the 1969 Master Agreement on Apportionment.

5.1 EXTENSION OF NATURAL FLOWS

In order to carry out the present use analysis, the natural flows at station 05NE001 were extended based on the natural flows at station 05NG003 and station 05NG024. March through October flows from 1943 to 1957 were transferred from station 05NG024 using contributing drainage area ratios. Winter flows were transferred using effective drainage areas from station 05NG024. The array of extended natural flows is given in Table B-10. The same methodology was then used to transfer natural flows from station 05NE001 to Pipestone Lake (Table B-11).

5.2 PROJECT DEPLETIONS AT PRESENT LEVEL OF USE

Depletions for each project were extended to cover the study period 1943 to 1988. Minor project usage in each sub-basin was assumed to be equal to the 1988 values shown in Tables A-17 through A-19.

Annual drainage volumes from Kipling Marsh were extended by correlation to the eight-month natural flow volume at station 05NE001. Correlation analysis yielded the following relation:

$$\text{Kipling Drainage} = 0.1186 * \text{NE1} - 1033$$

where NE1 is the eight-month natural flow volume in cubic decametres at station 05NE001. The correlation coefficient (R) was 0.97. The coefficient of 0.1186 approximates the effective drainage area ratio of 0.123. A negative constant is reasonable due to abstractions from the runoff into the Kipling Marsh. Estimated drainage less than zero was assumed to be zero. Drainage was assumed to start in April, and continue at the maximum pumping rate of 2.02 m^3/s until the annual volume had been discharged. The average annual Kipling Marsh drainage at the present level of development is 3 540 dam^3. Table A-25 lists the monthly and annual drainage volumes at the present level of development.

The annual drainage volumes for the Silverwood, Highway No. 8, and Moosomin projects, and the depletion due to the Grenfell diversion were extended using the same methodology as was used in the natural flow model. The resulting drainage

and depletion arrays are given in Tables A-26 through A-29. The average annual incremental flow increases from the Silverwood, Highway No. 8, and Moosomin projects at the present level of development are 47 dam^3, 47 dam^3 and 223 dam^3 respectively. The average annual Grenfell diversion at the present level of development is 213 dam^3.

The depletion due to Irrigation Project No. 14251 was extended using the same methodology as was used to determine the project usage in the natural flow model. The resulting depletion array is given in Table A-30. The average annual depletion at the present level of development is 109 dam^3.

Water withdrawals from Moosomin Reservoir for the Town of Moosomin were assumed to be 447 dam^3 annually, based on the 1988 population of 2,580 and an average consumption rate of 475 litres per capita per day. The annual volume was distributed to each month using the percentages given in Table 2.

The Moosomin Golf Club was assumed to withdraw 57.2 dam^3 per year from Moosomin Reservoir distributed according to the monthly distribution given in Table 3.

5.3 PIPESTONE LAKE NET DEPLETION

A single-reservoir water balance model developed by PFRA, HY03 [13], was used to simulate Pipestone Lake over the study period 1943 to 1988 under natural conditions and at the present level of development. An array of natural inflows to Pipestone Lake was developed using contributing drainage area ratios for the months of March through October, the effective drainage area ratio for November through February, and the extended natural flows at station 05NE001. In the natural lake simulation, the FSL was 589.73 m and there were no water imports or demands. The simulated average annual natural spill from the lake was 9 400 dam^3 and the evaporation was 400 dam^3.

The simulation of the lake under present conditions included water imports from Kipling Marsh and the Silverwood drainage project averaging 3 590 dam^3 annually. Inflow deductions included the Grenfell diversion and 110 dam^3 annually in minor project demands. The simulation used the 1989 spill level of 590.64 m. The average annual spill was 12 500 dam^3 with an average evaporation of 567 dam^3.

The net effect of increasing the spill level of Pipestone Lake and of the upstream drainage and water use projects is to increase the average annual spill from the lake by 3 100 dam^3.

5.4 MOOSOMIN RESERVOIR SIMULATION

The HY03 model was used again to simulate Moosomin Reservoir under present level of use conditions over the study period 1943 to 1988. Local natural inflows to the reservoir were calculated by subtracting the extended natural inflow to Pipestone Lake from the extended natural flow at Station 05NE001. Deductions from the reservoir inflow included local demands between the reservoir and Pipestone Lake totalling 253 dam^3 and the present level of use for irrigation project 14251 at 109 dam^3. The present level of use spill from Pipestone Lake was included in the simulation as an import. The present level of use incremental increases in flow from the Highway No. 8 drainage project were also treated as an import. Local demands directly from the reservoir totalled 973 dam^3 per year, comprised of the demands for the Town of Moosomin, the Moosomin Golf Club, and irrigation projects 8050 and 14504.

The reservoir was simulated with a FSL of 543.91 m and a dead storage level of 542.39 m. The net evaporation from the reservoir in millimetres is given in Table A-1. The average annual volume of net evaporation from the reservoir at the present level of use is 1 660 dam^3 (Table A-31). The simulated average annual spill (Table A-32) from the reservoir was 39 600 dam^3, 200 dam^3 more than the average natural flow of 39 400 dam^3.

The historic average annual net evaporation from 1955 to 1988 is 2 200 dam^3. The average annual net evaporation for the period 1943 to 1988 at the present level of use is 1 660 dam^3. The present level of use net evaporation is significantly lower than the historic net evaporation for several reasons. Firstly, the additional years, 1943 to 1954, generally have below average net evaporation rates. The average annual net evaporation from 1955 to 1988 is 474 mm. The average annual net evaporation from 1943 to 1954 is 293 mm. Secondly, the historic water levels indicate regular surcharging of the reservoir above 543.91 m due to the installation of flashboards on the spillway crest, and due to the development of hydraulic head required to discharge flow over the spillway or flashboards. The maximum monthly level simulated in the present use analysis was 543.91 m.

5.5 PRESENT USE FLOW AT THE BOUNDARY

Present use flow at the Saskatchewan-Manitoba boundary was obtained by adding the local natural inflow between Moosomin Reservoir and the boundary and the Moosomin CAA#3 incremental flow increases to the present use spill from the reservoir, and subtracting the minor water use between the reservoir and the boundary. The resulting present use flow at the boundary is given in Table B-12.

The average annual present use flow at the boundary is 43 100 dam^3, 100 dam^3 less than the natural flow.

The apportionment requirement of 50 percent of natural flow was subtracted from the present use flow at the boundary to derive the array of present level of use apportionment surpluses (positive) and deficits (negative) given in Table B-13. Surpluses were simulated in all but five years; 1959/60, 1961/62, 1962/63, 1968/69 and 1981/82. However, in those five years, there was sufficient storage in Moosomin Reservoir that the deficits could have been avoided. The average annual apportionment requirement is 21 600 dam^3. The average annual apportionment surplus under present use conditions is 22 300 dam^3.

If apportionment were calculated on a calendar year basis rather than a water year starting April 1 and ending March 31 as specified by the Master Agreement on Apportionment, there would still have been five years with an apportionment deficit: 1959, 1962, 1981, 1984 and 1988, as shown in Table B-14. A water year from April to March provides the possibility of a year with virtually no inflow if runoff occurs in March of the first year and April or later in the subsequent spring. This situation is exactly what occurred in 1961, 1968, and 1981. Using the April to March water year for 1962 resulted in that year receiving credit for the surplus of March 1963. The use of an April to March water year for apportionment on Pipestone Creek complicates the management of apportionment in years when spring runoff occurs prior to April 1.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

This study developed a natural flow array for the Pipestone Creek at the Saskatchewan-Manitoba boundary. The 1944 to 1988 average annual natural flow at the boundary is 43 200 dam^3. Natural flows for the winter months from 1956/57 to 1987/88 were generated by adding known depletions to the recorded flow at Station 05NG003 (1956 to 1981) and transferring the flow to the Saskatchewan-Manitoba boundary using drainage area ratios, and by adding known depletions to the recorded flow at Station 05NG024 (1982 to 1988). The results indicate that there is a continuous natural flow in Pipestone Creek in most years. This conclusion is contrary to the general belief that Pipestone Creek is an intermittent stream.

The Kipling Marsh drainage project has the largest impact on natural flows with an historic average annual drainage volume of 3 150 dam^3 over the seventeen-year period 1972 to 1988 and a projected average annual drainage volume of 3 540 dam^3 over the study period 1943 to 1988. The largest single consumptive use in the basin is evaporation from Moosomin Reservoir, averaging 1 660 dam^3 at the present level of use.

Simulation of the Pipestone Creek Basin in Saskatchewan indicates that the average flow at the Saskatchewan-Manitoba boundary at the present level of development (1988) is approximately equal to the natural flow. Closer examination of the simulations reveal that drainage from the Kipling Drainage project causes large apportionment surpluses in wet years. However, in drier years there is no drainage from the Kipling project and surpluses are smaller. In extreme dry years, about 1 in 10 according to the simulation results, consumptive uses in the Saskatchewan portion of the basin exceed the one-half of natural flow to which Saskatchewan is entitled.

Estimated winter natural flows (total for months of November, December, January, and February) average 1 850 dam^3, or 4.3% of the annual natural flow volume at the Saskatchewan-Manitoba boundary. Over the concurrent period 1943 through 1977, winter flows calculated in this study were marginally higher than those of the 1979 study [1] (2 190 dam^3 in the current study versus 2 030 dam^3). The source of these winter flows is uncertain, although based on natural flows above Moosomin Reservoir during the fall months, it is not likely to be surface runoff between the reservoir and the boundary.

6.2 RECOMMENDATIONS

The natural flow array developed in this study is felt to be as accurate as the observed data allows. However, a number of improvements to the calculations would be possible with better data. The following data improvements are recommended:

1. Consideration should be given to verifying and updating the Moosomin Reservoir area/capacity curves by undertaking a bathometric survey of the reservoir.

2. Depletions of Pipestone Lake could be improved by monitoring water levels on the lake. With the calculation procedure used in this study, readings would only be required on or near the first day of each month from March to November, although daily readings would provide a more accurate monthly average surface area for net evaporation estimates. The natural flow report of 1979 [1] also contained the suggestion that monitoring Pipestone Lake levels would improve the natural flow estimates.

3. The Pipestone Lake dam has fallen into a state of disrepair and even a moderate flood could lower the spill elevation and/or could breach the dam completely, thus returning the lake to its natural FSL. The dam should be inspected and the invert of the spill channel surveyed after all major flood events. The Natural Flow Model allows the input of the Pipestone Lake FSL.

4. Improvements could be made to the estimates of winter natural flows by monitoring Moosomin Reservoir water levels during the winter. With the calculation procedure used in this study, water level readings would only be required on or near the first day of each month.

5. Direct monitoring of large water withdrawal projects such as Irrigation Project No. 14504 (451 dam^3) would also improve natural flow calculations.

6. The source of the natural winter flows at the boundary should be determined. To this end, a hydrogeologic investigation should be undertaken to determine groundwater interactions between the Moosomin Reservoir and the stream channel below Moosomin Dam to the boundary, and to determine the seepage from Moosomin Reservoir.

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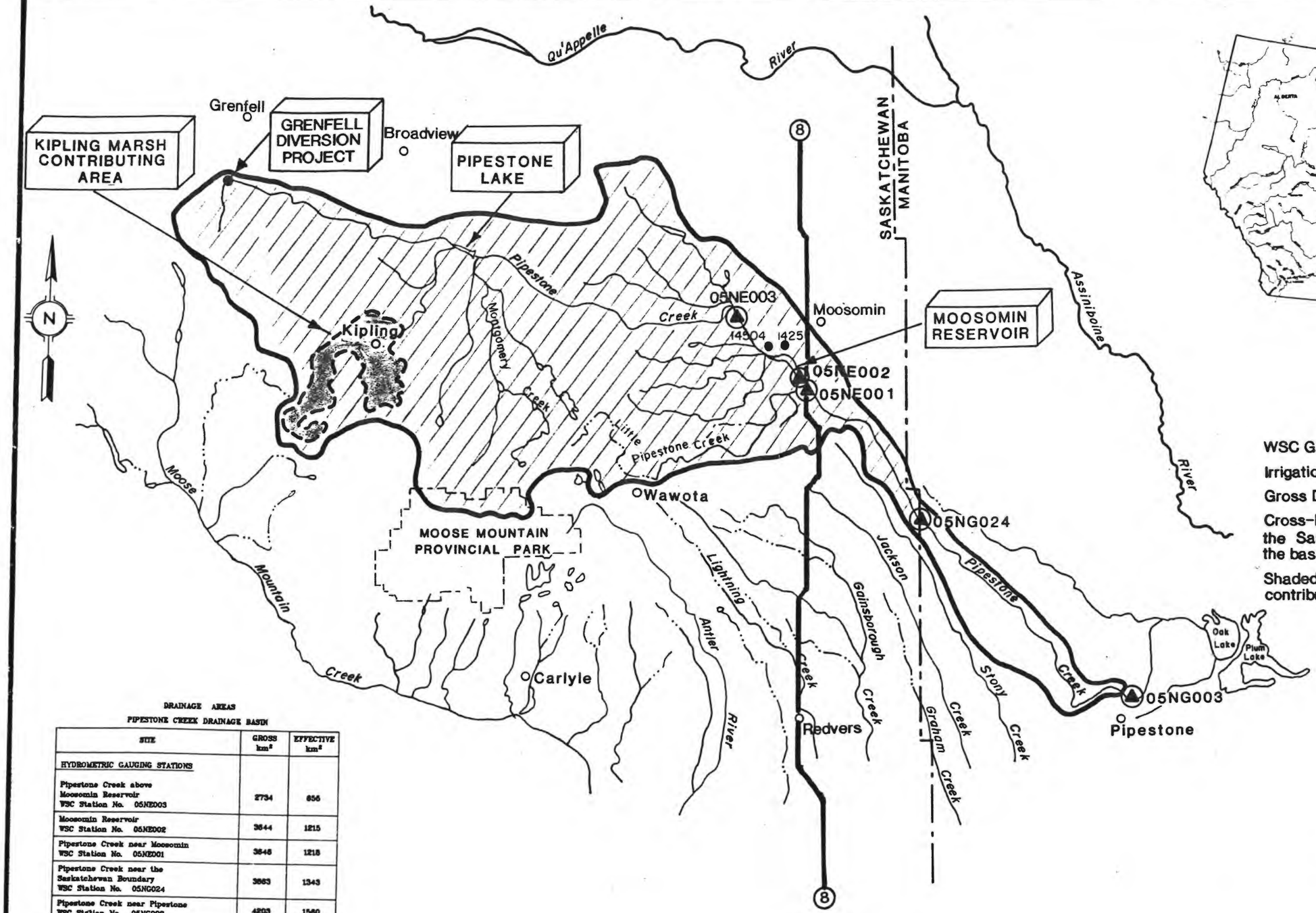
KEY MAP

Pipestone Creek Drainage Basin



LEGEND

- WSC Gauging Station
- Irrigation Projects
- Gross Drainage Area
- Cross-hatched area represents the Saskatchewan portion of the basin
- Shaded area represents the area contributing to Kipling March

10 5 0 10 20

SCALE IN KILOMETRES

DRAINAGE AREAS

PIPESTONE CREEK DRAINAGE BASIN

SITE	GROSS km²	EFFECTIVE km²
HYDROMETRIC GAUGING STATIONS		
Pipestone Creek above Moosomin Reservoir WSC Station No. 05NE003	2734	656
Moosomin Reservoir WSC Station No. 05NE002	3644	1215
Pipestone Creek near Moosomin WSC Station No. 05NE001	3648	1218
Pipestone Creek near the Saskatchewan Boundary WSC Station No. 05NG024	3663	1343
Pipestone Creek near Pipestone WSC Station No. 05NG003	4203	1560
MAJOR PROJECT SITES		
Kipling March		150
Pipestone Lake	1212	200
Moosomin Reservoir	3644	1215
AREA TRIBUTARY TO SASK-MAN BOUNDARY		
Pipestone Creek at the Interprovincial Boundary	3858	1338

Designed

Drawn D. F.

Recommended

Approved

SASKATCHEWAN WATER CORPORATION

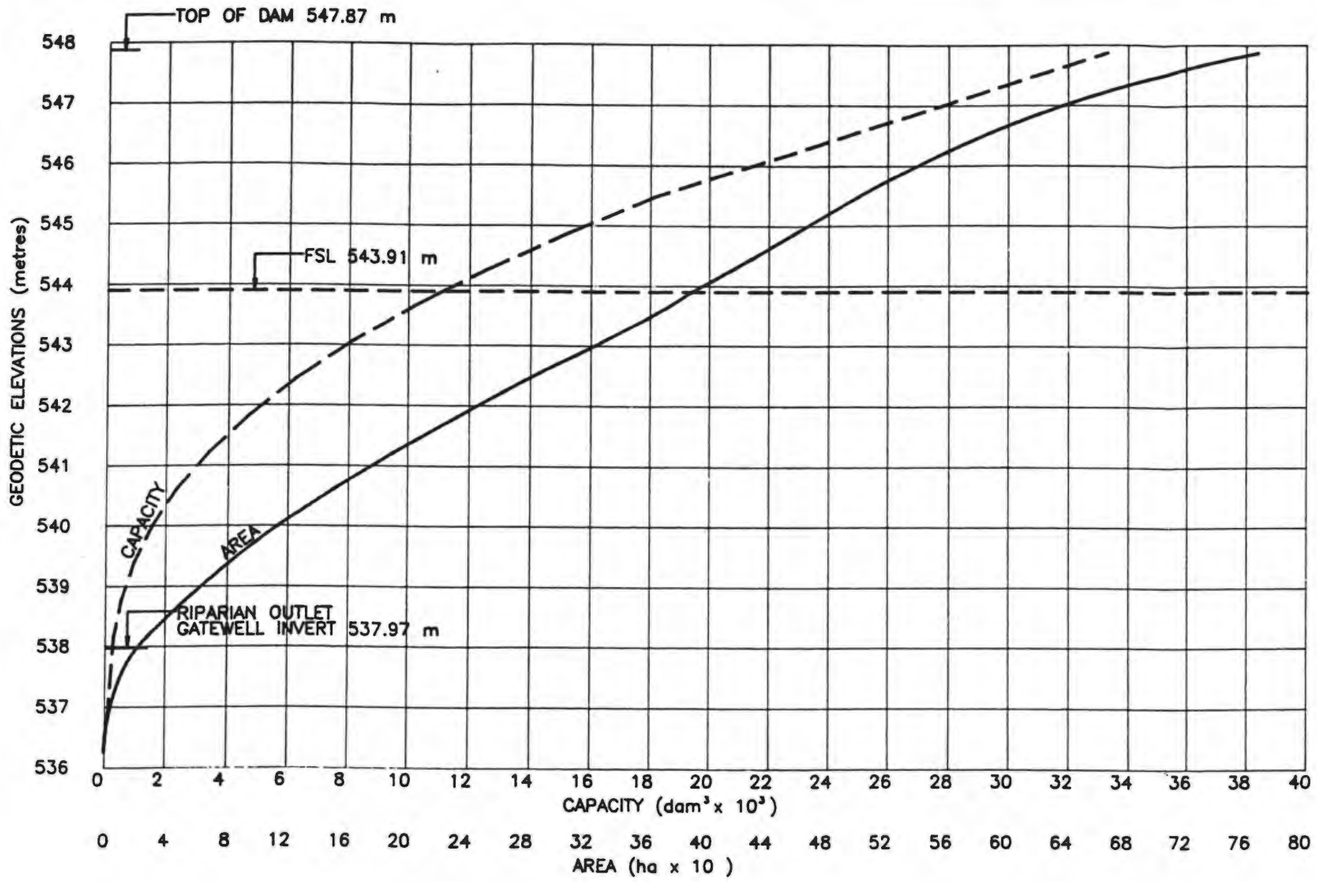
LOCATION MAP OF THE PIPESTONE CREEK BASIN

Date JULY 13, 1992

Sheet 1 of 6

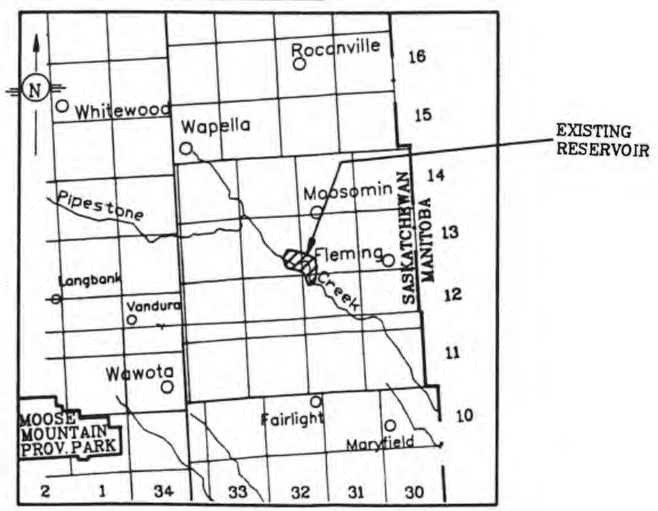
PLAN No. FIGURE 1

FIGURE H1-6 (1)



ELEV. (m)	AREA (ha)	CAPACITY (dam^3)
536.27	0	0
538.16	28	268
538.77	53	515
539.38	81	922
539.99	113	1514
540.6	150	2315
541.21	190	3352
541.82	233	4643
542.43	277	6200
543.04	326	8040
543.65	372	10167
543.91	389	11156
544.26	415	12562
544.87	457	15223
545.48	500	18143
547.87	768	33292

LOCATION PLAN



SCALE 1:1 000 000

NOTES

1) STRUCTURE COMPLETED IN 1954
2) COMPILED FROM PFRA DATA

No.	Date	Revisions	By	App'd

SASKATCHEWAN WATER CORPORATION

AREA AND CAPACITY CURVES

FOR

MOOSOMIN RESERVOIR

TWP 12 – RGE 31 W1M

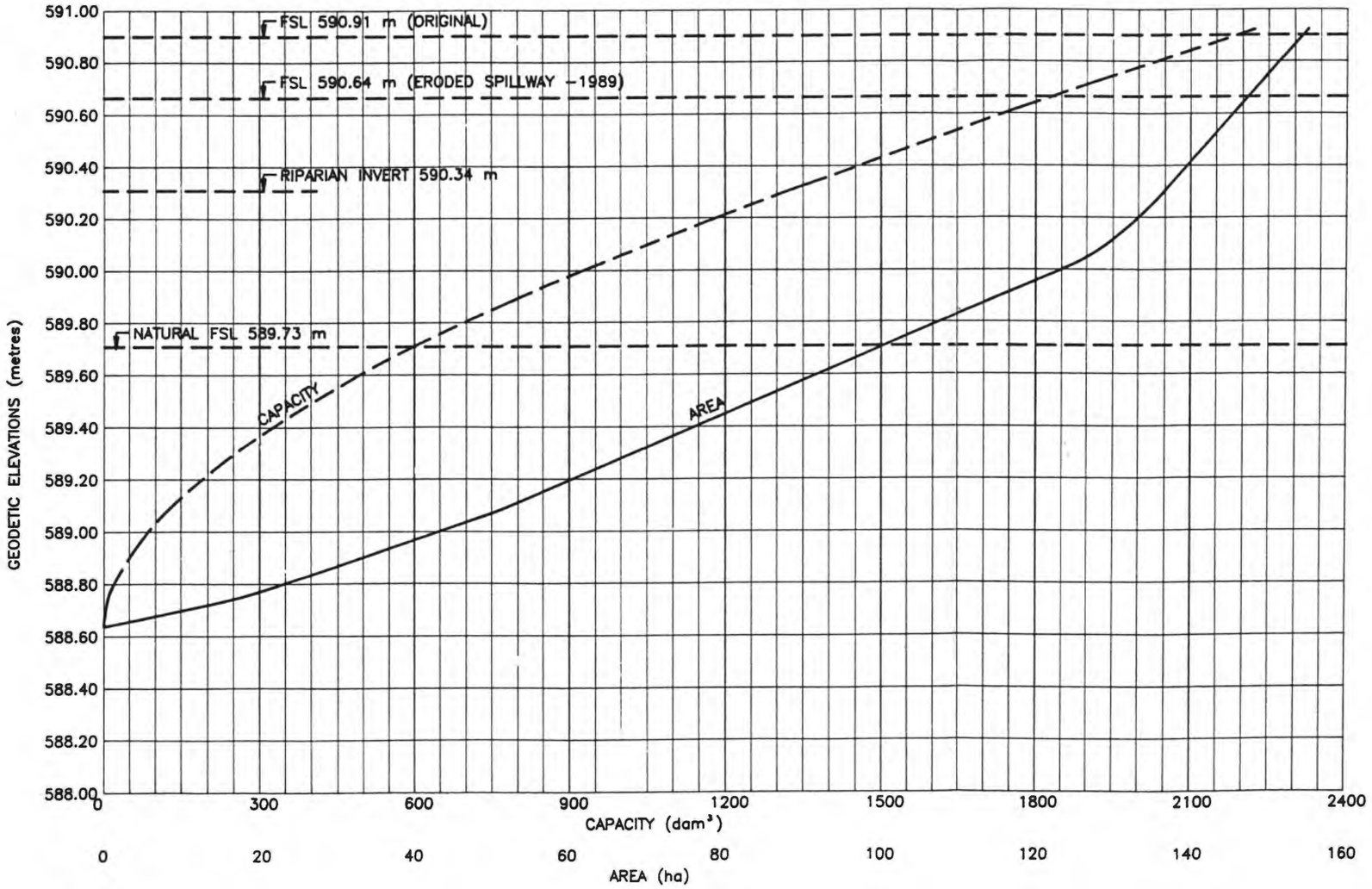
Submitted by:	Date:	Designed by:	Date:
Drawn by:	Date:	Checked by:	Date:
Recommended by:	Date:	Approved by:	Date:
PLAN DATE: 26/07/90		SCALE:	

Plan No. H1–6 (1) FIGURE: 2

CAD FILE MAIN

ELEV. (m)	AREA (ha)	CAPACITY (dam^3)
588.636	0	0
588.788	22	17
589.093	52	130
589.398	76	324
589.703	100	593
590.007	124	936
590.312	137	1335
590.617	146	1766
590.922	155	2224

TOP OF DAM 592.74m



NOTES

1) CALCULATED BY PFRA IN 1985 BASED ON 1938 TOPOGRAPHY

No.	Date	Revisions	By	App'd
	01/92	Revised data (Replaces plan dated 26/09/91)		

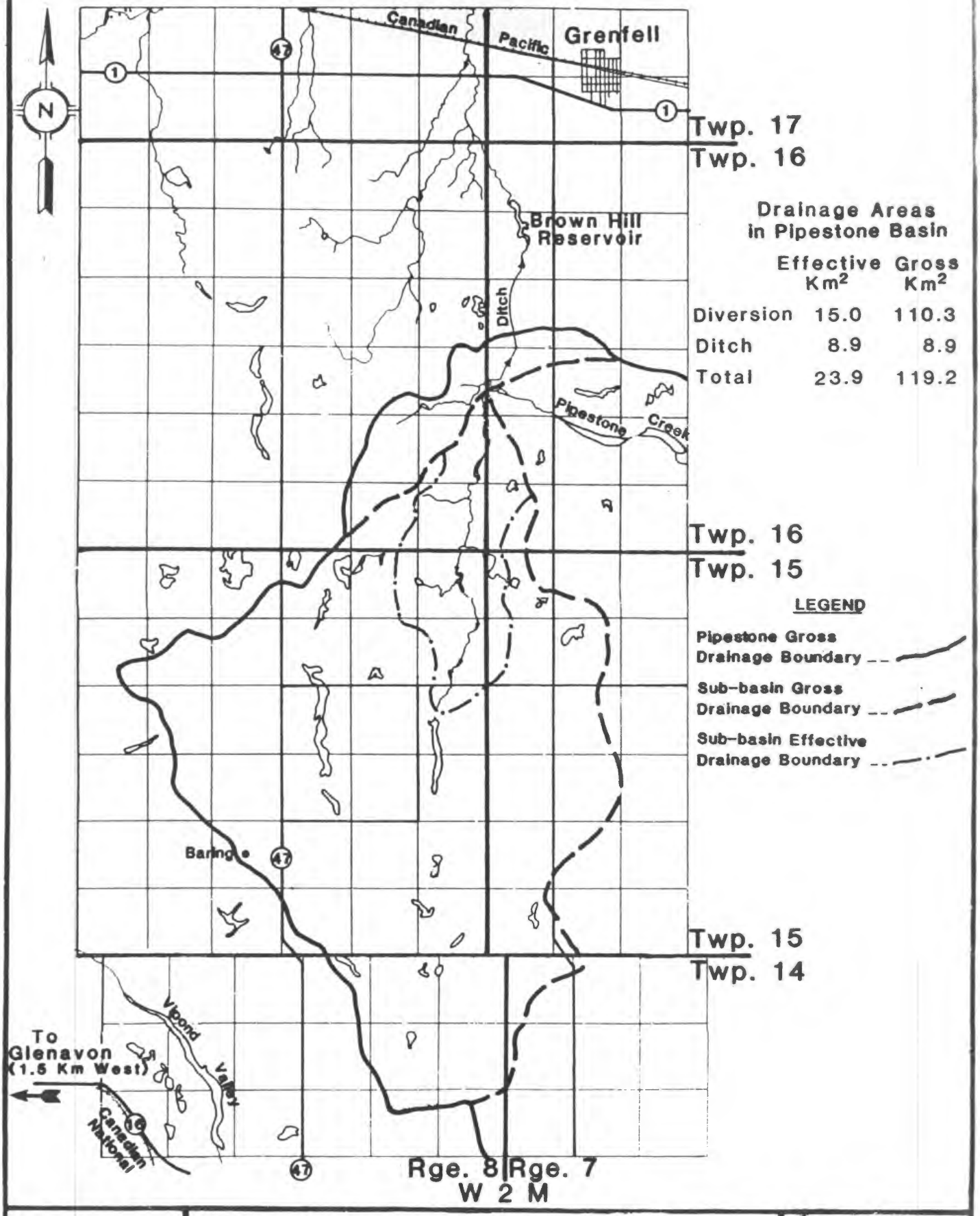
SASKATCHEWAN WATER CORPORATION

AREA AND CAPACITY CURVES
FOR
PIPESTONE LAKE
TWP 15 – RGE 3 W2M

Submitted by:	Date:	Designed by:	Date:
Drawn by: GJ	Date:	Checked by:	Date:
Recommended by:	Date:	Approved by:	Date:
PLAN DATE: 02/01/92		SCALE:	

Plan No. H1-6 (1) | Figure 3

CAD FILE PSTONE



Drainage Areas in Pipestone Basin

	Effective Km^2	Gross Km^2
Diversion	15.0	110.3
Ditch	8.9	8.9
Total	23.9	119.2

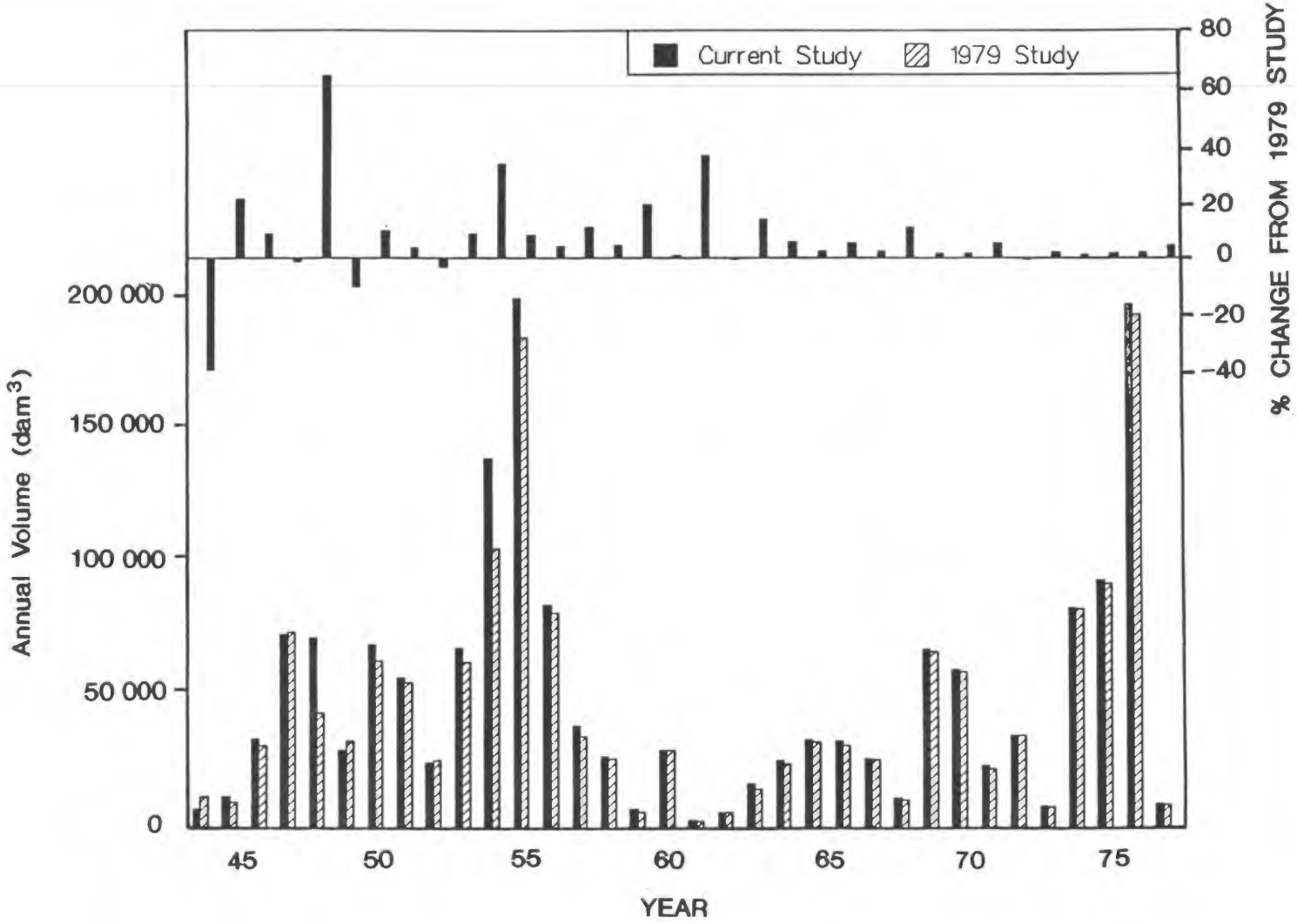
LEGEND

Pipestone Gross Drainage Boundary

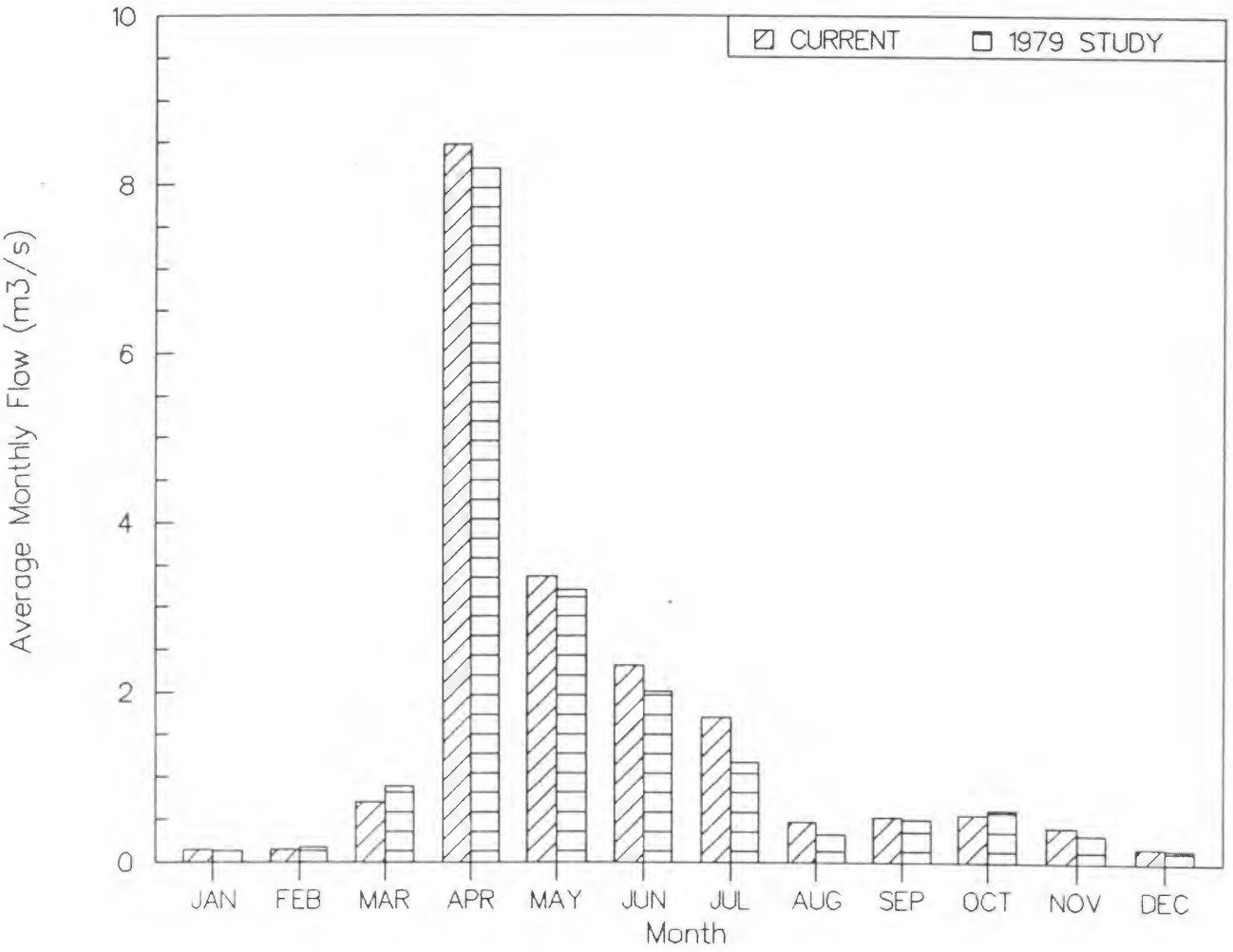
Sub-basin Gross Drainage Boundary

Sub-basin Effective Drainage Boundary

Designed	SASKATCHEWAN WATER CORPORATION	Date Oct. 20, 1989
Drawn D. F.	LOCATION MAP OF GRENFELL DIVERSION DRAINAGE AREA	Sheet 4 of 6
Recm'd		PLAN No. H1-6 (1)
Approved		FIGURE 4



Designed Drawn Recm'd Approved	SASKATCHEWAN WATER CORPORATION **COMPARISON OF PIPESTONE CREEK ANNUAL NATURAL FLOW VOLUMES 1944 – 1977**	Date **Feb. 6, 1992** Sheet **5** of **6** PLAN No. **H1-6 (1)** FIGURE **5**



Designed	SASKATCHEWAN WATER CORPORATION	Date Feb. 6, 1992
Drawn	**PIPESTONE CREEK**	Sheet 6 of 6
Recm'd	**AVERAGE MONTHLY FLOWS**	PLAN No. H1-6 (1)
Approved	**1944 - 1977**	FIGURE 6

APPENDIX A

WATER USE

LIST OF TABLES

Table A-1

MOOSOMIN RESERVOIR

NET EVAPORATION - mm

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	-85.3	-33.0	-71.2	63.8	49.9	47.5	138.7	97.9	97.0	37.5	-21.5	-0.5	321.
1944	-6.4	-14.7	-15.7	35.2	94.7	-73.2	116.9	70.6	76.4	62.5	-6.3	-4.6	335.
1945	-17.0	-14.0	-31.3	36.1	103.2	36.1	136.5	158.6	70.1	49.4	-30.5	-10.1	487.
1946	-18.7	-12.3	-35.9	62.0	98.8	97.8	18.1	108.2	62.4	3.3	-5.1	-2.0	377.
1947	-5.1	-45.9	-3.9	32.7	116.0	-161.6	150.0	64.9	60.6	58.3	-62.8	-22.4	181.
1948	-12.3	-5.0	-12.2	-16.1	60.6	67.1	59.7	97.3	124.9	40.4	-22.8	-53.2	328.
1949	-7.5	-8.0	-41.7	54.4	90.2	21.1	9.7	102.2	104.0	17.1	-13.1	-45.8	283.
1950	-56.2	-10.5	-11.5	-1.9	46.0	67.2	-34.7	46.6	73.2	54.7	-29.5	-48.1	95.
1951	-30.5	-41.9	-52.0	1.5	132.3	81.3	114.9	76.4	35.5	11.8	-15.1	-16.4	298.
1952	-40.5	-2.5	-8.1	50.5	127.0	39.8	133.4	12.9	93.7	70.1	-11.4	-5.6	459.
1953	-28.0	-12.9	-72.6	20.6	24.0	-48.0	80.3	128.6	93.8	13.9	-8.6	-34.3	157.
1954	-31.8	-5.6	-5.1	14.6	87.4	-66.1	86.2	92.5	-13.9	46.8	-16.3	0.0	189.
1955	-54.6	-16.4	-41.6	-3.8	21.4	72.8	41.0	149.0	87.4	43.1	-72.8	-32.8	193.
1956	-44.4	-26.7	-70.0	40.5	86.9	104.3	38.6	115.4	102.0	34.9	-34.7	-54.5	292.
1957	-6.4	-5.2	-19.1	27.8	115.8	78.7	156.4	79.2	105.7	22.1	-26.4	-7.6	521.
1958	-7.9	-25.5	-10.0	61.9	175.6	157.8	127.7	158.9	111.6	51.7	-67.5	-8.9	725.
1959	0.0	-2.5	-17.5	67.5	138.7	129.3	162.8	146.4	53.2	-32.9	-15.2	-17.7	612.
1960	-12.6	0.0	-27.4	38.4	81.3	124.4	190.7	138.8	150.8	65.5	-16.5	-13.6	720.
1961	-17.7	-40.7	-6.3	51.4	114.4	219.4	210.9	266.4	69.5	56.6	-7.0	-12.7	904.
1962	-38.0	-40.6	-12.7	44.2	26.6	89.5	101.4	96.6	129.9	10.4	-6.1	-24.9	376.
1963	-12.6	-16.4	-5.9	2.5	60.3	35.7	65.9	74.5	112.4	79.1	-2.8	-25.8	367.
1964	-12.6	-15.0	-35.5	47.2	87.1	70.2	133.1	140.7	105.6	66.1	-12.7	-17.8	556.
1965	-16.4	-20.2	-12.7	16.8	68.2	122.6	101.2	137.7	-69.6	73.5	-27.9	-20.3	353.
1966	-20.3	-12.7	-15.8	15.5	124.5	102.7	103.0	25.9	93.5	51.8	-12.6	-15.2	440.
1967	-43.2	-15.2	-38.2	-1.7	131.6	147.4	181.1	192.4	118.3	10.3	-26.3	-29.5	627.
1968	-40.8	-5.0	-3.9	57.4	110.9	153.8	155.8	41.4	100.3	12.1	-15.0	-27.9	539.
1969	-66.0	-45.7	-23.1	-10.7	122.1	90.0	9.4	164.8	69.4	16.7	-3.8	-30.4	293.
1970	-22.8	-29.2	-33.1	-17.0	78.0	131.8	28.1	166.2	22.2	-14.0	-12.6	-30.4	267.
1971	-22.8	-2.5	-25.3	16.8	143.3	-14.0	137.0	163.1	77.6	-3.6	-29.8	-8.9	431.
1972	-19.4	-33.8	-20.0	52.4	73.4	130.3	95.2	48.3	101.9	52.6	-8.0	-9.4	464.
1973	0.0	-14.8	-6.4	12.2	83.5	56.4	126.5	142.0	-26.6	18.0	-19.3	-38.5	333.
1974	-41.0	-18.7	-40.6	4.7	26.5	151.9	161.3	81.9	85.2	35.9	-3.3	-38.1	406.
1975	-18.9	-34.0	-53.6	-34.5	86.8	5.7	162.0	4.3	-41.8	11.1	-19.4	-41.9	26.
1976	-41.1	-54.0	-60.0	30.1	138.3	-10.4	154.8	121.5	136.8	64.3	-1.3	-23.7	455.
1977	-5.4	-6.5	-8.4	70.8	59.6	95.6	56.2	116.6	16.8	63.5	-20.4	-28.9	410.
1978	-6.8	-8.0	-10.6	38.8	69.0	48.2	44.8	135.7	64.8	40.4	-41.0	-23.5	352.
1979	-37.1	-27.8	-34.8	-5.5	31.8	162.9	149.9	141.5	61.7	28.5	-11.2	-19.8	440.
1980	-31.2	-14.1	-12.8	75.7	167.3	115.3	37.5	8.2	61.0	39.0	-0.2	-11.1	435.
1981	-18.8	-15.8	-25.1	33.6	94.2	66.2	162.5	67.0	95.9	-7.0	-4.8	-7.6	440.
1982	-10.2	-9.6	-25.8	40.8	79.4	144.9	118.1	109.8	73.0	-20.3	-2.4	-14.0	484.
1983	-14.9	-16.0	-42.2	43.1	79.6	153.1	105.1	215.7	102.3	42.8	-19.4	-14.9	634.
1984	-7.8	-8.2	-43.6	37.2	139.6	121.7	236.7	217.6	51.6	25.8	-35.4	-5.8	729.
1985	-13.6	-10.0	-5.4	52.0	120.3	79.7	185.6	13.0	2.0	61.0	-12.0	-6.2	466.
1986	-14.2	-12.4	-5.6	40.4	107.2	20.9	68.5	168.3	52.4	35.9	-4.2	-10.0	447.
1987	-4.2	-13.6	-30.8	77.9	137.1	103.0	73.2	144.6	91.3	63.0	-2.4	-3.8	635.
1988	-10.4	-5.0	-27.2	59.1	55.1	190.5	198.6	168.8	87.6	62.2	-33.0	-9.2	737.
MIN	-85.3	-54.0	-72.6	-34.5	21.4	-161.6	-34.7	4.3	-69.6	-32.9	-72.8	-54.5	26.
MAX	0.0	0.0	-3.9	77.9	175.6	219.4	236.7	266.4	150.8	79.1	-0.2	0.0	904.
MEAN	-23.3	-18.0	-26.4	31.2	92.7	77.4	110.7	113.5	72.5	35.3	-18.9	-20.2	427.

Table A-2

MOOSOMIN RESERVOIR

FIRST-OF-MONTH WATER LEVELS - m

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1955	---	---	---	44.324	44.339	44.355	44.187	43.968	43.725	43.750	43.775	43.800
1956	43.825	43.850	43.875	43.888	44.202	44.019	44.036	44.053	44.069	44.086	44.103	44.120
1957	44.137	44.153	44.170	44.187	44.077	43.908	43.899	43.885	43.956	42.530	42.138	42.636
1958	42.719	42.660	42.611	44.214	43.925	43.958	43.931	43.872	43.792	43.635	43.475	43.425
1959	43.388	43.249	43.162	43.382	43.771	43.792	43.849	43.801	43.754	43.706	43.659	43.611
1960	43.563	43.516	43.468	44.050	43.974	44.199	44.101	44.009	43.946	43.866	43.366	43.365
1961	43.364	43.363	43.362	43.361	42.964	42.608	42.513	42.466	42.343	42.395	42.242	42.215
1962	42.188	42.160	42.133	42.560	42.746	42.879	42.879	42.862	42.849	42.776	42.806	42.886
1963	42.966	43.046	43.126	44.224	44.208	44.318	44.352	44.266	44.319	44.198	43.922	43.909
1964	43.895	43.882	43.868	43.855	44.123	44.251	44.284	44.252	44.190	44.142	44.007	43.986
1965	43.965	43.943	43.922	43.901	44.199	44.385	44.318	44.288	44.214	44.154	43.951	43.861
1966	43.892	43.923	43.950	44.306	44.020	44.352	44.285	44.280	44.326	44.022	43.901	43.964
1967	44.042	44.121	44.191	44.270	44.067	44.084	44.044	43.990	43.837	43.625	43.712	43.770
1968	43.828	43.885	43.943	44.001	43.916	43.916	43.884	43.867	43.863	43.794	43.830	43.898
1969	43.968	44.038	44.102	44.172	44.083	44.325	44.315	44.346	44.265	44.245	44.093	44.064
1970	44.035	44.007	43.978	43.949	44.498	44.518	44.426	44.474	44.315	44.095	43.962	43.948
1971	43.934	43.919	43.905	44.092	44.026	44.253	44.407	44.317	44.187	43.966	43.935	44.017
1972	44.099	44.180	44.262	44.046	44.025	44.227	44.177	44.364	44.339	44.081	43.934	43.920
1973	43.907	43.893	43.879	43.948	43.959	44.119	44.222	44.181	44.161	44.056	43.901	43.898
1974	43.896	43.893	43.885	43.791	44.227	44.120	44.257	44.123	44.068	43.983	43.760	43.647
1975	43.540	43.434	43.338	43.284	44.751	44.294	44.123	44.169	44.303	44.339	44.291	44.243
1976	44.193	44.143	44.096	43.901	44.269	44.440	44.440	44.278	44.449	44.205	43.974	43.963
1977	43.952	43.941	43.931	43.952	43.946	44.257	44.208	44.184	44.142	43.958	43.928	43.928
1978	43.928	43.928	43.928	43.986	44.035	44.355	44.321	44.288	44.157	44.077	43.925	43.924
1979	43.922	43.920	43.919	43.927	44.272	44.297	44.409	44.255	44.135	44.012	43.838	43.845
1980	43.865	43.886	43.908	43.908	44.315	44.234	44.092	44.058	44.108	44.094	44.020	43.970
1981	43.989	44.008	43.997	43.962	43.934	43.935	43.898	43.791	43.798	43.747	43.739	43.723
1982	43.771	43.820	43.865	43.961	44.471	44.400	44.289	44.460	44.299	44.264	44.174	44.168
1983	44.167	44.166	44.165	44.227	44.172	44.459	44.393	44.332	44.069	43.861	43.884	43.838
1984	43.792	43.745	43.699	43.863	43.958	43.945	43.906	43.767	43.436	43.370	43.386	43.451
1985	43.518	43.585	43.644	44.122	44.512	44.406	44.352	44.201	44.412	44.426	44.414	44.373
1986	44.309	44.219	44.130	44.205	44.624	44.567	44.535	44.488	44.355	44.331	43.993	43.833
1987	43.893	43.953	43.996	44.050	44.366	44.374	44.286	44.232	44.135	43.963	43.820	43.856
1988	43.892	43.928	43.965	43.952	43.945	44.226	44.054	43.927	43.839	43.680	43.589	------
MIN	42.188	42.160	42.133	42.560	42.746	42.608	42.513	42.466	42.343	42.395	42.138	42.215
MAX	44.309	44.219	44.262	44.324	44.751	44.567	44.535	44.488	44.449	44.426	44.414	44.373
MEAN	43.768	43.768	43.769	43.936	44.086	44.140	44.108	44.062	44.005	43.866	43.748	43.759

ADD 500.000 m TO GET GEODETIC SURVEY OF CANADA DATUM

Table A-3

MOOSOMIN RESERVOIR

MONTHLY AVERAGE WATER LEVELS - m

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1955	----	----	----	44.421	44.542	44.302	44.127	43.796	43.738	43.763	43.788	43.813
1956	43.838	43.863	43.882	44.185	44.136	44.028	44.045	44.061	44.078	44.095	44.112	44.129
1957	44.145	44.162	44.179	44.075	43.929	43.906	43.893	43.917	43.504	42.036	42.409	42.679
1958	42.691	42.636	43.291	44.079	43.954	43.957	43.912	43.828	43.697	43.531	43.426	43.429
1959	43.325	43.192	43.210	43.577	43.792	43.786	43.825	43.778	43.730	43.683	43.635	43.587
1960	43.540	43.492	43.759	44.124	44.095	44.140	44.077	44.002	43.889	43.620	43.366	43.365
1961	43.364	43.363	43.362	43.163	42.752	42.570	42.498	42.399	42.376	42.390	42.229	42.202
1962	42.174	42.147	42.340	42.667	42.791	42.891	42.882	42.859	42.804	42.791	42.846	42.926
1963	43.006	43.086	43.616	44.236	44.277	44.360	44.327	44.286	44.276	44.064	43.916	43.902
1964	43.889	43.875	43.862	44.030	44.312	44.271	44.285	44.225	44.162	44.067	43.997	43.976
1965	43.954	43.933	43.912	44.076	44.307	44.361	44.300	44.239	44.199	44.053	43.873	43.877
1966	43.858	43.937	43.938	44.056	44.200	44.299	44.258	44.321	44.229	43.928	43.929	44.003
1967	44.082	44.156	44.231	44.171	44.026	44.056	43.998	43.903	43.712	43.677	43.737	43.799
1968	43.857	43.914	44.004	43.939	43.924	43.903	43.873	43.839	43.825	43.795	43.864	43.933
1969	44.003	44.070	44.137	44.281	44.326	44.298	44.427	44.311	44.248	44.233	44.079	44.050
1970	44.021	43.993	43.964	44.184	44.312	44.473	44.439	44.409	44.229	44.031	43.955	43.941
1971	43.927	43.912	43.963	44.138	44.167	44.329	44.372	44.251	44.080	43.940	43.969	44.053
1972	44.139	44.223	44.260	44.107	44.183	44.190	44.273	44.370	44.215	43.982	43.927	43.914
1973	43.900	43.886	43.890	43.943	44.026	44.207	44.204	44.154	44.128	44.020	43.900	43.897
1974	43.895	43.891	43.843	44.058	44.143	44.197	44.201	44.081	44.056	43.875	43.698	43.594
1975	43.487	43.386	43.298	43.733	44.253	44.283	44.174	44.168	44.338	44.309	44.267	44.218
1976	44.168	44.120	44.074	44.742	44.181	44.488	44.278	44.335	44.251	44.023	43.969	43.958
1977	43.947	43.936	43.939	43.972	44.144	44.234	44.189	44.168	44.034	43.936	43.928	43.928
1978	43.928	43.928	43.936	44.073	44.255	44.324	44.317	44.232	44.091	43.946	43.925	43.923
1979	43.921	43.920	43.922	44.121	44.136	44.420	44.333	44.194	44.111	43.889	43.836	43.855
1980	43.876	43.897	43.908	44.108	44.285	44.175	44.059	44.117	44.089	44.073	43.968	43.980
1981	43.999	44.016	43.958	43.937	43.930	43.936	43.838	43.800	43.761	43.725	43.738	43.747
1982	43.796	43.843	43.896	44.203	44.440	44.344	44.293	44.369	44.270	44.188	44.169	44.168
1983	44.167	44.166	44.210	44.295	44.349	44.430	44.379	44.239	43.896	43.880	43.861	43.815
1984	43.769	43.722	43.741	43.916	43.964	43.923	43.833	43.683	43.362	43.357	43.419	43.485
1985	43.552	43.613	43.737	44.339	44.466	44.366	44.280	44.319	44.420	44.429	44.394	44.348
1986	44.263	44.177	44.397	44.468	44.657	44.549	44.526	44.431	44.318	44.209	43.826	43.863
1987	43.923	43.978	44.020	44.267	44.356	44.329	44.243	44.166	44.064	43.850	43.838	43.874
1988	43.910	43.936	43.955	43.938	44.136	44.142	44.003	43.890	43.769	43.615	------	------
MIN	42.174	42.147	42.340	42.667	42.752	42.570	42.498	42.399	42.376	42.036	42.229	42.202
MAX	44.263	44.223	44.397	44.742	44.657	44.549	44.526	44.431	44.420	44.429	44.394	44.348
MEAN	43.767	43.769	43.837	44.048	44.110	44.131	44.087	44.034	43.940	43.794	43.751	43.765

Add 500.000 m to get Geodetic Survey of Canada Datum

Table A-4

MOOSOMIN RESERVOIR

NET EVAPORATION - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1955	---	---	---	-16.2	93.0	304.2	166.1	568.5	330.2	163.5	-277.4	-125.5	----
1956	-170.6	-103.0	-271.0	165.8	352.6	414.9	154.0	461.9	409.5	140.6	-140.2	-220.9	1194.
1957	-26.0	-21.2	-78.1	111.5	452.1	305.9	606.7	308.5	381.6	54.9	-72.7	-22.6	2001.
1958	-23.5	-74.9	-34.5	248.6	688.8	619.4	496.9	609.6	418.6	187.7	-239.7	-31.6	2865.
1959	0.0	-8.4	-59.3	247.4	528.8	492.5	624.2	556.9	200.7	-123.1	-56.4	-65.0	2338.
1960	-45.8	0.0	-103.9	155.5	327.4	505.2	765.5	549.4	584.5	242.2	-57.8	-47.7	2875.
1961	-62.0	-142.6	-22.1	172.3	346.5	632.4	595.7	732.0	189.8	155.1	-18.4	-33.1	2546.
1962	-98.2	-104.2	-34.4	130.8	81.4	281.1	317.7	300.9	398.8	31.8	-18.9	-78.9	1208.
1963	-40.7	-54.0	-21.8	10.3	251.0	150.6	276.5	310.5	467.7	316.7	-10.9	-100.2	1556.
1964	-48.8	-58.0	-137.0	187.8	364.6	291.9	554.7	580.2	430.6	264.8	-50.2	-70.1	2311.
1965	-64.3	-78.9	-49.4	67.4	285.2	517.3	422.8	569.3	-285.7	293.7	-107.9	-78.5	1491.
1966	-78.3	-49.7	-61.8	62.0	511.1	429.0	427.3	108.6	385.9	202.2	-49.2	-60.2	1827.
1967	-173.6	-61.9	-157.7	-6.9	523.3	589.4	716.3	747.6	444.9	38.5	-99.3	-112.6	2448.
1968	-157.3	-19.5	-15.4	224.5	432.6	597.6	602.3	159.1	384.6	46.2	-57.9	-109.0	2088.
1969	-261.3	-183.2	-93.8	-44.6	512.3	375.9	40.1	689.7	287.4	69.0	-15.3	-121.4	1255.
1970	-90.6	-115.4	-130.1	-69.6	326.5	566.3	120.1	706.8	91.6	-55.7	-49.4	-119.0	1182.
1971	-89.0	-9.7	-99.4	68.2	584.8	-58.8	579.1	675.8	311.7	-14.1	-117.2	-35.6	1796.
1972	-78.8	-139.3	-83.0	211.5	300.4	534.0	395.9	204.1	419.5	207.4	-31.2	-36.6	1904.
1973	0.0	-57.3	-24.8	47.8	332.0	231.8	519.7	578.1	-107.8	71.5	-75.0	-149.4	1367.
1974	-159.1	-72.5	-156.2	18.8	107.7	623.3	662.3	329.0	340.7	138.8	-12.4	-140.1	1680.
1975	-68.0	-119.7	-185.2	-130.2	359.8	23.7	662.0	17.6	-175.7	46.4	-80.6	-172.6	177.
1976	-167.8	-218.5	-240.7	134.9	565.8	-44.8	644.3	510.5	566.8	255.5	-5.1	-93.0	1908.
1977	-21.2	-25.4	-32.9	278.7	242.2	394.9	230.3	475.9	66.9	248.2	-79.6	-112.8	1665.
1978	-26.5	-31.2	-41.4	155.6	286.1	202.2	187.7	560.3	260.8	158.2	-159.9	-91.6	1460.
1979	-144.6	-108.3	-135.7	-22.3	129.0	694.0	629.6	580.3	249.2	110.5	-43.0	-76.3	1862.
1980	-120.7	-54.7	-49.8	305.6	697.2	471.2	150.0	33.2	245.4	156.4	-0.8	-43.8	1789.
1981	-74.4	-62.7	-98.5	131.4	367.8	258.8	624.5	255.8	363.7	-26.4	-18.1	-28.8	1693.
1982	-38.9	-36.9	-100.1	167.6	339.4	609.7	492.8	463.9	303.5	-83.2	-9.8	-57.1	2051.
1983	-60.8	-65.3	-173.6	179.9	335.2	653.3	444.8	891.8	397.0	165.7	-74.8	-57.0	2636.
1984	-29.6	-30.9	-164.8	144.9	548.6	474.6	908.8	814.2	180.7	90.3	-125.5	-20.9	2790.
1985	-49.6	-36.9	-20.4	218.6	516.3	336.6	772.8	54.5	8.5	260.2	-50.9	-26.1	1984.
1986	-59.0	-50.7	-23.8	173.4	474.2	90.9	296.8	718.3	219.6	147.6	-16.1	-38.6	1933.
1987	-16.4	-53.6	-122.3	323.7	578.0	432.3	302.9	590.0	365.6	242.6	-9.2	-14.7	2619.
1988	-40.5	-19.5	-106.7	231.1	223.6	773.9	786.3	654.4	332.7	229.7	----	----	----
MIN	-261.3	-218.5	-271.0	-130.2	81.4	-58.8	40.1	17.6	-285.7	-123.1	-277.4	-220.9	177.
MAX	0.0	0.0	-15.4	323.7	697.2	773.9	908.8	891.8	584.5	316.7	-0.8	-14.7	2875.
MEAN	-78.4	-68.7	-94.8	126.1	384.3	405.2	475.8	481.4	278.5	130.4	-67.6	-78.5	1890.

Table A-5

PIPESTONE LAKE

NET EVAPORATION - mm

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	-32.9	-31.7	-36.7	51.1	76.8	21.6	98.9	49.9	87.8	24.5	-22.4	-1.9	285.0
1944	-3.3	-13.2	-22.2	12.4	53.7	-43.2	97.7	30.1	76.3	56.3	-8.4	-13.3	222.9
1945	-11.4	-8.3	-33.1	17.4	86.3	-24.8	132.3	137.7	30.4	25.6	-18.2	-8.5	325.4
1946	-14.4	-17.1	-10.9	40.8	93.3	90.1	79.9	78.1	33.1	17.4	-36.0	-7.3	347.0
1947	-32.8	-15.7	-7.8	19.4	95.7	-56.4	138.2	38.6	31.2	50.3	-51.3	-20.0	189.4
1948	-23.3	-7.5	-10.6	4.9	72.5	93.3	106.6	62.6	105.1	39.1	-35.6	-40.6	366.5
1949	-1.6	-6.5	-15.9	45.1	61.6	88.0	14.7	89.6	86.5	23.8	-30.3	-18.8	336.2
1950	-17.0	-4.8	-20.4	32.8	55.3	48.0	38.9	109.3	66.2	35.7	-14.9	-17.1	312.0
1951	-19.6	-33.6	-12.0	27.7	114.9	-1.9	141.1	59.9	9.4	-1.8	-29.9	-19.6	234.6
1952	-20.4	-2.1	-8.3	44.0	96.8	5.2	92.2	8.4	63.9	54.8	-10.2	-5.9	318.4
1953	-18.8	-13.5	-40.5	13.0	17.0	-73.3	58.7	102.1	71.4	4.0	-9.4	-14.1	96.6
1954	-27.6	-12.3	-9.8	16.0	47.1	-106.4	18.6	62.2	-28.3	42.4	-8.4	-5.6	-12.1
1955	-34.0	-10.8	-63.0	7.6	-8.5	50.5	90.8	132.3	67.0	33.0	-45.6	-22.7	196.6
1956	-29.1	-20.9	-44.8	26.5	74.7	55.5	23.8	119.3	96.7	18.7	-31.9	-40.4	248.1
1957	-8.8	-8.1	-18.7	21.1	120.6	70.2	107.2	51.5	100.1	19.0	-26.4	-6.5	421.2
1958	-14.0	-22.9	-17.5	57.7	152.2	143.6	122.9	133.4	95.5	47.2	-50.3	-21.8	626.0
1959	-4.3	-6.9	-8.4	53.9	115.7	56.1	179.8	180.5	0.6	-14.9	-23.1	-26.4	502.6
1960	-13.7	-4.8	-15.5	27.0	77.1	110.8	171.4	129.4	133.6	62.9	-19.3	-10.2	648.7
1961	-18.0	-16.3	-6.4	47.3	126.4	196.4	203.3	236.6	70.4	48.4	-6.9	-16.8	864.4
1962	-32.0	-18.5	-19.8	41.4	44.7	87.1	101.3	118.8	115.0	21.5	-19.3	-24.1	416.1
1963	-14.0	-15.2	-15.5	10.0	30.7	37.2	60.0	68.4	59.5	70.5	-5.1	-19.1	267.4
1964	-10.7	-17.5	-34.8	44.8	69.7	69.4	117.6	88.5	84.4	60.5	-17.0	-28.2	426.7
1965	-11.9	-15.5	-7.1	10.9	58.9	71.0	121.4	102.1	-47.3	65.3	-25.1	-19.1	303.6
1966	-13.2	-8.6	-8.9	-1.7	119.5	95.2	99.5	50.8	99.9	49.5	-26.2	-8.9	446.9
1967	-33.3	-4.6	-28.4	26.3	112.0	138.0	165.4	154.7	91.9	-12.6	-24.9	-22.4	562.1
1968	-21.3	-2.8	-8.1	58.9	89.6	136.8	143.5	28.0	77.6	7.8	-11.9	-18.8	479.3
1969	-35.3	-19.3	-15.7	25.9	97.6	60.1	73.5	124.2	75.5	-8.3	-4.3	-10.9	363.0
1970	-13.5	-23.1	-20.6	-42.4	63.4	138.7	72.9	152.7	45.1	-12.6	-9.9	-20.1	330.6
1971	-11.9	-5.1	-17.8	29.6	134.1	10.4	100.7	124.9	86.2	3.0	-11.9	-10.7	431.5
1972	-17.0	-21.6	-20.8	40.4	64.5	130.9	100.4	100.7	93.5	48.7	-11.9	-14.0	493.8
1973	-0.8	-9.9	-11.9	19.3	86.5	34.0	121.5	138.8	-9.9	54.9	-18.5	-27.7	376.3
1974	-25.4	-9.9	-21.3	9.0	14.6	129.2	153.6	26.4	73.9	44.6	-1.5	-19.6	373.6
1975	-17.0	-13.7	-22.4	-65.3	95.8	37.5	155.7	26.5	-7.3	40.7	-11.9	-25.9	192.7
1976	-32.8	-22.4	-29.7	16.5	122.4	-7.8	134.1	131.6	122.0	53.9	-2.0	-31.2	454.6
1977	-4.9	-7.6	-7.7	54.5	15.6	52.0	69.0	99.7	7.0	50.5	-15.2	-33.4	279.5
1978	-7.5	-4.8	-7.4	21.0	56.5	110.1	62.6	78.8	59.1	24.4	-31.0	-25.3	336.5
1979	-8.5	-15.8	-16.7	5.3	66.9	152.0	136.3	138.6	58.3	12.5	-8.0	-19.0	501.9
1980	-22.3	-14.4	-11.0	67.0	150.4	121.7	62.7	16.0	66.8	52.4	-4.6	-11.3	473.4
1981	-14.8	-12.0	-18.4	45.8	99.1	63.5	148.2	93.0	69.2	3.6	-8.2	-19.7	449.3
1982	-17.7	-8.0	-13.2	44.3	70.3	121.1	95.9	109.0	50.7	44.9	-4.6	-31.0	461.7
1983	-10.2	-10.2	-54.6	30.6	55.7	141.4	117.6	195.1	90.6	41.0	-22.0	-8.9	566.1
1984	-7.1	-4.2	-24.4	42.8	112.3	110.9	175.1	208.2	17.4	-1.1	-33.0	-18.0	578.9
1985	-15.6	-10.6	-3.8	47.7	102.7	61.7	156.8	-13.2	-19.4	48.1	-25.1	-11.8	317.5
1986	-17.8	-13.0	-16.3	32.2	81.5	92.4	36.8	144.0	51.1	35.0	-9.6	-10.6	405.7
1987	-7.6	-17.2	-37.0	59.7	135.2	74.0	26.1	133.6	47.0	56.3	-7.0	-5.4	457.7
1988	-16.0	-9.0	-30.8	50.5	17.9	144.8	174.4	146.6	104.1	55.8	-14.6	-15.1	608.6
MIN	-35.3	-33.6	-63.0	-65.3	-8.5	-106.4	14.7	-13.2	-47.3	-14.9	-51.3	-40.6	-12.1
MAX	-0.8	-2.1	-3.8	67.0	152.2	196.4	203.3	236.6	133.6	70.5	-1.5	-1.9	864.4
MEAN	-17.1	-12.9	-20.1	28.1	80.4	68.2	106.5	100.0	60.0	32.5	-18.8	-18.0	388.8

Table A-6

PIPESTONE LAKE

HISTORIC NET DEPLETION - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	-47.6	39.8	40.3	11.3	51.9	13.8	0.0	0.0	0.0	0.0	110.
1944	0.0	0.0	46.0	19.5	28.2	-22.7	51.3	15.8	0.0	0.0	0.0	0.0	138.
1945	0.0	0.0	33.9	22.1	45.3	-13.0	69.5	0.0	0.0	0.0	0.0	0.0	158.
1946	0.0	0.0	0.0	99.8	49.0	47.1	42.1	0.0	0.0	68.3	0.0	0.0	306.
1947	0.0	0.0	-45.5	23.2	50.3	-29.6	72.6	20.3	16.4	26.4	0.0	0.0	134.
1948	0.0	0.0	-51.7	0.0	40.8	49.0	56.0	32.9	0.0	0.0	0.0	0.0	127.
1949	0.0	0.0	28.0	42.7	32.3	46.2	7.7	47.1	0.0	1.4	0.0	0.0	205.
1950	0.0	0.0	19.5	36.2	29.0	25.2	20.4	57.4	34.8	18.7	0.0	0.0	241.
1951	0.0	0.0	-44.6	33.5	60.3	-1.0	74.1	31.5	4.9	-0.9	0.0	0.0	158.
1952	0.0	0.0	-36.6	42.1	50.8	2.7	48.4	4.4	33.6	0.9	0.0	0.0	146.
1953	0.0	0.0	-12.5	22.8	8.9	-38.5	30.8	53.6	0.0	39.6	0.0	0.0	105.
1954	0.0	0.0	-33.4	24.4	24.7	-55.9	9.8	32.7	-14.9	22.3	0.0	0.0	10.
1955	0.0	0.0	-58.4	20.0	-4.5	26.5	47.7	69.5	35.2	17.3	0.0	0.0	153.
1956	0.0	0.0	-76.1	29.9	39.2	29.1	12.5	62.7	50.8	9.8	0.0	0.0	158.
1957	0.0	0.0	-49.8	27.1	63.3	36.9	56.3	27.0	52.6	10.0	0.0	0.0	223.
1958	0.0	0.0	-53.0	16.9	75.1	0.0	0.0	0.0	0.0	163.7	0.0	0.0	203.
1959	0.0	0.0	91.3	74.0	0.0	49.9	0.0	0.0	0.0	0.0	0.0	0.0	215.
1960	0.0	0.0	29.4	454.7	35.9	55.1	0.0	0.0	0.0	0.0	0.0	0.0	575.
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1963	0.0	0.0	167.0	235.5	50.3	481.8	291.6	158.8	0.0	0.0	0.0	0.0	1385.
1964	0.0	0.0	0.0	474.4	87.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	562.
1965	0.0	0.0	0.0	450.6	27.2	31.5	57.7	0.0	31.3	32.2	0.0	0.0	631.
1966	0.0	0.0	1.2	205.2	53.6	47.2	50.1	20.2	0.0	10.3	0.0	0.0	388.
1967	0.0	0.0	30.7	247.8	48.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	327.
1968	0.0	0.0	252.1	143.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	395.
1969	0.0	0.0	-27.4	244.9	40.7	12.2	47.9	0.0	0.0	0.0	0.0	0.0	318.
1970	0.0	0.0	0.0	287.0	11.6	61.4	32.8	0.0	0.0	0.0	0.0	0.0	393.
1971	0.0	0.0	0.0	306.6	52.5	1.2	43.9	0.0	0.0	0.0	0.0	0.0	404.
1972	0.0	0.0	279.2	-2002.6	24.1	58.0	44.5	0.0	0.0	0.0	0.0	0.0	-1597.
1973	0.0	0.0	0.0	55.4	95.7	123.9	0.0	0.0	0.0	0.0	0.0	0.0	275.
1974	0.0	0.0	133.6	-4975.7	-990.5	55.3	70.0	12.0	33.7	20.1	0.0	0.0	-5642.
1975	0.0	0.0	-14.3	-4985.3	-5370.6	-1379.4	70.8	11.4	-13.5	12.5	0.0	0.0	-11668.
1976	0.0	0.0	-34.7	-4959.5	-5346.6	-5233.0	-2691.4	48.9	54.9	24.0	0.0	0.0	-18137.
1977	0.0	0.0	-5.9	119.9	40.2	7.1	0.0	0.0	102.4	55.6	0.0	0.0	319.
1978	0.0	0.0	-6.9	266.0	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	281.
1979	0.0	0.0	134.5	-4424.2	11.1	65.7	49.2	0.0	0.0	107.2	0.0	0.0	-4056.
1980	0.0	0.0	-23.5	237.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	214.
1981	0.0	0.0	255.0	77.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	333.
1982	0.0	0.0	45.8	171.5	46.5	0.0	132.2	0.0	0.0	83.6	0.0	0.0	480.
1983	0.0	0.0	-28.2	-2684.9	32.1	81.2	12.3	0.0	0.0	20.8	0.0	0.0	-2567.
1984	0.0	0.0	174.6	88.1	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	269.
1985	0.0	0.0	469.7	-4464.8	62.0	46.3	0.0	81.6	-9.9	20.2	0.0	0.0	-3795.
1986	0.0	0.0	190.0	-1678.9	44.3	59.5	33.7	0.0	0.0	79.5	0.0	0.0	-1272.
1987	0.0	0.0	69.2	59.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
MIN	0.0	0.0	-76.1	-4985.3	-5370.6	-5233.0	-2691.4	0.0	-14.9	-0.9	0.0	0.0	-18137.
MAX	0.0	0.0	469.7	474.4	95.7	481.8	291.6	158.8	102.4	163.7	0.0	0.0	1385.
MEAN	0.0	0.0	39.1	-553.8	-223.6	-114.4	-24.0	17.4	9.0	18.3	0.0	0.0	-832.

Table A-7

GRENFELL DIVERSION

ESTIMATED DIVERSIONS - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1959	0.0	0.0	20.5	35.1	11.9	14.9	9.4	12.6	9.3	0.0	0.0	0.0	114.
1960	0.0	0.0	1.2	251.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1961	0.0	0.0	0.0	2.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.
1962	0.0	0.0	0.0	10.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.
1963	0.0	0.0	92.3	29.3	9.7	62.0	42.1	17.5	0.0	0.0	0.0	0.0	253.
1964	0.0	0.0	0.0	171.4	60.3	0.4	0.8	0.0	0.0	0.2	0.0	0.0	233.
1965	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1966	0.0	0.0	38.8	214.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1967	0.0	0.0	1.2	251.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1968	0.0	0.0	70.8	24.3	5.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	102.
1969	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1970	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1971	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1972	0.0	0.0	228.4	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1973	0.0	0.0	13.0	13.8	22.0	25.4	14.2	1.6	4.0	1.9	0.0	0.0	96.
1974	0.0	0.0	24.7	228.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1975	0.0	0.0	15.5	237.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1976	0.0	0.0	13.1	239.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1977	0.0	0.0	17.3	49.4	39.0	7.2	4.1	6.9	21.9	12.8	0.0	0.0	159.
1978	0.0	0.0	11.8	240.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1979	0.0	0.0	13.5	239.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1980	0.0	0.0	6.2	181.1	12.9	6.9	10.7	6.3	7.6	5.4	0.0	0.0	237.
1981	0.0	0.0	28.3	14.9	8.9	7.4	6.5	7.0	5.0	8.4	0.0	0.0	86.
1982	0.0	0.0	8.9	244.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1983	0.0	0.0	7.5	245.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1984	0.0	0.0	16.0	18.1	14.4	10.9	12.3	9.6	9.6	11.0	0.0	0.0	102.
1985	0.0	0.0	109.3	143.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1986	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1987	0.0	0.0	85.3	167.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1988	0.0	0.0	0.0	2.2	21.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.
MAX	0.0	0.0	253.0	253.0	60.3	62.0	42.1	17.5	21.9	12.8	0.0	0.0	253.
MEAN	0.0	0.0	35.9	143.1	6.9	4.6	3.3	2.1	1.9	1.3	0.0	0.0	199.

Table A-8

IRRIGATION PROJECT 14251

ESTIMATED DIVERSIONS - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1981	0.0	0.0	9.2	4.9	2.9	2.4	2.1	2.3	1.6	2.8	0.0	0.0	28.
1982	0.0	0.0	2.2	93.4	11.3	2.3	9.5	1.1	2.9	3.8	0.0	0.0	127.
1983	0.0	0.0	1.2	107.4	29.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1984	0.0	0.0	5.2	5.9	4.7	3.6	4.0	3.1	3.1	3.6	0.0	0.0	33.
1985	0.0	0.0	23.1	82.6	10.6	2.7	2.2	6.2	2.5	4.8	0.0	0.0	135.
1986	0.0	0.0	79.2	17.6	31.6	5.1	3.2	1.2	0.0	0.0	0.0	0.0	138.
1987	0.0	0.0	7.8	83.3	10.6	4.0	4.4	3.9	5.0	4.5	0.0	0.0	124.
1988	0.0	0.0	3.1	8.9	13.7	3.9	7.2	5.4	4.9	3.4	0.0	0.0	51.
MIN	0.0	0.0	1.2	4.9	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.
MAX	0.0	0.0	79.2	107.4	31.6	5.1	9.5	6.2	5.0	4.8	0.0	0.0	138.
MEAN	0.0	0.0	16.4	50.5	14.4	3.0	4.1	2.9	2.5	2.9	0.0	0.0	97.

Table A-9

SILVERWOOD DRAINAGE PROJECT

INCREMENTAL INCREASE IN STREAMFLOW - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1958	0.0	0.0	12.8	29.4	4.8	1.4	1.2	1.0	1.0	2.8	0.0	0.0	54.
1959	0.0	0.0	3.1	5.4	1.8	2.3	1.4	1.9	1.4	0.0	0.0	0.0	17.
1960	0.0	0.0	0.1	35.3	4.6	3.1	0.0	0.0	0.0	0.0	0.0	0.0	43.
1961	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1962	0.0	0.0	0.0	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.
1963	0.0	0.0	14.1	4.5	1.5	9.5	6.4	4.2	0.0	0.1	0.0	0.0	40.
1964	0.0	0.0	0.0	26.2	9.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	36.
1965	0.0	0.0	0.0	27.0	3.8	5.8	1.3	0.3	2.4	2.1	0.0	0.0	43.
1966	0.0	0.0	3.5	24.1	9.2	2.8	2.1	0.7	0.7	0.9	0.0	0.0	44.
1967	0.0	0.0	0.1	33.8	10.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	45.
1968	0.0	0.0	10.8	3.7	0.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0	16.
1969	0.0	0.0	0.0	36.0	4.2	0.3	1.0	0.0	0.0	0.0	0.0	0.0	42.
1970	0.0	0.0	0.0	20.4	17.5	2.4	0.7	0.4	0.0	0.0	0.0	0.0	41.
1971	0.0	0.0	0.0	29.9	9.3	3.6	2.4	0.0	0.0	0.0	0.0	0.0	45.
1972	0.0	0.0	16.4	16.7	5.6	2.3	1.7	0.3	0.0	0.0	0.0	0.0	43.
1973	0.0	0.0	2.0	2.1	3.4	3.9	2.2	0.2	0.6	0.3	0.0	0.0	15.
1974	0.0	0.0	0.7	36.1	15.2	4.2	0.7	0.2	0.3	0.4	0.0	0.0	58.
1975	0.0	0.0	0.4	20.7	13.7	4.6	0.9	0.8	10.1	6.2	0.0	0.0	57.
1976	0.0	0.0	0.1	35.0	2.0	4.4	0.1	0.7	1.3	0.8	0.0	0.0	44.
1977	0.0	0.0	2.6	7.6	6.0	1.1	0.6	1.1	3.4	2.0	0.0	0.0	24.
1978	0.0	0.0	1.8	36.8	5.4	0.7	0.6	1.7	1.8	1.1	0.0	0.0	50.
1979	0.0	0.0	0.6	29.2	19.7	4.2	0.9	0.5	0.4	1.0	0.0	0.0	57.
1980	0.0	0.0	0.9	27.7	2.0	1.1	1.6	1.0	1.2	0.8	0.0	0.0	36.
1981	0.0	0.0	4.3	2.3	1.4	1.1	1.0	1.1	0.8	1.3	0.0	0.0	13.
1982	0.0	0.0	0.9	40.0	4.8	1.0	4.1	0.5	1.2	1.6	0.0	0.0	54.
1983	0.0	0.0	0.4	37.4	12.5	2.8	0.8	0.8	0.8	0.5	0.0	0.0	56.
1984	0.0	0.0	2.5	2.8	2.2	1.7	1.9	1.5	1.5	1.7	0.0	0.0	16.
1985	0.0	0.0	9.4	33.5	4.3	1.1	0.9	2.5	1.0	2.0	0.0	0.0	55.
1986	0.0	0.0	30.5	6.8	12.2	2.0	1.2	0.7	0.6	1.1	0.0	0.0	55.
1987	0.0	0.0	8.5	35.7	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	45.
1988	0.0	0.0	0.0	0.3	3.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	4.
MIN	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
MAX	0.0	0.0	30.5	40.0	19.7	9.5	6.4	4.2	10.1	6.2	0.0	0.0	58.
MEAN	0.0	0.0	4.1	20.9	6.2	2.2	1.2	0.7	1.0	0.9	0.0	0.0	37.

Table A-10

HIGHWAY No. 8 DRAINAGE PROJECT

INCREMENTAL INCREASE IN STREAMFLOW - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1958	0.0	0.0	10.9	25.1	4.1	1.2	1.0	0.8	0.9	2.4	0.0	0.0	46.
1959	0.0	0.0	2.7	4.6	1.6	1.9	1.2	1.7	1.2	0.0	0.0	0.0	15.
1960	0.0	0.0	14.6	12.1	1.3	4.0	5.8	3.7	3.9	14.3	0.0	0.0	60.
1961	0.0	0.0	4.6	0.0	0.0	1.9	2.5	2.7	2.5	0.0	0.0	0.0	14.
1962	0.0	0.0	6.8	3.7	2.7	1.6	1.5	1.4	1.0	0.7	0.0	0.0	19.
1963	0.0	0.0	9.6	0.8	5.8	2.4	1.2	1.7	2.2	0.0	0.0	0.0	24.
1964	0.0	0.0	0.0	30.2	18.6	3.9	3.3	1.8	1.4	4.6	0.0	0.0	64.
1965	0.0	0.0	0.9	33.5	3.1	0.0	1.8	0.8	5.0	0.0	0.0	0.0	45.
1966	0.0	0.0	14.1	37.0	11.1	3.0	1.8	0.9	0.0	0.0	0.0	0.0	68.
1967	0.0	0.0	7.3	22.4	13.5	2.3	2.6	0.7	1.5	2.0	0.0	0.0	52.
1968	0.0	0.0	6.9	3.7	3.1	3.3	3.1	2.9	1.9	1.1	0.0	0.0	26.
1969	0.0	0.0	6.3	55.5	4.8	1.5	16.1	1.4	0.8	0.0	0.0	0.0	86.
1970	0.0	0.0	0.7	36.3	25.5	1.2	2.5	1.7	1.3	1.6	0.0	0.0	71.
1971	0.0	0.0	5.8	17.7	0.2	1.6	5.0	1.9	0.4	1.2	0.0	0.0	34.
1972	0.0	0.0	18.6	26.5	2.3	1.9	3.7	2.0	0.8	3.0	0.0	0.0	59.
1973	0.0	0.0	1.8	2.7	3.6	2.7	1.6	3.6	0.4	5.0	0.0	0.0	21.
1974	0.0	0.0	0.6	30.9	13.0	3.6	0.6	0.2	0.3	0.4	0.0	0.0	50.
1975	0.0	0.0	0.3	17.7	11.7	4.0	0.8	0.7	8.7	5.3	0.0	0.0	49.
1976	0.0	0.0	0.1	29.9	1.7	3.7	0.1	0.6	1.1	0.7	0.0	0.0	38.
1977	0.0	0.0	2.3	6.5	5.1	0.9	0.5	0.9	2.9	1.7	0.0	0.0	21.
1978	0.0	0.0	1.5	31.4	4.6	0.6	0.5	1.5	1.6	0.9	0.0	0.0	43.
1979	0.0	0.0	0.6	25.0	16.9	3.6	0.8	0.4	0.4	0.8	0.0	0.0	49.
1980	0.0	0.0	0.8	23.7	1.7	0.9	1.4	0.8	1.0	0.7	0.0	0.0	31.
1981	0.0	0.0	3.7	1.9	1.2	1.0	0.9	0.9	0.7	1.1	0.0	0.0	11.
1982	0.0	0.0	0.8	34.2	4.1	0.8	3.5	0.4	1.1	1.4	0.0	0.0	46.
1983	0.0	0.0	0.4	32.0	10.7	2.4	0.7	0.7	0.6	0.4	0.0	0.0	48.
1984	0.0	0.0	2.1	2.4	1.9	1.4	1.6	1.3	1.3	1.4	0.0	0.0	13.
1985	0.0	0.0	8.0	28.6	3.7	0.9	0.8	2.2	0.9	1.7	0.0	0.0	47.
1986	0.0	0.0	26.1	5.8	10.4	1.7	1.0	0.6	0.5	1.0	0.0	0.0	47.
1987	0.0	0.0	3.0	31.8	4.0	1.5	1.7	1.5	1.9	1.7	0.0	0.0	47.
1988	0.0	0.0	1.3	3.6	5.5	1.5	2.9	2.2	2.0	1.4	0.0	0.0	20.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	11.
MAX	0.0	0.0	26.1	55.5	25.5	4.0	16.1	3.7	8.7	14.3	0.0	0.0	86.
MEAN	0.0	0.0	5.3	19.9	6.4	2.0	2.3	1.4	1.6	1.8	0.0	0.0	41.

Table A-11

MOOSOMIN CAA #3 DRAINAGE PROJECT

INCREMENTAL INCREASE IN STREAMFLOW - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1978	0.0	0.0	0.0	0.0	37.8	7.1	16.3	0.0	0.0	0.0	0.0	0.0	61.
1979	0.0	0.0	0.0	0.0	156.9	12.5	6.4	0.0	0.0	0.0	0.0	0.0	176.
1980	0.0	0.0	0.0	59.5	5.3	0.0	7.6	2.5	0.0	0.0	0.0	0.0	75.
1981	0.0	0.0	43.4	14.6	3.6	0.0	0.2	0.4	0.0	0.0	0.0	0.0	62.
1982	0.0	0.0	0.2	217.8	20.7	2.2	0.0	0.0	0.0	0.0	0.0	0.0	241.
1983	0.0	0.0	0.0	202.5	83.7	9.7	0.0	0.0	12.9	0.0	0.0	0.0	309.
1984	0.0	0.0	45.3	17.0	2.8	0.0	0.0	0.0	6.7	0.0	0.0	0.0	72.
1985	0.0	0.0	3.5	151.2	92.1	5.1	0.0	7.2	5.7	0.9	0.0	0.0	266.
1986	0.0	0.0	62.5	63.9	146.9	59.3	14.7	0.0	0.0	0.0	0.0	0.0	347.
1987	0.0	0.0	148.9	0.0	8.9	0.6	6.5	0.0	0.0	14.7	0.0	0.0	180.
1988	0.0	0.0	0.0	14.9	6.7	0.0	0.0	0.0	0.0	5.4	0.0	0.0	27.
MIN	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.
MAX	0.0	0.0	148.9	217.8	156.9	59.3	16.3	7.2	12.9	14.7	0.0	0.0	347.
MEAN	0.0	0.0	27.6	67.4	51.4	8.8	4.7	0.9	2.3	1.9	0.0	0.0	165.

Table A-12

TOWN OF MOOSOMIN

WATER CONSUMPTION - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1968	15.3	15.1	16.1	16.9	18.4	21.1	22.7	19.8	16.9	15.3	14.3	14.7	207.
1969	16.8	16.5	17.7	18.6	20.2	23.1	24.9	21.8	18.6	16.8	15.6	16.1	227.
1970	17.1	16.9	18.1	19.0	20.6	23.6	25.5	22.2	19.0	17.1	16.0	16.4	231.
1971	16.5	16.3	17.4	18.3	19.9	22.8	24.5	21.4	18.3	16.5	15.4	15.8	223.
1972	17.1	16.9	18.0	19.0	20.6	23.6	25.5	22.2	19.0	17.1	16.0	16.4	231.
1973	17.5	17.3	18.4	19.4	21.0	24.1	26.0	22.7	19.4	17.5	16.3	16.8	236.
1974	19.3	19.0	20.3	21.4	23.2	26.6	28.7	25.0	21.4	19.3	18.0	18.5	261.
1975	20.9	20.6	22.1	23.2	25.2	28.9	31.1	27.2	23.2	20.9	19.5	20.1	283.
1976	24.6	24.3	25.9	27.3	29.6	33.9	36.6	31.9	27.3	24.6	22.9	23.6	333.
1977	27.8	27.5	29.3	30.8	33.5	38.3	41.4	36.1	30.8	27.8	26.0	26.7	376.
1978	24.7	24.4	26.1	27.4	29.8	34.1	36.8	32.1	27.4	24.7	23.1	23.7	334.
1979	24.5	24.1	25.8	27.1	29.5	33.8	36.4	31.8	27.1	24.5	22.8	23.5	331.
1980	29.4	29.0	31.0	32.6	35.3	40.5	43.7	38.1	32.6	29.4	27.4	28.2	397.
1981	29.9	28.2	32.5	29.8	34.2	34.5	51.5	38.8	41.4	32.5	32.7	29.9	416.
1982	32.6	39.9	34.3	37.0	35.5	48.7	49.2	40.1	39.9	33.5	31.1	31.2	453.
1983	30.8	27.8	31.3	36.3	33.0	44.4	44.2	48.6	33.3	35.9	32.5	32.9	431.
1984	40.2	36.6	38.7	35.5	37.9	46.8	56.6	55.2	41.2	38.4	34.4	39.0	501.
1985	35.7	40.3	45.7	35.7	53.2	46.0	56.5	36.9	38.4	38.0	34.7	35.8	497.
1986	42.1	39.7	41.8	50.7	49.6	48.7	47.4	54.2	46.3	44.4	42.8	42.7	550.
1987	39.8	34.0	37.7	41.9	56.9	47.3	49.0	40.9	34.1	26.3	24.2	25.7	458.
1988	26.7	26.9	32.9	42.2	35.3	65.9	55.6	43.7	33.0	29.3	25.5	31.9	449.
MIN	15.3	15.1	16.1	16.9	18.4	21.1	22.7	19.8	16.9	15.3	14.3	14.7	207.
MAX	42.1	40.3	45.7	50.7	56.9	65.9	56.6	55.2	46.3	44.4	42.8	42.7	550.
MEAN	26.2	25.8	27.7	29.1	31.5	36.0	38.7	33.8	29.0	26.2	24.3	25.2	354.

TABLE A-13
USES WITHIN PIPESTONE LAKE
EFFECTIVE DRAINAGE AREA

Project No.	Land Location	Status	Year	Purpose	Licensed Diversion (dam^3)	Comment
-	SE 16-15-4-2	Unlicensed	81	Irr.	56	Diversion estimated from Irrigated Area. Diversion in May, June and July.
2969	SW 6-15-3-2	Auth.	39	Dom.	1850	Pipestone Lake. Monthly depletion calculated.
3183	NE 36-15-8-2	Auth. Lic.	40 73	Dom.	8	Upstream of Grenfell Diversion.
3629	SW 28-14-4-2	Auth. Lic.	42 43	Dom.	3	Washed out in 1953.
3980	SE 19-14-4-2	Auth. Lic.	42 73	Dom.	2	
5064	SE 12-16-8-2	Auth. Lic.	48 73	Dom.	6	Upstream of Grenfell Diversion.
7514	SW 18-16-7-2	App. Lic.	57 70	Mun.	253	Grenfell Diversion. Monthly depletion calculated.
11962	NW 4-15-4-2	App.	71	Irr.	37	Backflood project on Kipling drainage ditch.

TABLE A-14
USES IN LOCAL EFFECTIVE DRAINAGE AREA
BETWEEN PIPESTONE LAKE AND STATION 05NE003

Project No.	Land Location	Status	Year	Purpose	Licensed Diversion (dam^3)	Comment
761	SW 4-14-3-2	Auth. Lic.	36 46	Dom.	3	
802	SE 30-14-3-2	Auth. Lic.	36 40	Irr.	3	Washed out in 1953.
2313	SW 20-14-4-2	Lic.	40	Dom.	2	Abandoned in 1973.
3397	SE 6-15-3-2	Auth. Lic.	39 73	Dom.	1	
3407	SE 34-14-3-2	Auth. Lic.	40 73	Dom.	2	
3645	SW 3-13-3-2	Auth. Lic.	40 77	Dom.	6	
5267	NW 6-15-3-2	Auth. Lic.	49 75	Dom.	1	
10025	SE 6-14-32-1	Auth.	65	Irr.	32	Diverts in May, June and July. Abandoned in 1986.
10324	SW 26-14-33-1	Auth. Lic.	80 80	Wild	6	
11158	SE 33-13-3-2	Auth. Lic.	69 69	Irr.	12	
12956	SW 22-12-4-2	Auth.	76	Irr.	6	
13021	SE 21-12-4-2	Auth. Lic.	77 83	Irr.	5	
13722	SW 7-12-3-2	Auth.	79	Wild	11	
50581	SE 14-13-4-2	Lic.	42	Dom.	4	Abandoned in 1970.
50582	NE 28-12-3-2	Lic.	40	Dom.	5	Abandoned in 1970.
55430	SE 26-13-3-2	Lic.	68	Irr.	16	Washed in 1970.

TABLE A-15
USES IN LOCAL EFFECTIVE DRAINAGE AREA
BETWEEN STATIONS 05NE003 AND 05NE001

Project No.	Land Location	Status	Year	Purpose	Licensed Diversion (dam^3)	Comment
-	SW 32-12-31-1	Unlicensed	71	Irr.	-	Moosomin Golf Club.
2775	NE 9-13-1-2	Auth. Lic.	38 70	Dom.	3	
3147	NE 13-13-1-2	Auth. Lic.	39 73	Dom.	1	
3607	SW 6-13-33-1	Auth. Lic.	40 40	Dom.	3	
3650	SW 25-12-1-2	Auth. Lic.	43 71	Dom.	3	
3838	NW 16-11-1-2	Auth. Lic.	43 75	Dom.	4	Abandoned in 1977. Washed out.
3843	NE 11-12-1-2	Auth. Lic.	47 74	Dom.	11	
4825	NE 31-11-33-1	Auth. Lic.	46 71	Dom.	4	
5077	SW 5-13-33-1	Auth. Lic.	48 50	Dom.	3	
6626	SW 23-12-33-1	Auth. Lic.	62 63	Irr.	10	
6769	NW 29-12-31-1	Auth.	55	Mun., Dom., Irr.	5304	Moosomin Reservoir. Monthly Depletion Calculated.
6943	SW 31-11-32-1	Auth. Lic.	55 59	Dom.	7	
7018	SW 1-14-32-1	Auth. Lic.	55 57	Irr.	7	
8050	SE 15-13-32-1	Auth. Lic.	70 71	Irr.	17	Diverts in May, June and July.
8147	NE 17-13-32-1	Auth. Lic.	61 63	Dom.	3	
10464	SW 28-12-32-1	Auth. Lic.	75 75	Wild	58	
10465	SE 35-12-33-1	Auth. Lic.	75 75	Wild	51	
10865	SE 8-14-32-1	Auth. Lic.	68 70	Irr.	4	
11001	NE 8-14-32-1	Auth. Lic.	68 70	Irr.	7	
11954	NE 18-12-33-1	Auth. Lic.	73 73	Dom.	4	
13331	NW 12-12-2-2	Auth.	85	Wild	513	Project partially completed. Diversion of 21 dam^3 assumed.
14251	NW 17-13-31-1	Auth. Lic.	81 81	Irr.	138	Monthly depletion calculated.
14504	SW 12-13-32-1	Auth.	82	Irr.	451	Diverts in May, June and July.
53476	SW 11-13-1-2	Auth. Lic.	39 39	Dom.	5	Washed out in 1970.

TABLE A-16
USES IN LOCAL EFFECTIVE DRAINAGE AREA
BETWEEN STATIONS 05NE001 AND 05NG024

Project No.	Land Location	Status	Year	Purpose	Licensed Diversion (dam^3)
3235	NW 22-11-32-1	Auth. Lic.	39 77	Dom.	3

Table A-17

MINOR WATER USE

ABOVE PIPESTONE LAKE - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.
1944	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.
1945	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.
1946	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.
1947	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.
1948	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1949	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1950	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1951	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1952	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1953	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1954	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1955	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1956	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1957	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1958	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1959	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1960	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1961	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1962	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1963	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1964	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1965	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1966	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1967	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1968	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1969	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1970	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1971	0.0	0.0	0.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
1972	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1973	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1974	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1975	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1976	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1977	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1978	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1979	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1980	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1981	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
1982	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
1983	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
1984	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
1985	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
1986	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
1987	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
1988	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
MIN	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.
MAX	0.0	0.0	0.0	53.0	19.0	19.0	18.0	0.0	0.0	0.0	0.0	0.0	109.
MEAN	0.0	0.0	0.0	29.7	3.3	3.3	3.1	0.0	0.0	0.0	0.0	0.0	39.

Table A-18

MINOR WATER USE

BETWEEN PIPESTONE LAKE AND STATION 05NE003-dam³

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
1944	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
1945	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
1946	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
1947	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
1948	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
1949	0.0	0.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.
1950	0.0	0.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.
1951	0.0	0.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.
1952	0.0	0.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.
1953	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1954	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1955	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1956	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1957	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1958	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1959	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1960	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1961	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1962	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1963	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1964	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1965	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
1966	0.0	0.0	0.0	24.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	56.
1967	0.0	0.0	0.0	24.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	56.
1968	0.0	0.0	0.0	40.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	72.
1969	0.0	0.0	0.0	52.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	84.
1970	0.0	0.0	0.0	27.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	59.
1971	0.0	0.0	0.0	27.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	59.
1972	0.0	0.0	0.0	27.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	59.
1973	0.0	0.0	0.0	25.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	57.
1974	0.0	0.0	0.0	25.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	57.
1975	0.0	0.0	0.0	25.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	57.
1976	0.0	0.0	0.0	31.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	63.
1977	0.0	0.0	0.0	36.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	68.
1978	0.0	0.0	0.0	36.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	68.
1979	0.0	0.0	0.0	47.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	79.
1980	0.0	0.0	0.0	53.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	85.
1981	0.0	0.0	0.0	53.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	85.
1982	0.0	0.0	0.0	53.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	85.
1983	0.0	0.0	0.0	53.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	85.
1984	0.0	0.0	0.0	53.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	85.
1985	0.0	0.0	0.0	53.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	85.
1986	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1987	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
1988	0.0	0.0	0.0	53.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.
MIN	0.0	0.0	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.
MAX	0.0	0.0	0.0	53.0	10.7	10.7	10.6	0.0	0.0	0.0	0.0	0.0	85.
MEAN	0.0	0.0	0.0	32.6	4.7	4.7	4.6	0.0	0.0	0.0	0.0	0.0	47.

Table A-19

MINOR WATER USE

BETWEEN STATIONS 05NE003 AND 05NE001-dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1944	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1945	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
1946	0.0	0.0	0.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.
1947	0.0	0.0	0.0	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.
1948	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.
1949	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.
1950	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.
1951	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.
1952	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.
1953	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.
1954	0.0	0.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.
1955	0.0	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.
1956	0.0	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.
1957	0.0	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.
1958	0.0	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.
1959	0.0	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.
1960	0.0	0.0	0.0	51.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.
1961	0.0	0.0	0.0	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.
1962	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.
1963	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.
1964	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.
1965	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.
1966	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.
1967	0.0	0.0	0.0	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.
1968	0.0	0.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.
1969	0.0	0.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.
1970	0.0	0.0	0.0	70.0	5.7	5.7	5.6	0.0	0.0	0.0	0.0	0.0	87.
1971	0.0	0.0	0.0	70.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	144.
1972	0.0	0.0	0.0	70.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	144.
1973	0.0	0.0	0.0	74.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	148.
1974	0.0	0.0	0.0	74.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	148.
1975	0.0	0.0	0.0	183.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	257.
1976	0.0	0.0	0.0	183.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	257.
1977	0.0	0.0	0.0	179.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	253.
1978	0.0	0.0	0.0	179.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	253.
1979	0.0	0.0	0.0	179.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	253.
1980	0.0	0.0	0.0	179.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	253.
1981	0.0	0.0	0.0	179.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	253.
1982	0.0	0.0	0.0	179.0	11.4	17.1	19.9	11.4	8.6	5.7	0.0	0.0	253.
1983	0.0	0.0	0.0	179.0	162.0	167.0	170.0	11.4	8.6	5.7	0.0	0.0	704.
1984	0.0	0.0	0.0	179.0	162.0	167.0	170.0	11.4	8.6	5.7	0.0	0.0	704.
1985	0.0	0.0	0.0	179.0	160.0	164.0	166.0	7.8	5.9	3.9	0.0	0.0	687.
1986	0.0	0.0	0.0	179.0	162.0	167.0	170.0	11.4	8.6	5.7	0.0	0.0	704.
1987	0.0	0.0	0.0	200.0	163.0	169.0	172.0	13.1	9.8	6.6	0.0	0.0	734.
1988	0.0	0.0	0.0	200.0	163.0	169.0	173.0	13.3	10.0	6.7	0.0	0.0	735.
MIN	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.
MAX	0.0	0.0	0.0	200.0	163.0	169.0	173.0	13.3	10.0	6.7	0.0	0.0	735.
MEAN	0.0	0.0	0.0	90.9	24.2	26.4	27.5	4.5	3.4	2.2	0.0	0.0	179.

Table A-20

MINOR WATER USE

BETWEEN STATIONS 05NE001 AND 05NG003 - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1944	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1945	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1946	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1947	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1948	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1949	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1950	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1951	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1952	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1953	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1954	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1955	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1956	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1957	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1958	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1959	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1960	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1961	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
1962	2.0	2.0	2.0	2.0	3.0	7.0	7.0	7.0	3.0	2.0	2.0	2.0	41.
1963	7.0	12.0	7.0	13.0	13.0	26.0	26.0	26.0	13.0	7.0	7.0	7.0	164.
1964	7.0	12.0	7.0	13.0	13.0	26.0	26.0	26.0	13.0	7.0	7.0	7.0	164.
1965	7.0	12.0	7.0	13.0	13.0	26.0	26.0	26.0	13.0	7.0	7.0	7.0	164.
1966	7.0	12.0	7.0	13.0	13.0	26.0	26.0	26.0	13.0	7.0	7.0	7.0	164.
1967	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1968	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1969	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1970	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1971	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1972	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1973	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1974	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1975	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1976	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1977	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1978	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1979	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1980	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1981	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1982	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1983	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1984	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1985	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1986	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1987	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
1988	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
MIN	0.0	0.0	0.0	0.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	4.
MAX	8.0	15.0	8.0	15.0	16.0	32.0	32.0	32.0	15.0	8.0	8.0	8.0	197.
MEAN	4.5	8.3	4.5	8.3	9.7	18.1	18.1	17.7	8.4	4.5	4.5	4.5	111.

Table A-21

HISTORIC NET DEPLETION

TO STATION 05NE003 - m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1960	0.000	0.000	0.011	0.185	0.013	0.021	0.000	0.000	0.000	0.000	0.000	0.000	599
1961	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24
1962	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24
1963	0.000	0.000	0.062	0.100	0.019	0.186	0.109	0.059	0.000	0.000	0.000	0.000	1410
1964	0.000	0.000	0.000	0.192	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	586
1965	0.000	0.000	0.000	0.183	0.010	0.012	0.022	0.000	0.012	0.012	0.000	0.000	655
1966	0.000	0.000	0.000	0.088	0.024	0.022	0.023	0.008	0.000	0.004	0.000	0.000	444
1967	0.000	0.000	0.011	0.105	0.022	0.004	0.004	0.000	0.000	0.000	0.000	0.000	383
1968	0.000	0.000	0.094	0.071	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.000	467
1969	0.000	0.000	0.000	0.115	0.019	0.009	0.022	0.000	0.000	0.000	0.000	0.000	430
1970	0.000	0.000	0.000	0.121	0.008	0.028	0.016	0.000	0.000	0.000	0.000	0.000	452
1971	0.000	0.000	0.000	0.129	0.024	0.005	0.020	0.000	0.000	0.000	0.000	0.000	463
1972	0.000	0.000	0.104	-0.762	0.013	0.027	0.021	0.000	0.000	0.000	0.000	0.000	-1540
1973	0.000	0.000	0.000	0.031	0.040	0.052	0.004	0.000	0.000	0.000	0.000	0.000	332
1987	0.000	0.000	0.026	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	182
1988	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	53
MIN	0.000	0.000	0.000	-0.762	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-1540
MAX	0.000	0.000	0.104	0.192	0.040	0.186	0.109	0.059	0.012	0.012	0.000	0.000	1410
MEAN	0.000	0.000	0.019	0.040	0.014	0.023	0.015	0.004	0.001	0.001	0.000	0.000	310

Table A-22

HISTORIC NET DEPLETION

TO STATION 05NE001 - m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1958	-0.075	-0.092	2.07	-0.326	0.333	0.197	0.100	0.114	-0.067	-0.078	-0.160	-0.060	5280
1959	-0.181	-0.129	0.297	0.689	0.227	0.292	0.164	0.141	0.007	-0.113	-0.087	-0.087	3220
1960	-0.078	-0.069	0.783	0.142	0.473	0.063	0.146	0.109	0.104	-0.591	-0.024	-0.019	2770
1961	-0.024	-0.060	-0.011	-0.424	-0.272	0.133	0.169	0.149	0.123	-0.088	-0.034	-0.038	-978
1962	-0.063	-0.072	0.414	0.299	0.179	0.108	0.099	0.097	0.069	0.045	0.086	0.061	3510
1963	0.076	0.093	1.57	0.104	0.283	0.300	0.072	0.261	-0.016	-0.296	-0.024	-0.057	6290
1964	-0.037	-0.046	-0.070	0.689	0.354	0.165	0.155	0.123	0.091	-0.105	-0.052	-0.058	3170
1965	-0.057	-0.068	-0.050	0.682	0.411	0.099	0.130	0.098	-0.193	-0.183	-0.177	0.015	1880
1966	0.016	0.024	0.512	-0.327	0.720	0.074	0.173	0.123	-0.331	-0.101	0.078	0.095	2870
1967	0.054	0.091	0.070	-0.198	0.238	0.169	0.189	0.055	-0.137	0.134	0.047	0.040	2000
1968	0.028	0.092	0.179	0.060	0.171	0.194	0.212	0.060	0.053	0.074	0.083	0.069	3360
1969	0.014	0.037	0.074	-0.026	0.588	0.145	0.091	0.133	0.086	-0.196	-0.045	-0.083	2170
1970	-0.069	-0.089	-0.086	0.997	0.163	0.102	0.150	0.013	-0.306	-0.214	-0.035	-0.059	1480
1971	-0.050	-0.020	0.247	0.080	0.594	0.255	0.105	0.062	-0.212	-0.044	0.088	0.116	3260
1972	0.098	0.086	-0.251	-0.689	0.439	0.170	0.478	0.047	-0.238	-0.136	-0.028	-0.027	-88
1973	-0.013	-0.039	0.098	0.101	0.414	0.316	0.153	0.197	-0.194	-0.198	-0.027	-0.052	2020
1974	-0.056	-0.035	-0.135	-1.21	-0.478	0.494	0.094	0.058	0.024	-0.254	-0.163	-0.185	-4860
1975	-0.156	-0.179	-0.137	0.352	-2.60	-0.772	0.365	0.231	-0.004	-0.048	-0.102	-0.132	-8430
1976	-0.128	-0.158	-0.385	-1.21	-1.49	-2.01	-1.00	0.503	-0.150	-0.231	-0.010	-0.042	-16600
1977	-0.014	-0.016	0.027	0.237	0.591	0.104	0.077	0.132	-0.206	0.080	-0.021	-0.032	2570
1978	-0.001	-0.003	0.078	0.320	0.625	0.044	0.041	0.025	-0.010	-0.158	-0.054	-0.028	2330
1979	-0.048	-0.036	0.021	-1.09	0.106	0.504	0.028	0.053	-0.081	-0.163	0.002	0.009	-1800
1980	-0.004	0.024	-0.016	0.940	0.153	-0.012	0.032	0.106	0.088	-0.040	-0.067	0.023	3200
1981	0.012	-0.033	0.020	0.139	0.161	0.068	0.112	0.125	0.085	-0.006	-0.018	0.069	1950
1982	0.067	0.072	0.133	1.08	0.053	0.079	0.544	-0.070	0.078	-0.120	-0.001	-0.011	4960
1983	-0.013	-0.017	0.030	-0.919	0.677	0.257	0.155	-0.049	-0.149	0.118	-0.084	-0.074	-102
1984	-0.063	-0.070	0.252	0.338	0.267	0.210	0.231	-0.115	0.001	0.072	0.052	0.094	3370
1985	0.082	0.086	0.885	-0.876	0.129	0.143	0.138	0.405	0.041	0.102	-0.075	-0.101	2620
1986	-0.148	-0.152	0.210	0.231	0.188	0.089	0.129	0.076	0.065	-0.413	-0.231	0.087	374
1987	0.097	0.063	0.077	0.785	0.313	0.103	0.112	0.096	-0.107	-0.103	0.059	0.055	4070
1988	0.047	0.064	-0.046	0.194	0.582	0.123	0.190	0.140	-0.087	-0.022	---	---	---
MIN	-0.181	-0.179	-0.385	-1.21	-2.60	-2.01	-1.00	-0.115	-0.331	-0.591	-0.231	-0.185	-16600
MAX	0.098	0.093	2.07	1.08	0.720	0.504	0.544	0.503	0.123	0.134	0.088	0.116	6290
MEAN	-0.022	-0.021	0.221	0.037	0.148	0.071	0.124	0.113	-0.051	-0.106	-0.034	-0.014	1200

Table A-23

HISTORIC NET DEPLETION

TO STATION 05NG024 - m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1982	---	---	---	---	---	---	---	---	0.078	-0.122	-0.001	-0.011	---
1983	-0.013	-0.017	0.030	-0.996	0.646	0.253	0.155	-0.049	-0.154	0.118	-0.002	-0.074	-196
1984	-0.063	-0.070	0.235	0.332	0.266	0.210	0.231	-0.060	-0.002	0.072	0.052	0.094	3450
1985	0.082	0.086	0.884	-0.933	0.095	0.141	0.138	0.402	0.039	0.102	-0.075	-0.101	2350
1986	-0.148	-0.152	0.187	0.207	0.133	0.066	0.123	0.076	0.065	-0.413	-0.231	0.087	30
1987	0.097	0.063	0.021	0.786	0.310	0.103	0.110	0.096	-0.107	-0.109	0.059	0.055	3890
1988	0.047	0.064	-0.046	0.190	0.580	0.123	0.190	0.140	-0.010	-0.024	---	---	---
MIN	-0.148	-0.152	-0.046	-0.996	0.095	0.066	0.110	-0.060	-0.154	-0.413	-0.231	-0.101	-196
MAX	0.097	0.086	0.884	0.786	0.646	0.253	0.231	0.402	0.078	0.118	0.059	0.094	3890
MEAN	0.000	-0.004	0.219	-0.069	0.338	0.149	0.158	0.101	-0.013	-0.054	-0.033	0.008	1900

Table A-24

HISTORIC NET DEPLETION

TO STATION 05NG003 - m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	---	0.034	0.016	0.005	0.020	0.005	0.000	0.000	---	---	---
1944	---	---	0.017	0.026	0.011	-0.008	0.020	0.006	0.000	0.000	---	---	---
1945	---	---	0.013	0.027	0.018	-0.005	0.026	0.000	0.000	0.000	---	---	---
1946	---	---	---	0.059	0.019	0.019	0.016	0.000	0.000	0.026	---	---	---
1947	---	---	-0.017	0.033	0.020	-0.011	0.027	0.008	0.006	0.010	---	---	---
1948	---	---	---	---	0.016	0.019	0.021	0.012	0.000	---	---	---	---
1949	---	---	0.010	0.042	0.013	0.018	0.003	0.018	0.000	0.001	---	---	---
1950	---	---	0.007	0.040	0.012	0.010	0.008	0.021	0.013	0.007	---	---	---
1951	---	---	-0.017	0.039	0.023	0.000	0.028	0.012	0.002	0.000	---	---	---
1952	---	---	-0.014	0.042	0.020	0.001	0.018	0.002	0.013	0.000	---	---	---
1953	---	---	---	0.033	0.004	-0.014	0.012	0.020	0.000	0.015	---	---	---
1954	---	---	-0.012	0.034	0.010	-0.021	0.004	0.012	-0.006	0.008	0.000	---	---
1955	---	---	---	0.057	0.060	-0.145	-0.248	-0.112	0.178	0.103	---	---	---
1956	---	---	---	0.590	-0.127	0.198	0.088	0.220	0.204	0.082	-0.028	-0.082	---
1957	0.014	0.019	-0.022	-0.087	-0.060	0.119	0.228	0.230	-1.70	-0.367	0.499	-0.008	-2940
1958	-0.075	-0.092	2.07	-0.325	0.334	0.197	0.100	0.114	-0.067	-0.078	-0.160	-0.060	5290
1959	-0.181	-0.129	0.297	0.690	0.227	0.293	0.165	0.141	0.007	-0.113	-0.087	-0.087	3230
1960	-0.078	-0.069	0.783	0.143	0.473	0.063	0.146	0.109	0.104	-0.591	-0.024	-0.019	2780
1961	-0.024	-0.060	-0.011	-0.423	-0.271	0.133	0.169	0.149	0.123	-0.088	-0.034	-0.038	-971
1962	-0.063	-0.071	0.415	0.301	0.180	0.111	0.102	0.100	0.070	0.046	0.087	0.061	3560
1963	0.079	0.098	1.58	0.110	0.288	0.310	0.081	0.271	-0.011	-0.293	-0.022	-0.055	6450
1964	-0.034	-0.041	-0.067	0.695	0.359	0.175	0.164	0.133	0.096	-0.103	-0.049	-0.055	3340
1965	-0.054	-0.063	-0.047	0.688	0.415	0.109	0.140	0.107	-0.188	-0.180	-0.174	0.017	2040
1966	0.018	0.029	0.515	-0.320	0.725	0.084	0.183	0.132	-0.326	-0.099	0.081	0.097	3030
1967	0.057	0.097	0.073	-0.191	0.244	0.181	0.201	0.067	-0.131	0.137	0.050	0.043	2200
1968	0.031	0.099	0.182	0.067	0.177	0.206	0.224	0.072	0.059	0.077	0.086	0.072	3560
1969	0.017	0.044	0.077	-0.019	0.593	0.158	0.103	0.145	0.092	-0.193	-0.042	-0.080	2370
1970	-0.066	-0.083	-0.083	1.00	0.169	0.115	0.162	0.025	-0.300	-0.211	-0.032	-0.056	1680
1971	-0.047	-0.014	0.250	0.087	0.600	0.267	0.117	0.073	-0.206	-0.041	0.091	0.119	3460
1972	0.101	0.092	-0.248	-0.682	0.445	0.182	0.490	0.059	-0.232	-0.133	-0.024	-0.024	112
1973	-0.010	-0.032	0.101	0.108	0.420	0.328	0.165	0.209	-0.188	-0.195	-0.024	-0.049	2220
1974	-0.053	-0.028	-0.132	-1.21	-0.472	0.506	0.106	0.070	0.030	-0.251	-0.160	-0.182	-4660
1975	-0.153	-0.173	-0.134	0.358	-2.60	-0.760	0.377	0.243	0.002	-0.045	-0.099	-0.129	-8230
1976	-0.125	-0.152	-0.382	-1.20	-1.48	-2.00	-0.991	0.515	-0.144	-0.228	-0.007	-0.039	-16400
1977	-0.011	-0.010	0.030	0.244	0.597	0.117	0.089	0.144	-0.200	0.083	-0.018	-0.029	2770
1978	0.002	0.003	0.081	0.327	0.617	0.054	0.047	0.037	-0.004	-0.155	-0.051	-0.025	2470
1979	-0.045	-0.030	0.024	-1.08	0.053	0.511	0.037	0.065	-0.075	-0.160	0.006	0.012	-1780
1980	-0.001	0.030	-0.013	0.924	0.157	0.000	0.041	0.117	0.094	-0.037	-0.064	0.026	3320
1981	0.015	-0.026	0.007	0.141	0.165	0.080	0.124	0.136	0.091	-0.003	-0.015	0.072	2090
1982	0.070	0.078	0.136	0.999	0.051	0.090	0.556	-0.058	0.083	-0.119	0.002	-0.008	4920
1983	-0.010	-0.011	0.033	-0.990	0.652	0.266	0.167	-0.037	-0.148	0.121	0.001	-0.071	1
1984	-0.060	-0.064	0.238	0.338	0.272	0.223	0.243	-0.048	0.004	0.075	0.055	0.097	3640
1985	0.085	0.093	0.887	-0.927	0.101	0.153	0.150	0.414	0.044	0.105	-0.072	-0.098	2550
1986	-0.145	-0.146	0.190	0.213	0.139	0.078	0.135	0.088	0.071	-0.410	-0.228	0.090	227
1987	0.100	0.070	0.024	0.792	0.316	0.115	0.122	0.108	-0.102	-0.106	0.062	0.058	4090
1988	0.050	0.071	-0.043	0.195	0.585	0.136	0.202	0.152	-0.004	-0.021	---	---	---
MIN	-0.181	-0.173	-0.382	-1.21	-2.60	-2.00	-0.991	-0.112	-1.70	-0.591	-0.228	-0.182	-16400
MAX	0.101	0.099	2.07	1.00	0.725	0.511	0.556	0.515	0.204	0.137	0.499	0.119	6450
MEAN	-0.019	-0.014	0.170	0.045	0.100	0.058	0.095	0.094	-0.058	-0.074	-0.012	-0.014	1170

Table A-25

KIPLING MARSH

PRESENT USE DRAINAGE - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	5225.0	573.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5798.
1944	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1945	0.0	0.0	0.0	141.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	141.
1946	0.0	0.0	0.0	2419.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2419.
1947	0.0	0.0	0.0	5225.0	1493.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6718.
1948	0.0	0.0	0.0	5225.0	1340.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6565.
1949	0.0	0.0	0.0	1973.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1973.
1950	0.0	0.0	0.0	5225.0	1057.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6282.
1951	0.0	0.0	0.0	4917.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4917.
1952	0.0	0.0	0.0	1446.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1446.
1953	0.0	0.0	0.0	5225.0	928.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6153.
1954	0.0	0.0	0.0	5225.0	5401.0	2851.0	0.0	0.0	0.0	0.0	0.0	0.0	13477.
1955	0.0	0.0	0.0	5225.0	5401.0	5225.0	4991.0	0.0	0.0	0.0	0.0	0.0	20842.
1956	0.0	0.0	0.0	5225.0	2298.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7523.
1957	0.0	0.0	0.0	2383.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2383.
1958	0.0	0.0	0.0	1876.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1876.
1959	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1960	0.0	0.0	0.0	2352.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2352.
1961	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1963	0.0	0.0	0.0	324.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	324.
1964	0.0	0.0	0.0	1087.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1087.
1965	0.0	0.0	0.0	1968.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1968.
1966	0.0	0.0	0.0	2109.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2109.
1967	0.0	0.0	0.0	1574.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1574.
1968	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1969	0.0	0.0	0.0	5225.0	503.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5728.
1970	0.0	0.0	0.0	4670.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4670.
1971	0.0	0.0	0.0	1065.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1065.
1972	0.0	0.0	0.0	2082.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2082.
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1974	0.0	0.0	0.0	5225.0	982.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6207.
1975	0.0	0.0	0.0	5225.0	5401.0	1392.0	0.0	0.0	0.0	0.0	0.0	0.0	12018.
1976	0.0	0.0	0.0	5225.0	5401.0	5225.0	2765.0	0.0	0.0	0.0	0.0	0.0	18616.
1977	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1979	0.0	0.0	0.0	4690.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4690.
1980	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1982	0.0	0.0	0.0	363.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	363.
1983	0.0	0.0	0.0	2960.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2960.
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1985	0.0	0.0	0.0	4650.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4650.
1986	0.0	0.0	0.0	1740.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1740.
1987	0.0	0.0	0.0	153.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	153.
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
MAX	0.0	0.0	0.0	5225.0	5401.0	5225.0	4991.0	0.0	0.0	0.0	0.0	0.0	20842.
MEAN	0.0	0.0	0.0	2383.5	669.1	319.4	168.6	0.0	0.0	0.0	0.0	0.0	3541.

Table A-26

SILVERWOOD DRAINAGE PROJECT

PRESENT USE INCREMENTAL INCREASE IN STREAMFLOW - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	75.2	5.9	4.1	1.4	0.4	0.2	0.3	0.0	0.0	88.
1944	0.0	0.0	0.1	3.2	1.7	4.1	5.3	1.1	1.0	0.6	0.0	0.0	17.
1945	0.0	0.0	8.8	6.5	3.5	3.8	6.1	1.0	0.2	0.7	0.0	0.0	31.
1946	0.0	0.0	8.7	37.6	3.8	1.7	12.4	0.8	0.2	1.7	0.0	0.0	67.
1947	0.0	0.0	0.0	35.6	6.4	18.6	9.6	1.4	0.8	0.6	0.0	0.0	73.
1948	0.0	0.0	0.0	40.8	27.0	4.2	2.6	1.5	0.5	1.1	0.0	0.0	78.
1949	0.0	0.0	0.1	49.9	5.1	16.0	2.6	2.8	0.3	1.5	0.0	0.0	78.
1950	0.0	0.0	2.0	32.3	17.4	7.4	9.7	9.8	1.7	1.2	0.0	0.0	82.
1951	0.0	0.0	0.0	42.6	33.3	3.4	2.6	0.9	0.9	2.1	0.0	0.0	86.
1952	0.0	0.0	1.7	42.4	6.5	3.0	3.4	0.9	5.6	1.1	0.0	0.0	65.
1953	0.0	0.0	1.8	24.7	5.1	36.4	13.6	2.5	0.4	1.0	0.0	0.0	86.
1954	0.0	0.0	0.0	5.1	3.7	21.3	35.8	3.7	3.6	6.9	0.0	0.0	80.
1955	0.0	0.0	0.2	14.5	19.3	9.9	4.6	0.6	0.9	0.2	0.0	0.0	50.
1956	0.0	0.0	0.8	35.6	14.3	4.2	4.4	2.0	0.8	3.2	0.0	0.0	65.
1957	0.0	0.0	8.3	27.7	12.4	4.7	3.6	2.2	6.9	7.7	0.0	0.0	74.
1958	0.0	0.0	12.8	29.4	4.8	1.4	1.2	1.0	1.0	2.8	0.0	0.0	54.
1959	0.0	0.0	3.1	5.4	1.8	2.3	1.4	1.9	1.4	0.0	0.0	0.0	17.
1960	0.0	0.0	0.1	35.3	4.6	3.1	0.0	0.0	0.0	0.0	0.0	0.0	43.
1961	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
1962	0.0	0.0	0.0	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.
1963	0.0	0.0	14.1	4.5	1.5	9.5	6.4	4.2	0.0	0.1	0.0	0.0	40.
1964	0.0	0.0	0.0	26.2	9.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	36.
1965	0.0	0.0	0.0	27.0	3.8	5.8	1.3	0.3	2.4	2.1	0.0	0.0	43.
1966	0.0	0.0	3.5	24.1	9.2	2.8	2.1	0.7	0.7	0.9	0.0	0.0	44.
1967	0.0	0.0	0.1	33.8	10.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	45.
1968	0.0	0.0	10.8	3.7	0.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0	16.
1969	0.0	0.0	0.0	36.0	4.2	0.3	1.0	0.0	0.0	0.0	0.0	0.0	42.
1970	0.0	0.0	0.0	20.4	17.5	2.4	0.7	0.4	0.0	0.0	0.0	0.0	41.
1971	0.0	0.0	0.0	29.9	9.3	3.6	2.4	0.0	0.0	0.0	0.0	0.0	45.
1972	0.0	0.0	16.4	16.7	5.6	2.3	1.7	0.3	0.0	0.0	0.0	0.0	43.
1973	0.0	0.0	2.0	2.1	3.4	3.9	2.2	0.2	0.6	0.3	0.0	0.0	15.
1974	0.0	0.0	0.7	36.1	15.2	4.2	0.7	0.2	0.3	0.4	0.0	0.0	58.
1975	0.0	0.0	0.4	20.7	13.7	4.6	0.9	0.8	10.1	6.2	0.0	0.0	57.
1976	0.0	0.0	0.1	35.0	2.0	4.4	0.1	0.7	1.3	0.8	0.0	0.0	44.
1977	0.0	0.0	2.6	7.6	6.0	1.1	0.6	1.1	3.4	2.0	0.0	0.0	24.
1978	0.0	0.0	1.8	36.8	5.4	0.7	0.6	1.7	1.8	1.1	0.0	0.0	50.
1979	0.0	0.0	0.6	29.2	19.7	4.2	0.9	0.5	0.4	1.0	0.0	0.0	57.
1980	0.0	0.0	0.9	27.7	2.0	1.1	1.6	1.0	1.2	0.8	0.0	0.0	36.
1981	0.0	0.0	4.3	2.3	1.4	1.1	1.0	1.1	0.8	1.3	0.0	0.0	13.
1982	0.0	0.0	0.9	40.0	4.8	1.0	4.1	0.5	1.2	1.6	0.0	0.0	54.
1983	0.0	0.0	0.4	37.4	12.5	2.8	0.8	0.8	0.8	0.5	0.0	0.0	56.
1984	0.0	0.0	2.5	2.8	2.2	1.7	1.9	1.5	1.5	1.7	0.0	0.0	16.
1985	0.0	0.0	9.4	33.5	4.3	1.1	0.9	2.5	1.0	2.0	0.0	0.0	55.
1986	0.0	0.0	30.5	6.8	12.2	2.0	1.2	0.7	0.6	1.1	0.0	0.0	55.
1987	0.0	0.0	8.5	35.7	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	45.
1988	0.0	0.0	0.0	0.3	3.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	4.
MIN	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
MAX	0.0	0.0	30.5	75.2	33.3	36.4	35.8	9.8	10.1	7.7	0.0	0.0	88.
MEAN	0.0	0.0	3.5	24.4	7.8	4.6	3.3	1.2	1.2	1.2	0.0	0.0	47.

Table A-27

HIGHWAY NO. 8 DRAINAGE PROJECT

PRESENT USE INCREMENTAL INCREASE IN STREAMFLOW - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	64.6	5.1	3.5	1.2	0.3	0.2	0.3	0.0	0.0	75.
1944	0.0	0.0	0.1	2.7	1.4	3.5	4.6	1.0	0.9	0.5	0.0	0.0	15.
1945	0.0	0.0	7.6	5.6	3.0	3.3	5.2	0.8	0.2	0.6	0.0	0.0	26.
1946	0.0	0.0	7.5	32.3	3.3	1.4	10.6	0.7	0.1	1.5	0.0	0.0	57.
1947	0.0	0.0	0.0	33.2	6.0	17.4	8.9	1.3	0.7	0.6	0.0	0.0	68.
1948	0.0	0.0	0.0	35.1	23.2	3.6	2.2	1.3	0.4	1.0	0.0	0.0	67.
1949	0.0	0.0	0.1	42.9	4.3	13.8	2.3	2.4	0.3	1.2	0.0	0.0	67.
1950	0.0	0.0	1.7	27.7	14.9	6.3	8.3	8.4	1.4	1.0	0.0	0.0	70.
1951	0.0	0.0	0.0	36.6	28.6	2.9	2.3	0.8	0.8	1.8	0.0	0.0	74.
1952	0.0	0.0	1.4	36.4	5.6	2.6	3.0	0.8	4.8	0.9	0.0	0.0	56.
1953	0.0	0.0	1.5	21.2	4.4	31.3	11.7	2.1	0.3	0.9	0.0	0.0	73.
1954	0.0	0.0	0.0	4.4	3.2	18.3	30.8	3.1	3.1	5.9	0.0	0.0	69.
1955	0.0	0.0	0.2	12.4	16.5	8.5	4.0	0.5	0.7	0.1	0.0	0.0	43.
1956	0.0	0.0	0.7	30.6	12.3	3.6	3.8	1.7	0.7	2.8	0.0	0.0	56.
1957	0.0	0.0	7.1	23.8	10.6	4.0	3.1	1.9	5.9	6.6	0.0	0.0	63.
1958	0.0	0.0	10.9	25.1	4.1	1.2	1.0	0.8	0.9	2.4	0.0	0.0	46.
1959	0.0	0.0	2.7	4.6	1.6	1.9	1.2	1.7	1.2	0.0	0.0	0.0	15.
1960	0.0	0.0	14.6	12.1	1.3	4.0	5.8	3.7	3.9	14.3	0.0	0.0	60.
1961	0.0	0.0	4.6	0.0	0.0	1.9	2.5	2.7	2.5	0.0	0.0	0.0	14.
1962	0.0	0.0	6.8	3.7	2.7	1.6	1.5	1.4	1.0	0.7	0.0	0.0	19.
1963	0.0	0.0	9.6	0.8	5.8	2.4	1.2	1.7	2.2	0.0	0.0	0.0	24.
1964	0.0	0.0	0.0	30.2	18.6	3.9	3.3	1.8	1.4	4.6	0.0	0.0	64.
1965	0.0	0.0	0.9	33.5	3.1	0.0	1.8	0.8	5.0	0.0	0.0	0.0	45.
1966	0.0	0.0	14.1	37.0	11.1	3.0	1.8	0.9	0.0	0.0	0.0	0.0	68.
1967	0.0	0.0	7.3	22.4	13.5	2.3	2.6	0.7	1.5	2.0	0.0	0.0	52.
1968	0.0	0.0	6.9	3.7	3.1	3.3	3.1	2.9	1.9	1.1	0.0	0.0	26.
1969	0.0	0.0	6.3	55.5	4.8	1.5	16.1	1.4	0.8	0.0	0.0	0.0	86.
1970	0.0	0.0	0.7	36.3	25.5	1.2	2.5	1.7	1.3	1.6	0.0	0.0	71.
1971	0.0	0.0	5.8	17.7	0.2	1.6	5.0	1.9	0.4	1.2	0.0	0.0	34.
1972	0.0	0.0	18.6	26.5	2.3	1.9	3.7	2.0	0.8	3.0	0.0	0.0	59.
1973	0.0	0.0	1.8	2.7	3.6	2.7	1.6	3.6	0.4	5.0	0.0	0.0	21.
1974	0.0	0.0	0.6	30.9	13.0	3.6	0.6	0.2	0.3	0.4	0.0	0.0	50.
1975	0.0	0.0	0.3	17.7	11.7	4.0	0.8	0.7	8.7	5.3	0.0	0.0	49.
1976	0.0	0.0	0.1	29.9	1.7	3.7	0.1	0.6	1.1	0.7	0.0	0.0	38.
1977	0.0	0.0	2.3	6.5	5.1	0.9	0.5	0.9	2.9	1.7	0.0	0.0	21.
1978	0.0	0.0	1.5	31.4	4.6	0.6	0.5	1.5	1.6	0.9	0.0	0.0	43.
1979	0.0	0.0	0.6	25.0	16.9	3.6	0.8	0.4	0.4	0.8	0.0	0.0	49.
1980	0.0	0.0	0.8	23.7	1.7	0.9	1.4	0.8	1.0	0.7	0.0	0.0	31.
1981	0.0	0.0	3.7	1.9	1.2	1.0	0.9	0.9	0.7	1.1	0.0	0.0	11.
1982	0.0	0.0	0.8	34.2	4.1	0.8	3.5	0.4	1.1	1.4	0.0	0.0	46.
1983	0.0	0.0	0.4	32.0	10.7	2.4	0.7	0.7	0.6	0.4	0.0	0.0	48.
1984	0.0	0.0	2.1	2.4	1.9	1.4	1.6	1.3	1.3	1.4	0.0	0.0	13.
1985	0.0	0.0	8.0	28.6	3.7	0.9	0.8	2.2	0.9	1.7	0.0	0.0	47.
1986	0.0	0.0	26.1	5.8	10.4	1.7	1.0	0.6	0.5	1.0	0.0	0.0	47.
1987	0.0	0.0	3.0	31.8	4.0	1.5	1.7	1.5	1.9	1.7	0.0	0.0	47.
1988	0.0	0.0	1.3	3.6	5.5	1.5	2.9	2.2	2.0	1.4	0.0	0.0	20.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	11.
MAX	0.0	0.0	26.1	64.6	28.6	31.3	30.8	8.4	8.7	14.3	0.0	0.0	86.
MEAN	0.0	0.0	4.2	22.3	7.4	4.1	3.8	1.6	1.5	1.8	0.0	0.0	47.

Table A-28

MOOSOMIN CAA #3 DRAINAGE PROJECT

PRESENT USE INCREMENTAL INCREASE IN STREAMFLOW - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	217.5	17.0	11.7	4.0	1.0	0.5	0.9	0.0	0.0	253.
1944	0.0	0.0	0.3	9.4	4.9	12.0	15.6	3.4	2.9	1.8	0.0	0.0	50.
1945	0.0	0.0	26.0	19.3	10.3	11.2	18.0	2.8	0.5	2.0	0.0	0.0	90.
1946	0.0	0.0	27.4	117.7	11.9	5.2	38.8	2.5	0.5	5.4	0.0	0.0	209.
1947	0.0	0.0	0.0	107.7	19.4	56.3	29.0	4.3	2.4	1.9	0.0	0.0	221.
1948	0.0	0.0	0.0	121.2	80.3	12.4	7.7	4.5	1.4	3.4	0.0	0.0	231.
1949	0.0	0.0	0.2	147.2	14.9	47.4	7.7	8.2	1.0	4.3	0.0	0.0	231.
1950	0.0	0.0	5.8	94.9	51.1	21.7	28.5	28.9	4.9	3.4	0.0	0.0	239.
1951	0.0	0.0	0.0	123.3	96.3	9.8	7.6	2.7	2.6	6.1	0.0	0.0	248.
1952	0.0	0.0	4.8	125.0	19.1	9.0	10.2	2.6	16.4	3.2	0.0	0.0	190.
1953	0.0	0.0	5.2	71.7	14.7	105.7	39.5	7.2	1.1	3.0	0.0	0.0	248.
1954	0.0	0.0	0.0	14.9	10.8	62.1	104.2	10.7	10.4	20.1	0.0	0.0	233.
1955	0.0	0.0	0.7	42.9	57.1	29.3	13.7	1.8	2.6	0.5	0.0	0.0	149.
1956	0.0	0.0	2.6	109.3	44.1	13.0	13.4	6.0	2.6	9.9	0.0	0.0	201.
1957	0.0	0.0	25.1	83.6	37.4	14.2	10.7	6.6	20.7	23.3	0.0	0.0	222.
1958	0.0	0.0	88.6	89.6	36.8	2.6	0.8	0.0	0.0	16.3	0.0	0.0	235.
1959	0.0	0.0	31.8	45.7	11.6	3.8	0.7	0.0	6.3	0.2	0.0	0.0	100.
1960	0.0	0.0	0.0	108.3	33.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.
1961	0.0	0.0	7.4	25.1	0.0	6.1	2.0	0.0	0.0	0.0	0.0	0.0	41.
1962	0.0	0.0	1.5	69.2	6.1	36.2	8.1	19.9	0.7	0.0	0.0	0.0	142.
1963	0.0	0.0	111.2	29.8	17.8	40.8	40.6	30.3	7.5	0.0	0.0	0.0	278.
1964	0.0	0.0	0.0	236.9	126.8	58.6	12.7	18.3	40.7	30.6	0.0	0.0	525.
1965	0.0	0.0	0.0	181.6	22.0	23.5	181.6	25.4	22.3	70.2	0.0	0.0	527.
1966	0.0	0.0	76.6	79.4	65.1	38.0	11.3	20.2	0.0	25.8	0.0	0.0	316.
1967	0.0	0.0	44.2	24.3	46.3	8.8	5.9	2.5	0.0	5.6	0.0	0.0	138.
1968	0.0	0.0	138.3	72.6	8.8	0.0	1.4	0.0	0.5	5.0	0.0	0.0	227.
1969	0.0	0.0	0.0	188.0	75.4	41.2	34.1	29.6	6.8	6.5	0.0	0.0	382.
1970	0.0	0.0	20.9	139.7	203.8	58.1	33.6	10.9	11.0	11.5	0.0	0.0	490.
1971	0.0	0.0	14.0	76.9	59.5	45.5	17.3	4.8	56.3	57.0	0.0	0.0	331.
1972	0.0	0.0	89.3	140.5	44.3	22.3	7.3	5.9	4.0	11.9	0.0	0.0	325.
1973	0.0	0.0	19.1	17.4	24.4	0.0	5.0	4.4	6.4	14.8	0.0	0.0	92.
1974	0.0	0.0	0.0	208.9	101.8	36.2	16.7	5.1	0.0	1.2	0.0	0.0	370.
1975	0.0	0.0	0.0	0.0	185.1	24.5	19.0	8.4	0.0	12.6	0.0	0.0	250.
1976	0.0	0.0	0.4	271.8	109.5	40.6	30.6	0.3	0.0	6.5	0.0	0.0	460.
1977	0.0	0.0	2.3	16.8	11.4	5.8	6.0	2.7	0.0	0.0	0.0	0.0	45.
1978	0.0	0.0	0.0	0.0	37.8	7.1	16.3	0.0	0.0	0.0	0.0	0.0	61.
1979	0.0	0.0	0.0	0.0	156.9	12.5	6.4	0.0	0.0	0.0	0.0	0.0	176.
1980	0.0	0.0	0.0	59.5	5.3	0.0	7.6	2.5	0.0	0.0	0.0	0.0	75.
1981	0.0	0.0	43.4	14.6	3.6	0.0	0.2	0.4	0.0	0.0	0.0	0.0	62.
1982	0.0	0.0	0.2	217.8	20.7	2.2	0.0	0.0	0.0	0.0	0.0	0.0	241.
1983	0.0	0.0	0.0	202.5	83.7	9.7	0.0	0.0	12.9	0.0	0.0	0.0	309.
1984	0.0	0.0	45.3	17.0	2.8	0.0	0.0	0.0	6.7	0.0	0.0	0.0	72.
1985	0.0	0.0	3.5	151.2	92.1	5.1	0.0	7.2	5.7	0.9	0.0	0.0	266.
1986	0.0	0.0	62.5	63.9	146.9	59.3	14.7	0.0	0.0	0.0	0.0	0.0	347.
1987	0.0	0.0	148.9	0.0	8.9	0.6	6.5	0.0	0.0	14.7	0.0	0.0	180.
1988	0.0	0.0	0.0	14.9	6.7	0.0	0.0	0.0	0.0	5.4	0.0	0.0	27.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.
MAX	0.0	0.0	148.9	271.8	203.8	105.7	181.6	30.3	56.3	70.2	0.0	0.0	527.
MEAN	0.0	0.0	22.8	90.6	48.8	22.0	18.2	6.3	5.6	8.4	0.0	0.0	223.

Table A-29

GRENFELL DIVERSION

PRESENT USE - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1944	0.0	0.0	0.7	20.1	10.6	25.8	33.7	7.3	6.4	4.0	0.0	0.0	109.
1945	0.0	0.0	55.9	41.6	22.2	24.1	38.7	6.2	1.2	4.4	0.0	0.0	194.
1946	0.0	0.0	87.4	165.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1947	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1948	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1949	0.0	0.0	0.4	252.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1950	0.0	0.0	40.8	212.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1951	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1952	0.0	0.0	10.5	242.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1953	0.0	0.0	33.5	219.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1954	0.0	0.0	0.0	232.8	20.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1955	0.0	0.0	27.2	225.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1956	0.0	0.0	26.7	226.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1957	0.0	0.0	71.6	181.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1958	0.0	0.0	114.0	139.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1959	0.0	0.0	20.5	35.1	11.9	14.9	9.4	12.6	9.3	0.0	0.0	0.0	114.
1960	0.0	0.0	1.2	251.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1961	0.0	0.0	0.0	2.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.
1962	0.0	0.0	0.0	10.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.
1963	0.0	0.0	92.3	29.3	9.7	62.0	42.1	17.5	0.0	0.0	0.0	0.0	253.
1964	0.0	0.0	0.0	171.4	60.3	0.4	0.8	0.0	0.0	0.2	0.0	0.0	233.
1965	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1966	0.0	0.0	38.8	214.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1967	0.0	0.0	1.2	251.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1968	0.0	0.0	70.8	24.3	5.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	102.
1969	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1970	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1971	0.0	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1972	0.0	0.0	228.4	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1973	0.0	0.0	13.0	13.8	22.0	25.4	14.2	1.6	4.0	1.9	0.0	0.0	96.
1974	0.0	0.0	24.7	228.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1975	0.0	0.0	15.5	237.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1976	0.0	0.0	13.1	239.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1977	0.0	0.0	17.3	49.4	39.0	7.2	4.1	6.9	21.9	12.8	0.0	0.0	159.
1978	0.0	0.0	11.8	240.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1979	0.0	0.0	13.5	239.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1980	0.0	0.0	6.2	181.1	12.9	6.9	10.7	6.3	7.6	5.4	0.0	0.0	237.
1981	0.0	0.0	28.3	14.9	8.9	7.4	6.5	7.0	5.0	8.4	0.0	0.0	86.
1982	0.0	0.0	8.9	244.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1983	0.0	0.0	7.5	245.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1984	0.0	0.0	16.0	18.1	14.4	10.9	12.3	9.6	9.6	11.0	0.0	0.0	102.
1985	0.0	0.0	109.3	143.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1986	0.0	0.0	253.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1987	0.0	0.0	85.3	167.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	253.
1988	0.0	0.0	0.0	2.2	21.7	2.0	0.0	0.0	0.0	0.0	0.0	0.0	26.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.
MAX	0.0	0.0	253.0	253.0	60.3	62.0	42.1	17.5	21.9	12.8	0.0	0.0	253.
MEAN	0.0	0.0	33.6	162.3	5.7	4.1	3.8	1.6	1.4	1.0	0.0	0.0	213.

Table A-30

IRRIGATION PROJECT 14251

PRESENT USE - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	138.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1944	0.0	0.0	0.2	6.6	3.5	8.4	11.0	2.4	2.1	1.3	0.0	0.0	36.
1945	0.0	0.0	18.3	13.6	7.2	7.9	12.6	2.0	0.4	1.4	0.0	0.0	63.
1946	0.0	0.0	20.2	86.9	8.8	3.9	18.2	0.0	0.0	0.0	0.0	0.0	138.
1947	0.0	0.0	0.0	117.3	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1948	0.0	0.0	0.0	128.3	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1949	0.0	0.0	0.1	103.6	10.5	23.8	0.0	0.0	0.0	0.0	0.0	0.0	138.
1950	0.0	0.0	6.0	96.9	35.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1951	0.0	0.0	0.0	112.2	25.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1952	0.0	0.0	3.4	87.9	13.4	6.3	7.2	1.8	11.6	2.2	0.0	0.0	134.
1953	0.0	0.0	5.1	71.6	14.7	46.6	0.0	0.0	0.0	0.0	0.0	0.0	138.
1954	0.0	0.0	0.0	23.7	17.2	97.1	0.0	0.0	0.0	0.0	0.0	0.0	138.
1955	0.0	0.0	2.2	133.8	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1956	0.0	0.0	3.1	133.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1957	0.0	0.0	18.5	61.5	27.5	10.4	7.9	4.8	7.4	0.0	0.0	0.0	138.
1958	0.0	0.0	37.2	85.4	12.3	3.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1959	0.0	0.0	7.8	11.5	3.9	4.8	3.1	4.1	3.0	0.0	0.0	0.0	38.
1960	0.0	0.0	20.3	86.6	10.9	11.7	8.0	0.8	0.0	0.0	0.0	0.0	138.
1961	0.0	0.0	5.3	0.0	0.0	2.2	2.9	3.1	2.8	0.0	0.0	0.0	16.
1962	0.0	0.0	7.8	6.1	3.2	1.8	1.7	1.7	1.1	0.8	0.0	0.0	24.
1963	0.0	0.0	27.2	6.0	8.4	13.6	8.8	6.7	2.5	0.0	0.0	0.0	73.
1964	0.0	0.0	0.0	64.9	32.0	4.6	3.9	2.1	1.7	5.3	0.0	0.0	115.
1965	0.0	0.0	1.2	112.0	13.4	11.5	0.0	0.0	0.0	0.0	0.0	0.0	138.
1966	0.0	0.0	19.5	96.8	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1967	0.0	0.0	8.3	86.3	33.4	4.1	3.4	0.9	1.6	0.0	0.0	0.0	138.
1968	0.0	0.0	20.4	8.6	4.4	3.9	3.6	3.3	2.1	1.3	0.0	0.0	48.
1969	0.0	0.0	9.7	128.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1970	0.0	0.0	1.1	113.2	23.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1971	0.0	0.0	6.7	67.2	14.6	7.5	9.5	2.2	0.4	1.4	0.0	0.0	109.
1972	0.0	0.0	55.3	66.5	13.6	2.6	0.0	0.0	0.0	0.0	0.0	0.0	138.
1973	0.0	0.0	4.4	5.5	8.0	7.7	4.3	4.5	1.1	6.1	0.0	0.0	42.
1974	0.0	0.0	3.0	135.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1975	0.0	0.0	1.8	96.4	39.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1976	0.0	0.0	1.2	136.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1977	0.0	0.0	5.6	16.1	12.7	2.3	1.3	2.3	7.2	4.2	0.0	0.0	52.
1978	0.0	0.0	3.9	78.3	11.5	1.4	1.2	3.6	3.9	2.3	0.0	0.0	106.
1979	0.0	0.0	2.4	108.1	27.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1980	0.0	0.0	2.0	59.1	4.2	2.3	3.5	2.1	2.5	1.8	0.0	0.0	78.
1981	0.0	0.0	9.2	4.9	2.9	2.4	2.1	2.3	1.6	2.8	0.0	0.0	28.
1982	0.0	0.0	2.2	93.4	11.3	2.3	9.5	1.1	2.9	3.8	0.0	0.0	127.
1983	0.0	0.0	1.2	107.4	29.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	138.
1984	0.0	0.0	5.2	5.9	4.7	3.6	4.0	3.1	3.1	3.6	0.0	0.0	33.
1985	0.0	0.0	23.1	82.6	10.6	2.7	2.2	6.2	2.5	4.8	0.0	0.0	135.
1986	0.0	0.0	79.2	17.6	31.6	5.1	3.2	1.2	0.0	0.0	0.0	0.0	138.
1987	0.0	0.0	7.8	83.3	10.6	4.0	4.4	3.9	5.0	4.5	0.0	0.0	124.
1988	0.0	0.0	3.1	8.9	13.7	3.9	7.2	5.4	4.9	3.4	0.0	0.0	51.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.
MAX	0.0	0.0	79.2	138.0	39.8	97.1	18.2	6.7	11.6	6.1	0.0	0.0	138.
MEAN	0.0	0.0	10.0	71.6	13.3	6.8	3.1	1.6	1.6	1.1	0.0	0.0	109.

Table A-31

MOOSOMIN RESERVOIR

PRESENT USE NET EVAPORATION - dam^3

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1943	0.0	0.0	0.0	-474.3	192.8	184.0	538.4	377.7	370.7	142.0	0.0	0.0	1331.
1944	0.0	0.0	0.0	-82.9	366.9	-285.1	455.3	275.9	295.5	241.1	0.0	0.0	1267.
1945	0.0	0.0	-259.8	140.0	401.8	140.0	530.3	610.7	267.0	187.5	0.0	0.0	2018.
1946	0.0	0.0	0.0	-160.7	383.0	381.0	69.6	417.8	238.5	13.4	0.0	0.0	1343.
1947	0.0	0.0	0.0	-103.7	450.0	-629.9	583.9	251.8	235.9	227.7	0.0	0.0	1016.
1948	0.0	0.0	0.0	-464.0	235.7	261.8	233.0	377.7	482.1	155.3	0.0	0.0	1282.
1949	0.0	0.0	0.0	-279.9	350.9	82.9	37.5	396.4	401.8	67.0	0.0	0.0	1057.
1950	0.0	0.0	0.0	-492.5	179.5	261.8	-133.9	182.1	285.1	211.6	0.0	0.0	494.
1951	0.0	0.0	0.0	-710.2	514.3	316.2	447.3	297.3	137.4	45.5	0.0	0.0	1048.
1952	0.0	0.0	0.0	-114.0	492.8	155.5	519.6	50.9	365.5	273.2	0.0	0.0	1744.
1953	0.0	0.0	0.0	-391.4	93.7	-186.6	313.4	500.9	362.9	53.6	0.0	0.0	746.
1954	0.0	0.0	0.0	-251.4	340.2	-256.6	334.8	358.9	-54.4	182.1	0.0	0.0	654.
1955	0.0	0.0	0.0	-471.7	83.0	282.5	160.7	578.5	339.6	168.7	0.0	0.0	1141.
1956	0.0	0.0	0.0	-733.5	337.5	406.9	150.0	450.0	396.6	136.6	0.0	0.0	1144.
1957	0.0	0.0	0.0	-326.6	450.0	305.9	608.0	308.0	412.1	85.7	0.0	0.0	1843.
1958	0.0	0.0	0.0	-54.4	683.0	609.1	487.5	600.0	417.3	195.5	0.0	0.0	2938.
1959	0.0	0.0	-340.2	261.8	535.7	497.7	618.7	549.1	199.6	-123.2	0.0	0.0	2199.
1960	0.0	0.0	0.0	-121.8	316.1	484.7	741.9	541.0	585.8	254.4	0.0	0.0	2802.
1961	0.0	0.0	-337.5	199.6	433.9	803.5	744.6	905.3	233.3	187.5	0.0	0.0	3170.
1962	0.0	0.0	-345.5	160.7	99.1	326.6	364.3	340.2	451.0	34.8	0.0	0.0	1431.
1963	0.0	0.0	-225.0	10.4	235.7	140.0	257.1	289.3	435.5	302.7	0.0	0.0	1446.
1964	0.0	0.0	0.0	-158.1	340.2	272.2	514.3	538.4	399.2	251.8	0.0	0.0	2158.
1965	0.0	0.0	0.0	-222.9	265.2	476.9	393.7	533.0	-269.6	286.6	0.0	0.0	1463.
1966	0.0	0.0	0.0	-290.3	484.8	399.2	401.8	101.8	360.3	195.5	0.0	0.0	1653.
1967	0.0	0.0	0.0	-448.4	511.6	570.2	688.3	712.5	427.7	37.5	0.0	0.0	2499.
1968	0.0	0.0	-372.3	222.9	431.2	593.6	591.9	158.0	381.0	45.5	0.0	0.0	2052.
1969	0.0	0.0	0.0	-668.7	474.1	349.9	37.5	637.5	267.0	64.3	0.0	0.0	1162.
1970	0.0	0.0	0.0	-484.7	302.7	513.2	109.8	645.5	85.5	-53.6	0.0	0.0	1118.
1971	0.0	0.0	0.0	-272.2	557.1	-54.4	533.0	629.4	295.5	-13.4	0.0	0.0	1675.
1972	0.0	0.0	-396.4	204.8	286.6	508.0	369.6	187.5	394.0	203.6	0.0	0.0	1758.
1973	0.0	0.0	0.0	-93.3	324.1	220.3	490.1	549.1	-103.7	69.6	0.0	0.0	1456.
1974	0.0	0.0	0.0	-544.3	101.8	591.0	624.1	313.4	324.0	136.6	0.0	0.0	1547.
1975	0.0	0.0	0.0	-648.0	337.5	23.3	629.4	16.1	-163.3	42.9	0.0	0.0	238.
1976	0.0	0.0	0.0	-661.0	538.4	-41.5	602.6	471.4	531.4	249.1	0.0	0.0	1690.
1977	0.0	0.0	0.0	90.7	233.0	370.7	214.3	441.9	64.8	246.4	0.0	0.0	1662.
1978	0.0	0.0	0.0	-127.0	267.8	186.6	171.4	516.9	246.2	155.3	0.0	0.0	1417.
1979	0.0	0.0	0.0	-603.9	123.2	632.4	578.5	541.0	233.3	109.8	0.0	0.0	1614.
1980	0.0	0.0	0.0	-46.7	645.5	438.0	142.0	32.1	233.3	150.0	0.0	0.0	1594.
1981	0.0	0.0	-251.8	129.6	364.3	254.0	613.4	249.1	355.1	-26.8	0.0	0.0	1687.
1982	0.0	0.0	0.0	-62.2	308.0	557.3	455.3	423.2	279.9	-77.7	0.0	0.0	1884.
1983	0.0	0.0	0.0	-165.9	310.7	596.2	407.1	822.3	386.2	160.7	0.0	0.0	2517.
1984	0.0	0.0	0.0	-202.2	533.0	456.2	867.8	774.1	181.4	93.7	0.0	0.0	2704.
1985	0.0	0.0	0.0	-64.8	468.7	308.4	709.8	50.9	7.8	238.4	0.0	0.0	1719.
1986	0.0	0.0	-179.5	158.1	417.8	80.4	265.2	648.2	199.6	139.3	0.0	0.0	1729.
1987	0.0	0.0	0.0	54.4	533.0	396.6	278.6	543.7	339.6	233.0	0.0	0.0	2379.
1988	0.0	0.0	0.0	36.3	214.3	730.9	741.9	613.4	313.6	222.3	0.0	0.0	2873.
MIN	0.0	0.0	-396.4	-733.5	83.0	-629.9	-133.9	16.1	-269.6	-123.2	0.0	0.0	238.
MAX	0.0	0.0	0.0	261.8	683.0	803.5	867.8	905.3	585.8	302.7	0.0	0.0	3170.
MEAN	0.0	0.0	-58.9	-202.8	359.8	298.1	423.8	430.6	274.5	134.8	0.0	0.0	1660.

Table A-32

MOOSOMIN RESERVOIR

PRESENT USE SPILL - m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	0.000	0.000	0.000	21.1	1.47	0.864	0.000	0.000	0.000	0.000	0.000	0.000	60800
1944	0.023	0.047	0.000	0.312	0.000	0.489	0.316	0.000	0.000	0.000	0.066	0.057	3420
1945	0.047	0.047	1.16	0.659	0.134	0.334	0.363	0.000	0.000	0.000	0.000	0.000	7260
1946	0.000	0.007	1.37	7.12	0.339	0.000	1.85	0.000	0.000	0.066	0.250	0.101	29100
1947	0.071	0.070	0.000	14.1	2.40	6.62	2.83	0.341	0.144	0.085	0.223	0.090	70500
1948	0.062	0.062	0.000	15.0	8.62	1.09	0.570	0.271	0.000	0.153	0.275	0.112	68700
1949	0.079	0.079	0.000	6.90	0.365	1.84	0.210	0.121	0.000	0.000	0.161	0.084	25500
1950	0.059	0.059	0.535	11.4	5.14	1.94	2.69	2.64	0.327	0.214	0.265	0.107	66900
1951	0.076	0.075	0.000	11.6	6.93	0.557	0.243	0.042	0.131	0.433	0.315	0.129	53800
1952	0.092	0.092	0.184	5.69	0.463	0.230	0.083	0.063	0.504	0.000	0.176	0.077	19900
1953	0.053	0.053	0.443	8.74	1.56	10.0	3.37	0.392	0.000	0.146	0.247	0.100	65600
1954	0.070	0.069	0.000	4.91	3.88	13.7	20.2	1.90	2.14	3.85	2.22	0.409	141000
1955	0.297	0.298	0.298	22.6	28.4	15.8	8.02	0.513	1.04	0.117	0.222	0.089	204600
1956	0.062	0.061	0.322	17.3	6.52	1.53	1.64	0.558	0.132	1.26	1.08	0.786	81900
1957	0.810	0.812	1.18	5.08	1.50	0.465	0.146	0.156	0.808	1.08	0.651	0.036	33200
1958	0.000	0.000	2.08	5.71	0.391	0.000	0.000	0.000	0.000	0.000	0.000	0.000	21400
1959	0.000	0.000	0.449	0.412	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2270
1960	0.000	0.000	0.892	6.42	0.450	0.425	0.057	0.044	0.046	1.09	0.264	0.062	25500
1961	0.006	0.000	0.445	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1210
1962	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
1963	0.000	0.000	0.697	0.259	0.297	0.633	0.280	0.218	0.000	0.000	0.077	0.195	7030
1964	0.153	0.030	0.000	4.20	1.59	0.043	0.000	0.000	0.000	0.000	0.092	0.034	16100
1965	0.007	0.000	0.048	7.38	0.563	0.437	0.035	0.000	0.709	0.015	0.188	0.306	25200
1966	0.144	0.029	1.13	6.66	1.60	0.281	0.083	0.063	0.000	0.000	0.000	0.344	27100
1967	0.406	0.457	0.472	5.77	1.61	0.000	0.000	0.000	0.000	0.000	0.000	0.000	22700
1968	0.000	0.000	1.08	0.256	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3550
1969	0.000	0.000	0.735	18.4	1.48	0.018	2.31	0.000	0.000	0.000	0.723	0.199	62400
1970	0.060	0.259	0.073	11.2	6.88	0.344	0.302	0.000	0.046	0.208	0.402	0.256	52400
1971	0.226	0.138	0.378	4.34	0.489	0.376	0.212	0.000	0.000	0.000	0.041	0.180	16600
1972	0.146	0.122	3.85	5.23	0.699	0.115	0.273	0.083	0.000	0.020	0.177	0.018	28200
1973	0.000	0.000	0.236	0.247	0.208	0.259	0.000	0.000	0.011	0.256	0.134	0.089	3800
1974	0.033	0.063	0.293	19.4	7.31	1.64	0.000	0.000	0.000	0.000	0.136	0.061	75700
1975	0.018	0.000	0.181	13.6	9.15	3.01	0.079	0.387	5.70	3.28	1.36	0.411	97600
1976	0.262	0.363	0.137	54.8	4.52	8.52	0.792	0.698	1.62	0.992	0.374	0.214	190000
1977	0.177	0.151	0.309	0.783	0.548	0.000	0.000	0.000	0.030	0.095	0.013	0.010	5560
1978	0.018	0.018	0.209	4.564	0.455	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13700
1979	0.000	0.000	0.019	10.5	5.50	0.837	0.000	0.000	0.000	0.000	0.046	0.031	44300
1980	0.000	0.012	0.101	3.38	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.055	9210
1981	0.040	0.005	0.559	0.082	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1830
1982	0.000	0.000	0.000	6.34	0.534	0.000	0.136	0.000	0.000	0.137	0.012	0.047	18800
1983	0.030	0.000	0.115	10.8	2.92	0.344	0.000	0.000	0.000	0.000	0.000	0.000	37000
1984	0.000	0.000	0.140	2.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5560
1985	0.000	0.000	1.17	7.97	0.472	0.000	0.000	0.106	0.177	0.222	0.242	0.135	27400
1986	0.044	0.100	6.27	1.90	2.22	0.246	0.041	0.000	0.000	0.000	0.354	0.104	30000
1987	0.090	0.059	1.02	5.81	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18200
1988	0.000	0.000	0.000	0.000	0.275	0.000	0.000	0.000	0.000	0.000	0.000	0.000	737
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	0.810	0.812	6.27	54.8	28.4	15.8	20.2	2.64	5.70	3.85	2.22	0.786	205000
MEAN	0.080	0.079	0.621	8.06	2.56	1.59	1.03	0.187	0.295	0.298	0.235	0.107	39600

APPENDIX B

RECORDED AND NATURAL STREAMFLOW ARRAYS

LIST OF TABLES

TABLE B-1

PIPESTONE CREEK ABOVE MOOSOMIN LAKE 05NE003

RECORDED FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1960	---	---	0.000	4.41	0.567	0.380	0.003	0.000	0.000	0.000	---	---
1961	---	---	0.000	0.014	0.007	0.000	0.000	0.000	0.000	0.000	---	---
1962	---	---	0.000	0.100	0.007	0.000	0.000	0.000	0.000	0.000	---	---
1963	---	---	0.882	0.210	0.081	0.470	0.322	0.220	0.001	0.009	---	---
1964	---	---	0.000	1.62	0.584	0.004	0.008	0.000	0.000	0.002	---	---
1965	---	---	0.000	3.74	0.519	0.830	0.158	0.046	0.336	0.284	---	---
1966	---	---	0.370	2.55	0.947	0.288	0.200	0.068	0.079	0.089	---	---
1967	---	---	0.000	3.03	0.932	0.065	0.000	0.000	0.000	0.000	---	---
1968	---	---	0.630	0.186	0.049	0.004	0.000	0.000	0.000	0.000	---	---
1969	---	---	0.000	8.12	0.918	0.062	0.195	0.000	0.000	0.000	---	---
1970	---	---	0.000	4.62	3.94	0.531	0.147	0.091	0.004	0.000	---	---
1971	---	---	0.000	2.69	0.821	0.337	0.199	0.001	0.000	0.000	---	---
1972	---	---	2.03	3.02	0.712	0.277	0.205	0.037	0.000	0.000	---	---
1973	---	---	0.133	0.115	0.185	0.217	0.141	0.016	0.042	0.019	---	---
1987	---	---	0.797	3.530	0.036	0.001	0.008	0.002	0.005	0.000	---	---
1988	---	---	0.000	0.003	0.222	0.021	0.000	0.000	0.000	0.000	---	---
MIN	---	---	0.000	0.003	0.007	0.000	0.000	0.000	0.000	0.000	---	---
MAX	---	---	2.03	8.12	3.94	0.830	0.322	0.220	0.336	0.284	---	---
MEAN	---	---	0.303	2.37	0.658	0.218	0.099	0.030	0.029	0.025	---	---

TABLE B-2

PIPESTONE CREEK NEAR MOOSOMIN 05NE001

RECORDED FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1958	------	------	0.107	5.48	0.480	0.042	0.102	0.055	0.251	0.556	------	------
1959	------	------	0.092	0.000	0.000	0.000	0.015	0.100	0.177	0.000	------	------
1960	------	------	0.507	5.55	0.222	0.704	0.366	0.216	0.250	1.85	------	------
1961	------	------	0.322	0.093	0.021	0.001	0.000	0.030	0.047	0.018	------	------
1962	------	------	0.041	0.068	0.007	0.000	0.000	0.000	0.000	0.004	------	------
1963	------	------	0.015	0.264	0.205	0.521	0.442	0.130	0.167	0.186	------	------
1964	------	------	0.051	3.22	1.51	0.111	0.074	0.000	0.009	0.415	------	------
1965	------	------	0.120	6.07	0.370	0.654	0.197	0.016	0.963	0.346	------	------
1966	------	------	1.07	6.26	1.21	0.502	0.201	0.029	0.105	0.104	------	------
1967	------	------	0.482	5.04	1.71	0.078	0.008	0.000	0.248	0.016	------	------
1968	------	------	1.01	0.456	0.088	0.040	0.000	0.134	0.076	0.000	------	------
1969	------	------	0.795	16.2	1.02	0.133	2.360	0.063	0.022	0.132	------	------
1970	------	------	0.172	8.37	6.94	0.607	0.321	0.284	0.475	0.409	------	------
1971	------	------	0.145	3.97	0.261	0.196	0.452	0.067	0.238	0.125	------	------
1972	------	------	4.03	5.37	0.488	0.304	0.076	0.164	0.314	0.399	------	------
1973	------	------	0.159	0.235	0.053	0.143	0.097	0.063	0.261	0.554	------	------
1974	------	------	0.451	18.6	7.54	1.53	0.217	0.028	0.137	0.461	------	------
1975	------	------	0.331	11.2	10.0	3.36	0.123	0.198	5.65	3.38	------	------
1976	------	------	0.540	53.9	4.34	8.59	1.15	0.464	2.06	1.36	------	------
1977	------	------	0.301	0.735	0.151	0.037	0.002	0.000	0.637	0.163	------	------
1978	------	------	0.147	4.40	0.044	0.040	0.031	0.187	0.244	0.293	------	------
1979	------	------	0.165	9.75	5.56	0.750	0.243	0.096	0.203	0.444	------	------
1980	------	------	0.133	2.62	0.093	0.148	0.172	0.014	0.060	0.142	------	------
1981	------	------	0.519	0.153	0.009	0.077	0.012	0.009	0.013	0.167	0.152	------
1982	------	------	0.014	5.52	0.718	0.084	0.108	0.146	0.128	0.377	------	------
1983	------	------	0.077	10.7	2.48	0.484	0.043	0.245	0.347	0.012	0.012	0.343
1984	0.149	0.087	0.053	0.019	0.007	0.004	0.002	0.297	0.187	0.137	------	------
1985	------	------	0.828	7.20	0.658	0.061	0.024	0.055	0.148	0.255	------	------
1986	------	------	6.07	1.21	2.32	0.333	0.123	0.069	0.061	0.646	------	------
1987	------	------	0.962	5.18	0.017	0.014	0.018	0.015	0.255	0.228	------	------
1988	------	------	0.131	0.076	0.008	0.005	0.003	0.006	0.223	0.114	------	------
MIN	0.149	0.087	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.343
MAX	0.149	0.087	6.07	53.9	10.0	8.59	2.36	0.464	5.65	3.38	0.152	0.343
MEAN	0.149	0.087	0.640	6.38	1.57	0.631	0.225	0.103	0.450	0.429	0.082	0.343

TABLE B-3

PIPESTONE CREEK NEAR THE SASKATCHEWAN BOUNDARY 05NG024

RECORDED FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1982	---	---	---	---	---	---	---	---	0.002	0.400	0.033	0.088	---
1983	0.068	0.036	0.055	12.1	3.04	0.551	0.028	0.129	0.436	0.001	0.002	0.272	43600
1984	0.113	0.073	0.262	0.099	0.020	0.001	0.000	0.060	0.219	0.075	0.005	0.003	2440
1985	0.000	0.000	0.847	8.05	1.16	0.090	0.008	0.094	0.180	0.260	0.355	0.263	29500
1986	0.209	0.278	6.44	1.60	3.19	0.696	0.210	0.036	0.041	0.476	0.711	0.041	37000
1987	0.015	0.017	1.65	5.16	0.058	0.017	0.048	0.014	0.190	0.296	0.011	0.004	19600
1988	0.000	0.000	0.099	0.146	0.039	0.001	0.000	0.000	0.010	0.139	0.024	0.002	1220
MIN	0.000	0.000	0.055	0.099	0.020	0.001	0.000	0.000	0.002	0.001	0.002	0.002	1220
MAX	0.209	0.278	6.44	12.1	3.19	0.696	0.210	0.129	0.436	0.476	0.711	0.272	43600
MEAN	0.068	0.067	1.56	4.53	1.25	0.226	0.049	0.055	0.154	0.235	0.163	0.096	22200

TABLE B-4

PIPESTONE CREEK NEAR PIPESTONE 05NG003

RECORDED FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	---	23.0	1.73	1.24	0.387	0.104	0.058	0.096	---	---	---
1944	---	---	0.000	0.480	0.247	0.657	0.801	0.171	0.160	0.097	---	---	---
1945	---	---	1.35	1.02	0.523	0.612	0.917	0.150	0.030	0.107	---	---	---
1946	---	---	---	7.89	0.758	0.335	2.52	0.161	0.036	0.328	---	---	---
1947	---	---	0.000	14.7	2.55	7.71	3.81	0.564	0.318	0.244	---	---	---
1948	---	---	---	---	10.2	1.61	0.963	0.560	0.188	---	---	---	---
1949	---	---	0.000	7.85	0.761	2.52	0.400	0.408	0.051	0.222	---	---	---
1950	---	---	0.668	11.3	5.90	2.58	3.29	3.32	0.574	0.386	---	---	---
1951	---	---	0.000	11.6	8.77	0.928	0.667	0.238	0.248	0.561	---	---	---
1952	---	---	0.269	6.73	0.983	0.486	0.515	0.136	0.879	0.165	---	---	---
1953	---	---	---	8.10	1.61	12.0	4.32	0.765	0.121	0.317	---	---	---
1954	---	---	0.000	3.50	2.47	14.8	24.0	2.44	2.49	4.63	2.71	---	---
1955	---	---	---	23.9	30.8	16.5	7.64	1.07	1.25	0.143	---	---	---
1956	---	---	---	17.5	7.18	1.96	2.06	0.747	0.223	1.51	1.37	1.06	---
1957	1.02	1.02	1.55	5.34	2.33	0.771	0.425	0.170	3.00	1.78	0.335	0.069	46600
1958	0.005	0.001	1.11	6.52	0.896	0.072	0.110	0.027	0.020	0.580	0.254	0.000	25100
1959	0.000	0.000	0.634	0.546	0.133	0.045	0.023	0.005	0.252	0.115	0.111	0.045	5030
1960	0.000	0.000	0.011	6.91	0.636	0.367	0.144	0.116	0.133	1.05	0.373	0.113	25700
1961	0.048	0.047	0.407	0.721	0.236	0.073	0.022	0.003	0.002	0.005	0.039	0.058	4360
1962	0.055	0.057	0.058	0.882	0.076	0.427	0.090	0.226	0.007	0.000	0.000	0.000	4900
1963	0.000	0.000	1.29	0.597	0.405	0.996	0.899	0.469	0.251	0.260	0.442	0.320	15700
1964	0.245	0.096	0.037	6.03	2.96	0.796	0.210	0.200	0.486	0.763	0.422	0.125	32400
1965	0.083	0.082	0.117	8.18	0.612	0.916	2.22	0.295	1.25	1.14	0.436	0.383	41100
1966	0.178	0.024	0.792	7.19	1.95	0.944	0.320	0.238	0.306	0.393	0.283	0.421	34200
1967	0.478	0.505	0.804	6.29	2.23	0.170	0.064	0.017	0.016	0.077	0.033	0.040	28000
1968	0.162	0.166	2.59	1.32	0.183	0.015	0.004	0.034	0.076	0.054	0.050	0.088	12500
1969	0.000	0.000	0.000	20.0	2.29	0.835	2.93	0.553	0.135	0.304	1.22	0.339	74700
1970	0.155	0.419	0.495	10.6	10.1	1.53	0.833	0.442	0.647	0.585	0.543	0.387	70400
1971	0.351	0.207	0.303	4.87	0.935	0.722	0.638	0.110	0.901	0.777	0.301	0.163	26900
1972	0.097	0.079	5.17	7.27	1.06	0.593	0.158	0.229	0.362	0.552	0.300	0.062	41900
1973	0.023	0.049	0.376	0.429	0.327	0.069	0.142	0.102	0.331	0.721	0.246	0.179	7910
1974	0.108	0.122	0.150	23.8	9.99	2.42	0.610	0.134	0.062	0.486	0.428	0.271	101000
1975	0.189	0.037	0.009	9.06	15.5	4.10	0.678	0.436	4.59	3.75	1.78	0.646	108000
1976	0.456	0.607	0.556	66.1	9.10	10.4	2.47	0.466	1.87	1.64	0.473	0.313	246000
1977	0.253	0.220	0.325	0.928	0.276	0.093	0.059	0.019	0.069	0.123	0.056	0.062	6490
1978	0.044	0.037	0.090	3.87	0.491	0.116	0.214	0.026	0.151	0.287	0.082	0.032	14200
1979	0.012	0.010	0.009	8.81	8.21	0.956	0.340	0.059	0.024	0.405	0.137	0.042	50100
1980	0.012	0.008	0.034	3.35	0.148	0.040	0.248	0.031	0.010	0.043	0.268	0.077	11100
1981	0.064	0.056	1.02	0.321	0.045	0.015	0.002	0.002	0.001	0.003	0.006	0.003	4080
1982	0.000	0.000	0.013	8.29	0.967	0.100	0.010	0.005	0.008	0.311	0.031	0.032	25400
1983	0.059	0.070	0.077	12.4	3.64	1.23	0.151	0.016	0.860	0.032	0.021	0.061	48600
1984	0.019	0.087	1.43	0.751	0.296	0.029	0.004	0.002	0.115	0.156	0.053	0.010	7800
1985	0.002	0.002	1.79	7.75	1.45	0.121	0.061	0.619	0.202	0.380	0.240	0.189	33600
1986	0.335	0.314	5.91	2.32	3.39	1.26	0.294	0.035	0.027	0.416	0.601	0.047	39600
1987	0.052	0.049	1.71	7.73	0.251	0.131	0.079	0.019	0.059	0.703	0.094	0.065	28600
1988	0.011	0.001	0.043	0.199	0.082	0.028	0.003	0.001	0.002	0.002	0.001	0.001	982
MIN	0.000	0.000	0.000	0.199	0.045	0.015	0.002	0.001	0.001	0.000	0.000	0.000	982
MAX	1.02	1.02	5.91	66.1	30.8	16.5	24.0	3.32	4.59	4.63	2.71	1.06	246000
MEAN	0.141	0.137	0.780	8.60	3.38	2.05	1.45	0.347	0.497	0.593	0.404	0.173	38200

TABLE B-5

PIPESTONE CREEK ABOVE MOOSOMIN RESERVOIR 05NE003

NATURAL FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1960	---	---	0.011	4.60	0.580	0.401	0.003	0.000	0.000	0.000	---	---
1961	---	---	0.000	0.023	0.007	0.000	0.000	0.000	0.000	0.000	---	---
1962	---	---	0.000	0.109	0.007	0.000	0.000	0.000	0.000	0.000	---	---
1963	---	---	0.944	0.310	0.100	0.656	0.431	0.279	0.001	0.009	---	---
1964	---	---	0.000	1.81	0.617	0.004	0.008	0.000	0.000	0.002	---	---
1965	---	---	0.000	3.92	0.529	0.842	0.180	0.046	0.348	0.296	---	---
1966	---	---	0.370	2.64	0.971	0.310	0.223	0.076	0.079	0.093	---	---
1967	---	---	0.011	3.14	0.954	0.069	0.004	0.000	0.000	0.000	---	---
1968	---	---	0.724	0.257	0.053	0.008	0.004	0.000	0.000	0.000	---	---
1969	---	---	0.000	8.24	0.937	0.071	0.217	0.000	0.000	0.000	---	---
1970	---	---	0.000	4.74	3.95	0.559	0.163	0.091	0.004	0.000	---	---
1971	---	---	0.000	2.82	0.845	0.342	0.219	0.001	0.000	0.000	---	---
1972	---	---	2.13	2.26	0.725	0.304	0.226	0.037	0.000	0.000	---	---
1973	---	---	0.133	0.146	0.225	0.269	0.145	0.016	0.042	0.019	---	---
1987	---	---	0.823	3.57	0.036	0.001	0.008	0.002	0.005	0.000	---	---
1988	---	---	0.000	0.023	0.222	0.021	0.000	0.000	0.000	0.000	---	---
MIN	---	---	0.000	0.023	0.007	0.000	0.000	0.000	0.000	0.000	---	---
MAX	---	---	2.13	8.24	3.95	0.842	0.431	0.279	0.348	0.296	---	---
MEAN	---	---	0.322	2.41	0.672	0.241	0.114	0.034	0.030	0.026	---	---

TABLE B-6

PIPESTONE CREEK NEAR MOOSOMIN 05NE001

NATURAL FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1958	------	------	2.17	5.15	0.813	0.239	0.202	0.169	0.184	0.478	------	------
1959	------	------	0.389	0.689	0.227	0.292	0.179	0.241	0.184	0.000	------	------
1960	------	------	1.29	5.69	0.695	0.767	0.512	0.325	0.354	1.26	------	------
1961	------	------	0.311	0.000	0.000	0.134	0.169	0.179	0.170	0.000	------	------
1962	------	------	0.455	0.367	0.186	0.108	0.099	0.097	0.069	0.049	------	------
1963	------	------	1.59	0.368	0.488	0.821	0.514	0.391	0.151	0.000	------	------
1964	------	------	0.000	3.91	1.86	0.276	0.229	0.123	0.100	0.310	------	------
1965	------	------	0.070	6.75	0.781	0.753	0.327	0.114	0.770	0.163	------	------
1966	------	------	1.58	5.93	1.93	0.576	0.374	0.152	0.000	0.003	------	------
1967	------	------	0.552	4.84	1.95	0.247	0.197	0.055	0.111	0.150	------	------
1968	------	------	1.19	0.516	0.259	0.234	0.212	0.194	0.129	0.074	------	------
1969	------	------	0.869	16.2	1.61	0.278	2.45	0.196	0.108	0.000	------	------
1970	------	------	0.086	9.37	7.10	0.709	0.471	0.297	0.169	0.195	------	------
1971	------	------	0.392	4.05	0.855	0.451	0.557	0.129	0.026	0.081	------	------
1972	------	------	3.78	4.68	0.927	0.474	0.554	0.211	0.076	0.263	------	------
1973	------	------	0.257	0.336	0.467	0.459	0.250	0.260	0.067	0.356	------	------
1974	------	------	0.316	17.4	7.06	2.02	0.311	0.086	0.161	0.207	------	------
1975	------	------	0.194	11.6	7.40	2.59	0.488	0.429	5.65	3.33	------	------
1976	------	------	0.155	52.7	2.85	6.58	0.147	0.967	1.91	1.13	------	------
1977	------	------	0.328	0.972	0.742	0.141	0.079	0.132	0.431	0.243	------	------
1978	------	------	0.225	4.72	0.669	0.084	0.072	0.212	0.234	0.135	------	------
1979	------	------	0.186	8.66	5.67	1.25	0.271	0.149	0.122	0.281	------	------
1980	------	------	0.117	3.56	0.246	0.136	0.204	0.120	0.148	0.102	------	------
1981	------	------	0.539	0.292	0.170	0.145	0.124	0.134	0.098	0.161	------	------
1982	------	------	0.147	6.60	0.771	0.163	0.652	0.076	0.206	0.257	------	------
1983	------	------	0.107	9.78	3.16	0.741	0.198	0.196	0.198	0.130	------	------
1984	------	------	0.305	0.357	0.274	0.214	0.233	0.182	0.188	0.209	------	------
1985	------	------	1.71	6.32	0.787	0.204	0.162	0.460	0.189	0.357	------	------
1986	------	------	6.28	1.44	2.51	0.422	0.252	0.145	0.126	0.233	------	------
1987	------	------	1.04	5.97	0.330	0.117	0.130	0.111	0.148	0.125	------	------
1988	------	------	0.085	0.270	0.590	0.129	0.193	0.147	0.136	0.092	------	------
MIN	------	------	0.000	0.000	0.000	0.084	0.072	0.055	0.000	0.000	------	------
MAX	------	------	6.28	52.7	7.40	6.58	2.45	0.967	5.65	3.33	------	------
MEAN	------	------	0.862	6.43	1.72	0.702	0.349	0.215	0.407	0.335	------	------

TABLE B-7

PIPESTONE CREEK NEAR THE SASKATCHEWAN BOUNDARY 05NG024

NATURAL FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1982	---	---	---	---	---	---	---	---	0.080	0.278	0.032	0.077	---
1983	0.055	0.019	0.085	11.1	3.69	0.804	0.183	0.080	0.282	0.119	0.000	0.198	43400
1984	0.050	0.003	0.497	0.431	0.286	0.211	0.231	0.000	0.217	0.147	0.057	0.097	5890
1985	0.082	0.086	1.73	7.12	1.26	0.231	0.146	0.496	0.219	0.362	0.280	0.162	31900
1986	0.061	0.126	6.63	1.81	3.32	0.762	0.333	0.112	0.106	0.063	0.480	0.128	37000
1987	0.112	0.080	1.67	5.95	0.368	0.120	0.158	0.110	0.083	0.187	0.070	0.059	23500
1988	0.047	0.064	0.053	0.336	0.619	0.124	0.190	0.140	0.000	0.115	---	---	---
MIN	0.047	0.003	0.053	0.336	0.286	0.120	0.146	0.000	0.000	0.063	0.000	0.059	5890
MAX	0.112	0.126	6.63	11.1	3.69	0.804	0.333	0.496	0.282	0.362	0.480	0.198	43400
MEAN	0.068	0.063	1.78	4.46	1.59	0.375	0.207	0.157	0.141	0.181	0.153	0.120	28300

TABLE B-8

PIPESTONE CREEK NEAR PIPESTONE 05NG003

NATURAL FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	---	23.0	1.75	1.25	0.407	0.109	0.058	0.096	---	---	---
1944	---	---	0.017	0.506	0.258	0.649	0.821	0.177	0.160	0.097	---	---	---
1945	---	---	1.36	1.05	0.541	0.607	0.943	0.150	0.030	0.107	---	---	---
1946	---	---	---	7.95	0.777	0.354	2.54	0.161	0.036	0.353	---	---	---
1947	---	---	0.000	14.7	2.57	7.70	3.84	0.572	0.324	0.254	---	---	---
1948	---	---	---	---	10.2	1.63	0.984	0.572	0.188	---	---	---	---
1949	---	---	0.010	7.89	0.774	2.59	0.403	0.426	0.051	0.223	---	---	---
1950	---	---	0.675	11.3	5.91	2.59	3.30	3.34	0.587	0.393	---	---	---
1951	---	---	0.000	11.6	8.79	0.928	0.695	0.250	0.250	0.561	---	---	---
1952	---	---	0.255	6.77	1.00	0.487	0.533	0.138	0.892	0.165	---	---	---
1953	---	---	---	8.13	1.61	12.0	4.33	0.785	0.121	0.332	---	---	---
1954	---	---	0.000	3.53	2.48	14.8	24.0	2.45	2.48	4.64	2.71	---	---
1955	---	---	---	24.0	30.9	16.4	7.39	0.958	1.43	0.246	---	---	---
1956	---	---	---	18.1	7.05	2.16	2.15	0.967	0.427	1.59	1.34	0.978	---
1957	1.03	1.04	1.53	5.25	2.27	0.890	0.653	0.400	1.30	1.41	0.834	0.061	43700
1958	0.000	0.000	3.18	6.20	1.23	0.269	0.210	0.141	0.000	0.502	0.094	0.000	31100
1959	0.000	0.000	0.931	1.24	0.360	0.338	0.188	0.146	0.259	0.002	0.024	0.000	9170
1960	0.000	0.000	0.794	7.05	1.11	0.430	0.290	0.225	0.237	0.459	0.349	0.094	28900
1961	0.024	0.000	0.396	0.298	0.000	0.206	0.191	0.152	0.126	0.000	0.005	0.020	3740
1962	0.000	0.000	0.473	1.18	0.256	0.538	0.192	0.326	0.077	0.046	0.087	0.061	8510
1963	0.079	0.098	2.87	0.707	0.693	1.31	0.980	0.740	0.240	0.000	0.420	0.265	22200
1964	0.211	0.055	0.000	6.73	3.32	0.971	0.374	0.333	0.582	0.660	0.373	0.070	35900
1965	0.029	0.019	0.070	8.87	1.03	1.03	2.36	0.402	1.06	0.960	0.262	0.400	43200
1966	0.196	0.053	1.31	6.87	2.68	1.03	0.503	0.370	0.000	0.294	0.364	0.518	37200
1967	0.535	0.602	0.877	6.10	2.47	0.351	0.265	0.084	0.000	0.214	0.083	0.083	30500
1968	0.193	0.265	2.77	1.39	0.360	0.221	0.228	0.106	0.135	0.131	0.136	0.160	16100
1969	0.017	0.044	0.077	20.0	2.88	0.993	3.03	0.698	0.227	0.111	1.18	0.259	77100
1970	0.089	0.336	0.412	11.6	10.3	1.65	0.995	0.467	0.347	0.374	0.511	0.331	72000
1971	0.304	0.193	0.553	4.96	1.54	0.989	0.755	0.183	0.695	0.736	0.392	0.282	30300
1972	0.198	0.171	4.92	6.59	1.51	0.775	0.648	0.288	0.130	0.419	0.276	0.038	42000
1973	0.013	0.017	0.477	0.537	0.747	0.397	0.307	0.311	0.143	0.526	0.222	0.130	10100
1974	0.055	0.094	0.018	22.6	9.52	2.93	0.716	0.204	0.092	0.235	0.268	0.089	96300
1975	0.036	0.000	0.000	9.42	12.9	3.34	1.06	0.679	4.59	3.71	1.68	0.517	99900
1976	0.331	0.455	0.174	64.9	7.62	8.40	1.48	0.981	1.73	1.41	0.466	0.274	230000
1977	0.242	0.210	0.355	1.17	0.873	0.210	0.148	0.163	0.000	0.206	0.038	0.033	9600
1978	0.046	0.040	0.171	4.20	1.11	0.170	0.261	0.063	0.147	0.132	0.031	0.007	16700
1979	0.000	0.000	0.033	7.73	8.26	1.47	0.377	0.124	0.000	0.245	0.143	0.054	48600
1980	0.011	0.038	0.021	4.27	0.305	0.040	0.289	0.148	0.104	0.006	0.204	0.103	14400
1981	0.079	0.030	1.03	0.462	0.210	0.095	0.126	0.138	0.092	0.000	0.000	0.075	6190
1982	0.070	0.078	0.149	9.29	1.02	0.190	0.566	0.000	0.091	0.192	0.033	0.024	30500
1983	0.049	0.059	0.110	11.4	4.29	1.50	0.318	0.000	0.712	0.153	0.022	0.000	48700
1984	0.000	0.023	1.67	1.09	0.568	0.252	0.247	0.000	0.119	0.231	0.108	0.107	11700
1985	0.087	0.095	2.68	6.82	1.55	0.274	0.211	1.03	0.246	0.485	0.168	0.091	36100
1986	0.190	0.168	6.10	2.53	3.53	1.34	0.429	0.123	0.098	0.006	0.373	0.137	39800
1987	0.152	0.119	1.73	8.52	0.567	0.246	0.201	0.127	0.000	0.597	0.156	0.123	32800
1988	0.061	0.072	0.000	0.394	0.667	0.164	0.205	0.153	0.000	0.000	---	---	---
MIN	0.000	0.000	0.000	0.298	0.000	0.040	0.126	0.000	0.000	0.000	0.000	0.000	3740
MAX	1.03	1.04	6.10	64.9	30.9	16.4	24.0	3.34	4.59	4.64	2.71	0.978	230000
MEAN	0.135	0.137	0.955	8.64	3.49	2.11	1.55	0.443	0.448	0.522	0.405	0.168	40700

TABLE B-9

PIPESTONE CREEK AT THE SASKATCHEWAN-MANITOBA BOUNDARY

NATURAL FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	0.000	20.6	1.56	1.12	0.364	0.098	0.052	0.086	0.206	0.089	---
1944	0.065	0.067	0.015	0.436	0.222	0.558	0.706	0.152	0.138	0.084	0.206	0.089	7200
1945	0.065	0.066	1.17	0.902	0.466	0.523	0.812	0.129	0.026	0.092	0.209	0.090	12000
1946	0.066	0.067	1.56	6.92	0.677	0.308	2.21	0.140	0.031	0.308	0.289	0.125	33400
1947	0.092	0.093	0.000	13.2	2.31	6.91	3.45	0.513	0.291	0.228	0.259	0.112	71800
1948	0.082	0.083	0.000	14.0	8.95	1.43	0.863	0.502	0.165	0.380	0.316	0.136	70600
1949	0.100	0.102	0.009	6.88	0.674	2.21	0.351	0.371	0.044	0.194	0.247	0.106	29400
1950	0.078	0.079	0.606	10.2	5.30	2.32	2.96	3.00	0.527	0.352	0.306	0.132	68000
1951	0.097	0.098	0.000	10.4	7.85	0.828	0.620	0.223	0.223	0.500	0.361	0.156	56100
1952	0.114	0.116	0.220	5.84	0.864	0.420	0.460	0.119	0.769	0.143	0.228	0.098	24500
1953	0.072	0.073	0.505	7.29	1.45	10.7	3.88	0.703	0.108	0.297	0.285	0.123	66800
1954	0.090	0.092	0.000	3.21	2.25	13.4	21.8	2.23	2.26	4.21	2.46	0.464	139000
1955	0.341	0.343	0.342	21.9	28.2	14.9	6.75	0.875	1.30	0.225	0.258	0.111	199000
1956	0.082	0.083	0.371	16.3	6.35	1.94	1.93	0.870	0.384	1.43	1.21	0.879	83400
1957	0.906	0.911	1.34	4.60	1.99	0.780	0.572	0.350	1.14	1.24	0.731	0.053	38300
1958	0.000	0.000	2.54	5.54	0.967	0.250	0.205	0.158	0.116	0.487	0.082	0.000	27200
1959	0.000	0.000	0.588	0.889	0.276	0.309	0.182	0.206	0.211	0.001	0.020	0.000	7060
1960	0.000	0.000	1.11	6.19	0.847	0.643	0.430	0.288	0.311	0.964	0.305	0.082	29300
1961	0.020	0.000	0.342	0.109	0.000	0.160	0.177	0.169	0.154	0.000	0.005	0.017	3050
1962	0.000	0.000	0.462	0.666	0.212	0.265	0.133	0.181	0.072	0.048	0.075	0.053	5710
1963	0.068	0.084	2.06	0.492	0.563	0.999	0.684	0.519	0.184	0.000	0.362	0.228	16500
1964	0.182	0.047	0.000	4.94	2.40	0.531	0.282	0.200	0.277	0.438	0.322	0.060	25400
1965	0.025	0.017	0.070	7.53	0.872	0.854	1.08	0.220	0.878	0.458	0.229	0.351	32900
1966	0.172	0.047	1.48	6.28	2.21	0.743	0.422	0.232	0.000	0.110	0.318	0.453	32700
1967	0.461	0.519	0.671	5.30	2.14	0.285	0.222	0.066	0.070	0.174	0.072	0.072	26300
1968	0.166	0.228	1.77	0.834	0.296	0.229	0.218	0.162	0.131	0.094	0.117	0.138	11600
1969	0.015	0.039	0.571	17.6	2.09	0.547	2.67	0.385	0.153	0.042	1.06	0.232	66400
1970	0.079	0.300	0.209	10.2	8.29	1.06	0.667	0.360	0.236	0.262	0.457	0.295	58900
1971	0.262	0.166	0.451	4.38	1.10	0.648	0.629	0.149	0.271	0.321	0.337	0.242	23500
1972	0.174	0.150	4.20	5.39	1.14	0.586	0.589	0.240	0.096	0.321	0.242	0.034	34700
1973	0.011	0.014	0.337	0.410	0.570	0.436	0.271	0.279	0.095	0.418	0.191	0.112	8320
1974	0.049	0.084	0.204	19.4	7.99	2.37	0.464	0.131	0.135	0.218	0.241	0.080	82000
1975	0.033	0.000	0.121	10.7	9.48	2.87	0.703	0.524	5.25	3.47	1.52	0.466	92500
1976	0.302	0.415	0.162	57.4	4.68	7.28	0.658	0.973	1.84	1.24	0.425	0.250	197000
1977	0.208	0.181	0.338	1.05	0.790	0.166	0.104	0.143	0.273	0.230	0.033	0.028	9300
1978	0.040	0.035	0.205	4.53	0.829	0.116	0.141	0.157	0.202	0.134	0.026	0.006	16800
1979	0.000	0.000	0.129	8.31	6.64	1.33	0.311	0.139	0.077	0.268	0.127	0.048	45700
1980	0.009	0.033	0.082	3.82	0.267	0.101	0.235	0.130	0.132	0.067	0.176	0.088	13400
1981	0.068	0.026	0.718	0.354	0.184	0.127	0.125	0.135	0.096	0.102	0.000	0.064	5300
1982	0.061	0.068	0.148	7.59	0.861	0.173	0.620	0.000	0.080	0.278	0.032	0.077	26000
1983	0.055	0.019	0.085	11.1	3.69	0.804	0.183	0.080	0.282	0.119	0.000	0.198	43400
1984	0.050	0.003	0.497	0.431	0.286	0.211	0.231	0.000	0.217	0.147	0.057	0.097	5890
1985	0.082	0.086	1.73	7.12	1.26	0.231	0.146	0.496	0.219	0.362	0.280	0.162	31900
1986	0.061	0.126	6.63	1.81	3.32	0.762	0.333	0.112	0.106	0.063	0.480	0.128	37000
1987	0.112	0.080	1.67	5.95	0.368	0.120	0.158	0.110	0.083	0.187	0.070	0.059	23500
1988	0.047	0.064	0.053	0.336	0.619	0.124	0.190	0.140	0.000	0.115	0.217	0.094	5280
MIN	0.000	0.000	0.000	0.109	0.000	0.101	0.104	0.000	0.000	0.000	0.000	0.000	3050
MAX	0.906	0.911	6.63	57.4	28.2	14.9	21.8	3.00	5.25	4.21	2.46	0.879	199000
MEAN	0.113	0.113	0.778	7.81	2.92	1.82	1.33	0.377	0.428	0.455	0.336	0.152	43200

TABLE B-10

PIPESTONE CREEK NEAR MOOSOMIN 05NE001

EXTENDED NATURAL FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	0.000	19.1	1.45	1.03	0.338	0.091	0.048	0.080	0.187	0.081	---
1944	0.059	0.060	0.013	0.395	0.202	0.507	0.641	0.138	0.125	0.076	0.186	0.081	6530
1945	0.059	0.060	1.07	0.818	0.422	0.474	0.737	0.117	0.024	0.084	0.189	0.082	10900
1946	0.060	0.061	1.42	6.31	0.617	0.281	2.01	0.128	0.029	0.281	0.262	0.113	30400
1947	0.083	0.084	0.000	12.3	2.14	6.42	3.20	0.477	0.270	0.212	0.235	0.102	66700
1948	0.074	0.076	0.000	13.0	8.32	1.33	0.801	0.466	0.153	0.353	0.287	0.124	65500
1949	0.091	0.092	0.008	6.24	0.612	2.01	0.319	0.336	0.040	0.176	0.224	0.097	26700
1950	0.071	0.072	0.562	9.44	4.92	2.16	2.75	2.78	0.489	0.327	0.277	0.120	63100
1951	0.088	0.089	0.000	9.61	7.26	0.766	0.573	0.206	0.206	0.463	0.327	0.141	51900
1952	0.104	0.105	0.200	5.30	0.784	0.381	0.417	0.108	0.698	0.129	0.206	0.089	22200
1953	0.065	0.066	0.469	6.76	1.34	9.97	3.60	0.653	0.101	0.276	0.259	0.112	61900
1954	0.082	0.083	0.000	3.01	2.11	12.6	20.4	2.09	2.11	3.95	2.23	0.421	130000
1955	0.309	0.311	0.322	20.6	26.5	14.0	6.35	0.823	1.23	0.211	0.234	0.101	187000
1956	0.074	0.075	0.346	15.1	5.90	1.81	1.80	0.809	0.357	1.33	1.10	0.798	77500
1957	0.822	0.826	1.22	4.20	1.81	0.711	0.522	0.319	1.04	1.13	0.663	0.048	34900
1958	0.000	0.000	2.17	5.15	0.813	0.239	0.202	0.169	0.184	0.478	0.074	0.000	24900
1959	0.000	0.000	0.389	0.689	0.227	0.292	0.179	0.241	0.184	0.000	0.018	0.000	5940
1960	0.000	0.000	1.29	5.69	0.695	0.767	0.512	0.325	0.354	1.26	0.276	0.074	29500
1961	0.018	0.000	0.311	0.000	0.000	0.134	0.169	0.179	0.170	0.000	0.004	0.016	2650
1962	0.000	0.000	0.455	0.367	0.186	0.108	0.099	0.097	0.069	0.049	0.068	0.048	4080
1963	0.061	0.076	1.59	0.368	0.488	0.821	0.514	0.391	0.151	0.000	0.328	0.207	13200
1964	0.165	0.043	0.000	3.91	1.86	0.276	0.229	0.123	0.100	0.310	0.292	0.055	19300
1965	0.023	0.015	0.070	6.75	0.781	0.753	0.327	0.114	0.770	0.163	0.208	0.318	26800
1966	0.156	0.042	1.58	5.93	1.93	0.576	0.374	0.152	0.000	0.003	0.288	0.411	30000
1967	0.418	0.471	0.552	4.84	1.95	0.247	0.197	0.055	0.111	0.150	0.065	0.065	23900
1968	0.151	0.207	1.19	0.516	0.259	0.234	0.212	0.194	0.129	0.074	0.106	0.125	8960
1969	0.014	0.035	0.869	16.2	1.61	0.278	2.45	0.196	0.108	0.000	0.957	0.211	59900
1970	0.072	0.272	0.086	9.37	7.10	0.709	0.471	0.297	0.169	0.195	0.414	0.268	51000
1971	0.238	0.151	0.392	4.05	0.855	0.451	0.557	0.129	0.026	0.081	0.306	0.220	19500
1972	0.158	0.136	3.78	4.68	0.927	0.474	0.554	0.211	0.076	0.263	0.219	0.030	30300
1973	0.010	0.013	0.257	0.336	0.467	0.459	0.250	0.260	0.067	0.356	0.173	0.101	7270
1974	0.045	0.076	0.316	17.4	7.06	2.02	0.311	0.086	0.161	0.207	0.219	0.073	73100
1975	0.030	0.000	0.194	11.6	7.40	2.59	0.488	0.429	5.65	3.33	1.38	0.423	87900
1976	0.274	0.376	0.155	52.7	2.85	6.58	0.147	0.967	1.91	1.13	0.386	0.226	176000
1977	0.189	0.164	0.328	0.972	0.742	0.141	0.079	0.132	0.431	0.243	0.030	0.026	9140
1978	0.036	0.032	0.225	4.72	0.669	0.084	0.072	0.212	0.234	0.135	0.024	0.005	16800
1979	0.000	0.000	0.186	8.66	5.67	1.25	0.271	0.149	0.122	0.281	0.115	0.043	44000
1980	0.008	0.030	0.117	3.56	0.246	0.136	0.204	0.120	0.148	0.102	0.159	0.080	12800
1981	0.062	0.023	0.539	0.292	0.170	0.145	0.124	0.134	0.098	0.161	0.000	0.058	4790
1982	0.055	0.061	0.147	6.60	0.771	0.163	0.652	0.076	0.206	0.257	0.029	0.070	23700
1983	0.050	0.017	0.107	9.78	3.16	0.741	0.198	0.196	0.198	0.130	0.000	0.179	38600
1984	0.046	0.003	0.305	0.357	0.274	0.214	0.233	0.182	0.188	0.209	0.052	0.088	5690
1985	0.074	0.078	1.71	6.32	0.787	0.204	0.162	0.460	0.189	0.357	0.254	0.147	28100
1986	0.056	0.114	6.28	1.44	2.51	0.422	0.252	0.145	0.126	0.233	0.435	0.116	32200
1987	0.102	0.073	1.04	5.97	0.330	0.117	0.130	0.111	0.148	0.125	0.063	0.054	21600
1988	0.043	0.058	0.085	0.270	0.590	0.129	0.193	0.147	0.136	0.092	0.197	0.085	5340
MIN	0.000	0.000	0.000	0.000	0.000	0.084	0.072	0.055	0.000	0.000	0.000	0.000	2650
MAX	0.822	0.826	6.28	52.7	26.5	14.0	20.4	2.78	5.65	3.95	2.23	0.798	187000
MEAN	0.102	0.103	0.704	7.21	2.56	1.66	1.20	0.352	0.425	0.423	0.304	0.138	39300

TABLE B-11

PIPESTONE CREEK ABOVE PIPESTONE LAKE

EXTENDED NATURAL FLOW m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	0.000	4.93	0.374	0.267	0.087	0.023	0.012	0.021	0.031	0.013	---
1944	0.010	0.010	0.002	0.065	0.033	0.083	0.105	0.023	0.020	0.013	0.031	0.013	1070
1945	0.010	0.010	0.175	0.134	0.069	0.078	0.121	0.019	0.004	0.014	0.031	0.013	1790
1946	0.010	0.010	0.267	1.19	0.116	0.053	0.378	0.024	0.005	0.053	0.043	0.019	5680
1947	0.014	0.014	0.000	3.28	0.572	1.72	0.855	0.127	0.072	0.057	0.039	0.017	17700
1948	0.012	0.012	0.000	3.45	2.21	0.352	0.213	0.124	0.041	0.094	0.047	0.020	17300
1949	0.015	0.015	0.001	1.03	0.101	0.332	0.053	0.056	0.007	0.029	0.037	0.016	4410
1950	0.012	0.012	0.148	2.48	1.29	0.567	0.722	0.731	0.129	0.086	0.045	0.020	16500
1951	0.014	0.015	0.000	2.38	1.80	0.189	0.142	0.051	0.051	0.115	0.054	0.023	12700
1952	0.017	0.017	0.033	0.87	0.129	0.063	0.069	0.018	0.115	0.021	0.034	0.015	3650
1953	0.011	0.011	0.123	1.77	0.351	2.61	0.942	0.171	0.026	0.072	0.042	0.018	16100
1954	0.013	0.014	0.000	0.905	0.635	3.78	6.15	0.628	0.636	1.19	0.366	0.069	38000
1955	0.051	0.051	0.102	6.52	8.39	4.45	2.01	0.261	0.388	0.067	0.038	0.017	58800
1956	0.012	0.012	0.095	4.14	1.61	0.494	0.491	0.221	0.098	0.364	0.180	0.131	20600
1957	0.135	0.136	0.227	0.781	0.338	0.132	0.097	0.059	0.193	0.210	0.109	0.008	6360
1958	0.000	0.000	0.356	0.845	0.133	0.039	0.033	0.028	0.030	0.078	0.012	0.000	4080
1959	0.000	0.000	0.064	0.114	0.037	0.048	0.029	0.040	0.030	0.000	0.003	0.000	960
1960	0.000	0.000	0.238	1.05	0.128	0.142	0.094	0.060	0.065	0.232	0.045	0.012	5430
1961	0.003	0.000	0.051	0.000	0.000	0.022	0.028	0.029	0.028	0.000	0.001	0.003	438
1962	0.000	0.000	0.075	0.060	0.031	0.018	0.016	0.016	0.011	0.008	0.011	0.008	670
1963	0.010	0.013	0.261	0.061	0.080	0.135	0.084	0.064	0.025	0.000	0.054	0.034	2170
1964	0.027	0.007	0.000	0.642	0.306	0.045	0.038	0.020	0.016	0.051	0.048	0.009	3170
1965	0.004	0.003	0.012	1.11	0.129	0.124	0.054	0.019	0.127	0.027	0.034	0.052	4420
1966	0.026	0.007	0.274	1.03	0.333	0.100	0.065	0.026	0.000	0.001	0.047	0.067	6280
1967	0.069	0.077	0.091	0.794	0.319	0.041	0.032	0.009	0.018	0.025	0.011	0.011	3910
1968	0.025	0.034	0.195	0.085	0.042	0.038	0.035	0.032	0.021	0.012	0.017	0.020	1470
1969	0.002	0.006	0.223	4.16	0.413	0.071	0.630	0.050	0.028	0.000	0.157	0.035	15100
1970	0.012	0.045	0.021	2.29	1.73	0.173	0.115	0.073	0.041	0.048	0.068	0.044	12200
1971	0.039	0.025	0.064	0.665	0.140	0.074	0.091	0.021	0.004	0.013	0.050	0.036	3200
1972	0.026	0.022	0.705	0.873	0.173	0.088	0.103	0.039	0.014	0.049	0.036	0.005	5620
1973	0.002	0.002	0.042	0.055	0.077	0.076	0.041	0.043	0.011	0.059	0.028	0.017	1200
1974	0.007	0.013	0.086	4.75	1.93	0.553	0.085	0.023	0.044	0.057	0.036	0.012	19900
1975	0.005	0.000	0.056	3.28	2.08	0.728	0.137	0.121	1.60	0.937	0.226	0.069	24200
1976	0.045	0.062	0.049	16.6	0.897	2.07	0.046	0.304	0.601	0.355	0.063	0.037	54800
1977	0.031	0.027	0.054	0.160	0.122	0.023	0.013	0.022	0.071	0.040	0.005	0.004	1500
1978	0.006	0.005	0.037	0.775	0.110	0.014	0.012	0.035	0.038	0.022	0.004	0.001	2760
1979	0.000	0.000	0.044	2.03	1.33	0.294	0.064	0.035	0.029	0.066	0.019	0.007	10300
1980	0.001	0.005	0.019	0.585	0.040	0.022	0.033	0.020	0.024	0.017	0.026	0.013	2100
1981	0.010	0.004	0.088	0.048	0.028	0.024	0.020	0.022	0.016	0.026	0.000	0.010	787
1982	0.009	0.010	0.024	1.08	0.126	0.027	0.107	0.013	0.034	0.042	0.005	0.011	3880
1983	0.008	0.003	0.024	2.16	0.698	0.164	0.044	0.043	0.044	0.029	0.000	0.029	8490
1984	0.007	0.000	0.050	0.059	0.045	0.035	0.038	0.030	0.031	0.034	0.009	0.014	931
1985	0.012	0.013	0.297	1.10	0.137	0.035	0.028	0.080	0.033	0.062	0.042	0.024	4880
1986	0.009	0.019	1.21	0.279	0.484	0.081	0.049	0.028	0.024	0.045	0.071	0.019	6160
1987	0.017	0.012	0.171	0.981	0.054	0.019	0.021	0.018	0.024	0.021	0.010	0.009	3540
1988	*0.007*	0.010	0.014	0.044	0.097	0.021	0.032	0.024	0.022	0.015	0.032	0.014	878
MIN	0.000	0.000	0.000	0.000	0.000	0.014	0.012	0.009	0.000	0.000	0.000	0.000	438
MAX	0.135	0.136	1.21	16.6	8.39	4.45	6.15	0.731	1.60	1.19	0.366	0.131	58800
MEAN	0.017	0.017	0.132	1.77	0.658	0.446	0.318	0.085	0.106	0.103	0.050	0.023	9690

TABLE B-12

PIPESTONE CREEK AT THE SASKATCHEWAN-MANITOBA BOUNDARY

FLOWS AT THE PRESENT (1988) LEVEL OF DEVELOPMENT - m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	0.000	22.7	1.59	0.950	0.028	0.007	0.004	0.006	0.000	0.000	---
1944	0.023	0.047	0.001	0.355	0.023	0.546	0.388	0.015	0.014	0.008	0.066	0.057	4040
1945	0.047	0.047	1.28	0.749	0.181	0.387	0.445	0.013	0.003	0.009	0.000	0.000	8360
1946	0.000	0.007	1.51	7.78	0.403	0.029	2.06	0.013	0.003	0.095	0.250	0.101	32100
1947	0.071	0.070	0.000	15.1	2.57	7.14	3.08	0.379	0.166	0.102	0.223	0.090	75700
1948	0.062	0.062	0.000	16.0	9.29	1.19	0.634	0.308	0.012	0.182	0.275	0.112	73800
1949	0.079	0.079	0.001	7.59	0.433	2.06	0.245	0.158	0.005	0.020	0.161	0.084	28400
1950	0.059	0.059	0.581	12.2	5.54	2.12	2.92	2.87	0.367	0.241	0.265	0.107	71900
1951	0.076	0.075	0.000	12.4	7.56	0.623	0.293	0.060	0.149	0.473	0.315	0.129	58100
1952	0.092	0.092	0.206	6.28	0.550	0.273	0.130	0.075	0.582	0.015	0.176	0.077	22200
1953	0.053	0.053	0.482	9.29	1.67	10.8	3.67	0.446	0.008	0.168	0.247	0.100	70500
1954	0.070	0.069	0.000	5.12	4.03	14.6	21.6	2.04	2.28	4.12	2.22	0.409	149000
1955	0.297	0.298	0.318	23.9	30.1	16.7	8.42	0.566	1.12	0.130	0.222	0.089	216000
1956	0.062	0.061	0.349	18.4	6.98	1.67	1.78	0.621	0.160	1.36	1.08	0.786	87500
1957	0.810	0.812	1.31	5.52	1.69	0.540	0.201	0.190	0.917	1.20	0.651	0.036	36300
1958	0.000	0.000	2.49	6.13	0.559	0.012	0.004	0.000	0.000	0.075	0.000	0.000	24300
1959	0.000	0.000	0.595	0.627	0.053	0.018	0.003	0.000	0.030	0.001	0.000	0.000	3500
1960	0.000	0.000	0.711	6.97	0.617	0.302	0.000	0.007	0.003	0.799	0.264	0.062	25400
1961	0.006	0.000	0.479	0.118	0.000	0.029	0.009	0.000	0.000	0.000	0.000	0.000	1700
1962	0.000	0.000	0.007	0.326	0.028	0.171	0.037	0.091	0.003	0.000	0.000	0.000	1730
1963	0.000	0.000	1.21	0.399	0.379	0.826	0.466	0.357	0.035	0.000	0.077	0.195	10400
1964	0.153	0.030	0.000	5.32	2.17	0.320	0.058	0.084	0.192	0.140	0.092	0.034	22500
1965	0.007	0.000	0.048	8.23	0.664	0.548	0.866	0.116	0.814	0.336	0.188	0.306	31600
1966	0.144	0.029	1.48	7.04	1.90	0.463	0.135	0.157	0.000	0.120	0.000	0.344	31000
1967	0.406	0.457	0.674	5.89	1.82	0.042	0.027	0.012	0.000	0.026	0.000	0.000	24400
1968	0.000	0.000	1.71	0.598	0.040	0.000	0.006	0.000	0.002	0.023	0.000	0.000	6320
1969	0.000	0.000	0.479	19.7	1.99	0.306	2.54	0.200	0.047	0.044	0.723	0.199	68600
1970	0.060	0.259	0.203	12.1	8.15	0.718	0.511	0.068	0.117	0.280	0.402	0.256	60600
1971	0.226	0.138	0.442	4.71	0.761	0.591	0.291	0.022	0.266	0.261	0.041	0.180	20700
1972	0.146	0.122	4.32	5.99	0.931	0.236	0.311	0.114	0.022	0.082	0.177	0.018	32800
1973	0.000	0.000	0.324	0.328	0.320	0.234	0.023	0.020	0.041	0.324	0.134	0.089	4860
1974	0.033	0.063	0.181	21.5	8.28	1.99	0.159	0.049	0.000	0.011	0.136	0.061	84800
1975	0.018	0.000	0.089	12.8	11.3	3.30	0.301	0.485	5.30	3.43	1.36	0.411	102000
1976	0.262	0.363	0.144	59.6	6.39	9.24	1.31	0.704	1.55	1.10	0.374	0.214	211000
1977	0.177	0.151	0.320	0.861	0.600	0.027	0.027	0.012	0.000	0.081	0.013	0.010	5990
1978	0.018	0.018	0.189	4.37	0.630	0.034	0.075	0.000	0.000	0.000	0.000	0.000	13900
1979	0.000	0.000	0.000	10.1	6.53	0.923	0.051	0.000	0.000	0.000	0.046	0.031	46500
1980	0.000	0.012	0.066	3.66	0.024	0.000	0.034	0.011	0.000	0.000	0.002	0.055	10000
1981	0.040	0.005	0.754	0.148	0.016	0.000	0.001	0.002	0.000	0.000	0.000	0.000	2570
1982	0.000	0.000	0.007	7.41	0.633	0.011	0.105	0.000	0.000	0.183	0.012	0.047	21900
1983	0.030	0.000	0.069	12.2	3.49	0.412	0.000	0.000	0.089	0.000	0.000	0.000	42500
1984	0.000	0.000	0.345	0.381	0.287	0.000	0.000	0.000	0.032	0.000	0.000	0.000	2760
1985	0.000	0.000	1.20	8.82	0.976	0.038	0.000	0.140	0.210	0.233	0.242	0.135	31300
1986	0.044	0.100	6.64	2.29	3.09	0.611	0.129	0.000	0.000	0.000	0.354	0.104	35500
1987	0.090	0.059	1.68	5.79	0.041	0.003	0.030	0.000	0.000	0.077	0.000	0.000	20300
1988	0.000	0.000	0.000	0.070	0.306	0.000	0.000	0.000	0.000	0.025	0.000	0.000	1070
MIN	0.000	0.000	0.000	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1070
MAX	0.810	0.812	6.64	59.6	30.1	16.7	21.6	2.87	5.30	4.12	2.22	0.786	216000
MEAN	0.081	0.081	0.715	8.65	2.95	1.76	1.16	0.226	0.316	0.343	0.235	0.107	43100

TABLE B-13

PIPESTONE CREEK BALANCE OF FLOW FOR APPORTIONMENT

AT THE PRESENT (1988) LEVEL OF DEVELOPMENT - m^3/s

YEAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	ANNUAL VOLUME (dam^3)
43/44	12.4	0.810	0.392	-0.154	-0.041	-0.022	-0.037	-0.103	-0.045	-0.010	0.014	-0.006	34100
44/45	0.137	-0.089	0.266	0.034	-0.061	-0.055	-0.033	-0.037	0.013	0.014	0.014	0.694	2380
45/46	0.299	-0.052	0.126	0.039	-0.052	-0.010	-0.037	-0.104	-0.045	-0.033	-0.027	0.733	2220
46/47	4.31	0.065	-0.125	0.957	-0.057	-0.013	-0.059	0.106	0.039	0.025	0.023	0.000	13800
47/48	8.49	1.41	3.68	1.36	0.122	0.020	-0.012	0.093	0.034	0.021	0.020	0.000	39700
48/49	9.02	4.81	0.478	0.203	0.057	-0.070	-0.009	0.117	0.044	0.029	0.028	-0.004	38500
49/50	4.15	0.096	0.955	0.070	-0.027	-0.018	-0.077	0.038	0.031	0.020	0.019	0.278	14400
50/51	7.13	2.89	0.958	1.44	1.37	0.103	0.064	0.112	0.041	0.027	0.026	0.000	37200
51/52	7.19	3.64	0.209	-0.017	-0.052	0.037	0.223	0.135	0.051	0.035	0.034	0.096	30300
52/53	3.36	0.118	0.062	-0.100	0.016	0.197	-0.057	0.062	0.028	0.017	0.016	0.229	10200
53/54	5.65	0.947	5.44	1.73	0.094	-0.046	0.020	0.105	0.038	0.025	0.023	0.000	36600
54/55	3.51	2.90	7.88	10.7	0.931	1.15	2.01	0.990	0.177	0.126	0.126	0.147	81000
55/56	12.9	16.0	9.27	5.05	0.128	0.466	0.018	0.093	0.033	0.021	0.019	0.163	116000
56/57	10.3	3.81	0.701	0.816	0.186	-0.032	0.646	0.479	0.346	0.357	0.357	0.638	48700
57/58	3.22	0.692	0.150	-0.085	0.014	0.347	0.575	0.286	0.010	0.000	0.000	1.22	16900
58/59	3.36	0.076	-0.113	-0.099	-0.079	-0.058	-0.169	-0.041	0.000	0.000	0.000	0.301	8250
59/60	0.182	-0.085	-0.136	-0.088	-0.103	-0.076	0.000	-0.010	0.000	0.000	0.000	0.158	-417
60/61	3.88	0.193	-0.019	-0.215	-0.137	-0.152	0.317	0.112	0.021	-0.004	0.000	0.308	11200
61/62	0.063	0.000	-0.051	-0.079	-0.084	-0.077	0.000	-0.002	-0.009	0.000	0.000	-0.224	-1240
62/63	-0.007	-0.078	0.039	-0.029	0.001	-0.033	-0.024	-0.037	-0.026	-0.034	-0.042	0.178	-235
63/64	0.153	0.097	0.327	0.124	0.098	-0.056	0.000	-0.104	0.081	0.062	0.006	0.000	2080
64/65	2.85	0.974	0.055	-0.083	-0.016	0.054	-0.079	-0.069	0.004	-0.006	-0.009	0.013	9620
65/66	4.47	0.228	0.121	0.327	0.006	0.376	0.107	0.073	0.131	0.058	0.006	0.741	17400
66/67	3.90	0.798	0.092	-0.076	0.041	0.000	0.065	-0.159	0.118	0.175	0.197	0.339	14300
67/68	3.24	0.750	-0.101	-0.084	-0.021	-0.035	-0.061	-0.036	-0.036	-0.083	-0.114	0.826	11100
68/69	0.181	-0.108	-0.115	-0.103	-0.081	-0.063	-0.025	-0.058	-0.069	-0.007	-0.020	0.193	-723
69/70	10.9	0.950	0.032	1.21	0.007	-0.029	0.023	0.195	0.083	0.020	0.109	0.099	35500
70/71	6.95	4.00	0.188	0.178	-0.112	-0.001	0.149	0.174	0.108	0.095	0.055	0.217	31500
71/72	2.52	0.209	0.267	-0.023	-0.052	0.131	0.101	-0.128	0.059	0.059	0.047	2.22	14200
72/73	3.30	0.361	-0.057	0.017	-0.006	-0.026	-0.078	0.056	0.001	-0.005	-0.007	0.155	9650
73/74	0.123	0.035	0.016	-0.113	-0.119	-0.006	0.115	0.038	0.033	0.008	0.021	0.079	597
74/75	11.8	4.28	0.810	-0.073	-0.017	-0.067	-0.098	0.016	0.021	0.002	0.000	0.029	43600
75/76	7.46	6.56	1.87	-0.051	0.223	2.68	1.69	0.605	0.178	0.111	0.155	0.063	56600
76/77	30.9	4.05	5.60	0.985	0.218	0.629	0.484	0.161	0.089	0.073	0.060	0.151	113000
77/78	0.339	0.205	-0.056	-0.024	-0.059	-0.137	-0.033	-0.003	-0.004	-0.002	0.001	0.087	823
78/79	2.11	0.215	-0.024	0.005	-0.079	-0.101	-0.067	-0.013	-0.003	0.000	0.000	-0.064	5120
79/80	5.97	3.21	0.256	-0.104	-0.070	-0.038	-0.134	-0.017	0.007	-0.005	-0.004	0.025	23800
80/81	1.75	-0.110	-0.050	-0.084	-0.054	-0.066	-0.034	-0.086	0.011	0.006	-0.008	0.395	4340
81/82	-0.029	-0.076	-0.063	-0.062	-0.066	-0.048	-0.051	0.000	-0.032	-0.030	-0.034	-0.067	-1470
82/83	3.62	0.202	-0.075	-0.205	0.000	-0.040	0.044	-0.004	0.009	0.002	-0.009	0.026	9250
83/84	6.63	1.64	0.010	-0.092	-0.040	-0.052	-0.059	0.000	-0.099	-0.025	-0.002	0.096	20900
84/85	0.165	0.144	-0.106	-0.116	0.000	-0.077	-0.073	-0.029	-0.048	-0.041	-0.043	0.331	304
85/86	5.26	0.348	-0.077	-0.073	-0.108	0.101	0.052	0.102	0.054	0.013	0.037	3.33	23700
86/87	1.39	1.43	0.231	-0.037	-0.056	-0.053	-0.032	0.114	0.040	0.034	0.019	0.847	10400
87/88	2.82	-0.143	-0.057	-0.049	-0.055	-0.041	-0.017	-0.035	-0.030	-0.024	-0.032	-0.026	5960
88/89	-0.098	-0.003	-0.062	-0.095	-0.070	0.000	-0.032	-0.109	-0.047	---	---	---	---
MIN	-0.098	-0.143	-0.136	-0.215	-0.137	-0.152	-0.169	-0.159	-0.099	-0.083	-0.114	-0.224	-1470
MAX	30.9	16.0	9.27	10.7	1.37	2.68	2.01	0.990	0.346	0.357	0.357	3.33	116000
MEAN	4.74	1.49	0.852	0.497	0.038	0.102	0.116	0.067	0.031	0.026	0.025	0.333	22300

TABLE B-14

PIPESTONE CREEK BALANCE OF FLOW ON CALENDAR YEAR BASIS

AT THE PRESENT (1988) LEVEL OF DEVELOPMENT - m^3/s

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL VOLUME (dam^3)
1943	---	---	0.000	12.4	0.810	0.392	-0.154	-0.041	-0.022	-0.037	-0.103	-0.045	---
1944	-0.010	0.014	-0.006	0.137	-0.089	0.266	0.034	-0.061	-0.055	-0.033	-0.037	0.013	436
1945	0.014	0.014	0.694	0.299	-0.052	0.126	0.039	-0.052	-0.010	-0.037	-0.104	-0.045	2340
1946	-0.033	-0.027	0.733	4.31	0.065	-0.125	0.957	-0.057	-0.013	-0.059	0.106	0.039	15400
1947	0.025	0.023	0.000	8.49	1.41	3.69	1.36	0.122	0.020	-0.012	0.093	0.034	39800
1948	0.021	0.020	0.000	9.02	4.81	0.478	0.203	0.057	-0.070	-0.009	0.117	0.044	38500
1949	0.029	0.028	-0.004	4.15	0.096	0.955	0.070	-0.027	-0.018	-0.077	0.038	0.031	13700
1950	0.020	0.019	0.278	7.13	2.89	0.958	1.44	1.37	0.103	0.064	0.112	0.041	37900
1951	0.027	0.026	0.000	7.19	3.64	0.209	-0.017	-0.052	0.037	0.223	0.135	0.051	30000
1952	0.035	0.034	0.096	3.36	0.118	0.062	-0.100	0.016	0.197	-0.057	0.062	0.028	9980
1953	0.017	0.016	0.229	5.65	0.947	5.44	1.73	0.094	-0.046	0.020	0.105	0.038	37200
1954	0.025	0.023	0.000	3.51	2.90	7.88	10.7	0.931	1.15	2.01	0.990	0.177	80100
1955	0.126	0.126	0.147	12.9	16.0	9.27	5.05	0.128	0.466	0.018	0.093	0.033	117000
1956	0.021	0.019	0.163	10.3	3.81	0.701	0.816	0.186	-0.032	0.646	0.479	0.346	45800
1957	0.357	0.357	0.638	3.22	0.692	0.150	-0.085	0.014	0.347	0.575	0.286	0.010	17100
1958	0.000	0.000	1.22	3.36	0.076	-0.113	-0.099	-0.079	-0.058	-0.169	-0.041	0.000	10700
1959	0.000	0.000	0.301	0.182	-0.085	-0.136	-0.088	-0.103	-0.076	0.000	-0.010	0.000	-33
1960	0.000	0.000	0.158	3.88	0.193	-0.019	-0.215	-0.137	-0.152	0.317	0.112	0.021	10800
1961	-0.004	0.000	0.308	0.063	0.000	-0.051	-0.079	-0.084	-0.077	0.000	-0.002	-0.009	178
1962	0.000	0.000	-0.224	-0.007	-0.078	0.039	-0.029	0.001	-0.033	-0.024	-0.037	-0.026	-1120
1963	-0.034	-0.042	0.178	0.153	0.097	0.327	0.124	0.098	-0.056	0.000	-0.104	0.081	2180
1964	0.062	0.006	0.000	2.85	0.974	0.055	-0.083	-0.016	0.054	-0.079	-0.069	0.004	9800
1965	-0.006	-0.009	0.013	4.47	0.228	0.121	0.327	0.006	0.376	0.107	0.073	0.131	15200
1966	0.058	0.006	0.741	3.90	0.798	0.092	-0.076	0.041	0.000	0.065	-0.159	0.118	14600
1967	0.175	0.197	0.339	3.24	0.750	-0.101	-0.084	-0.021	-0.035	-0.061	-0.036	-0.036	11300
1968	-0.083	-0.114	0.826	0.181	-0.108	-0.115	-0.103	-0.081	-0.063	-0.025	-0.058	-0.069	541
1969	-0.007	-0.020	0.193	10.9	0.950	0.032	1.21	0.007	-0.029	0.023	0.195	0.083	35400
1970	0.020	0.109	0.099	6.95	4.00	0.188	0.178	-0.112	-0.001	0.149	0.174	0.108	31100
1971	0.095	0.055	0.217	2.52	0.209	0.267	-0.023	-0.052	0.131	0.101	-0.128	0.059	8970
1972	0.059	0.047	2.22	3.30	0.361	-0.057	0.017	-0.006	-0.026	-0.078	0.056	0.001	15500
1973	-0.005	-0.007	0.155	0.123	0.035	0.016	-0.113	-0.119	-0.006	0.115	0.038	0.033	695
1974	0.008	0.021	0.079	11.8	4.28	0.810	-0.073	-0.017	-0.067	-0.098	0.016	0.021	43800
1975	0.002	0.000	0.029	7.41	6.56	1.87	-0.051	0.223	2.68	1.69	0.605	0.178	55800
1976	0.111	0.155	0.063	30.9	4.05	5.60	0.985	0.218	0.629	0.484	0.161	0.089	113000
1977	0.073	0.060	0.151	0.339	0.205	-0.056	-0.024	-0.059	-0.137	-0.033	-0.003	-0.004	1340
1978	-0.002	0.001	0.087	2.11	0.215	-0.024	0.005	-0.079	-0.101	-0.067	-0.013	-0.003	5520
1979	0.000	0.000	-0.064	5.97	3.21	0.256	-0.104	-0.070	-0.038	-0.134	-0.017	0.007	23600
1980	-0.005	-0.004	0.025	1.75	-0.110	-0.050	-0.084	-0.054	-0.066	-0.034	-0.086	0.011	3330
1981	0.006	-0.008	0.395	-0.029	-0.076	-0.063	-0.062	-0.066	-0.048	-0.051	0.000	-0.032	-75
1982	-0.030	-0.034	-0.067	3.62	0.202	-0.075	-0.205	0.000	-0.040	0.044	-0.004	0.009	8850
1983	0.002	-0.009	0.026	6.63	1.64	0.010	-0.092	-0.040	-0.052	-0.059	0.000	-0.099	20800
1984	-0.025	-0.002	0.096	0.165	0.144	-0.106	-0.116	0.000	-0.077	-0.073	-0.029	-0.048	-183
1985	-0.041	-0.043	0.331	5.26	0.348	-0.077	-0.073	-0.108	0.101	0.052	0.102	0.054	15400
1986	0.013	0.037	3.39	1.39	1.43	0.231	-0.037	-0.056	-0.053	-0.032	0.114	0.040	17000
1987	0.034	0.019	0.847	2.82	-0.143	-0.057	-0.049	-0.055	-0.041	-0.017	-0.035	-0.030	8580
1988	-0.024	-0.032	-0.026	-0.098	-0.003	-0.062	-0.095	-0.070	0.000	-0.032	-0.109	-0.047	-1570
MIN	-0.083	-0.114	-0.224	-0.098	-0.143	-0.136	-0.215	-0.137	-0.152	-0.169	-0.159	-0.099	-1570
MAX	0.357	0.357	3.39	30.9	16.0	9.27	10.7	1.37	2.68	2.01	0.990	0.346	117000
MEAN	0.026	0.025	0.326	4.74	1.49	0.852	0.497	0.038	0.102	0.116	0.067	0.031	21500