

October 9, 2026

VIA EMAIL

Re: Your request for access to information under Part II of the *Access to Information and Protection of Privacy Act, 2015* (File #: PB/1139/2026)

On August 26, 2026, we received your request for access to the following records/information:

Access to any internal NLH reports looking at the 50 year historical water availability and use at Churchill Falls would be greatly appreciated.

Updated to:

Raw data need not be included in this request but all internal reports, including those prepared by outside parties for internal evaluation and use as well as reports prepared by internal agents would be useful to include.

On September 22, 2026, you were notified of a time extension of 10 business days.

Please be advised that access to the records responsive to your request has been granted, in part, in accordance with the following exceptions to disclosure, as specified in the Access to Information and Protection of Privacy Act (the ATIPPA):

Section 35(1)(d): The head of a public body may refuse to disclose to an applicant information which could reasonably be expected to disclose information, the disclosure of which could reasonably be expected to result in the premature disclosure of a proposal or project or in significant loss or gain to a third party;

Section 35(1)(g): The head of a public body may refuse to disclose to an applicant information which could reasonably be expected to disclose information, the disclosure of which could reasonably be expected to prejudice the financial or economic interest of the government of the province or a public body.

Page 6 of Review of Churchill Falls Inflow Series has been withheld. Please see the Appendix A attached hereto. In keeping with our standard practice, it is our intention to post this letter on the Newfoundland and Labrador Hydro website.

Please be advised that you may ask the Information and Privacy Commissioner to review the processing of your access request, as set out in section 42 of **the Access to Information and Protection of Privacy Act, 2015** (the Act) (a copy of this section has been enclosed for your reference). A request to the

Commissioner must be made in writing within 15 business days of the date of this letter or within a longer period that may be allowed by the Commissioner.

The appeal may be addressed to the Information and Privacy Commissioner as follows:

Office of the Information and Privacy Commissioner
2 Canada Drive
P. O. Box 13004, Stn. A
St. John's, NL. A1B 3V8

Telephone: (709) 729-6309
Toll-Free: 1-877-729-6309
Email: commissioner@oipc.nl.ca

You may also appeal directly to the Supreme Court within 15 business days after you receive the decision of the public body, pursuant to section 52 of the Act (a copy of this section has been enclosed for your reference).

If you have any further questions, please contact me by telephone at (709) 733-5346 or by email at CassandraHearn@nlh.nl.ca.

Sincerely,

Cassandra Hearn

Cassandra Hearn
Access and Privacy Officer

Access or correction complaint

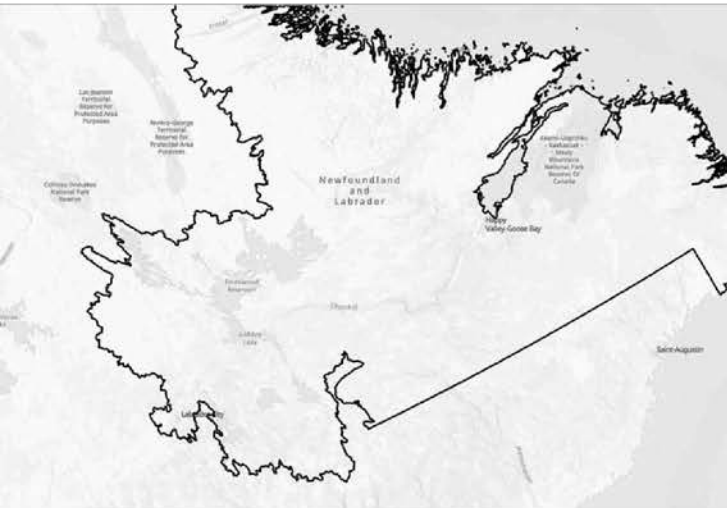
42. (1) A person who makes a request under this Act for access to a record or for correction of personal information may file a complaint with the commissioner respecting a decision, act or failure to act of the head of the public body that relates to the request.
- (2) A complaint under subsection (1) shall be filed in writing not later than 15 business days
 - (a) after the applicant is notified of the decision of the head of the public body, or the date of the act or failure to act; or
 - (b) after the date the head of the public body is considered to have refused the request under subsection 16(2).
- (3) A third party informed under section 19 of a decision of the head of a public body to grant access to a record or part of a record in response to a request may file a complaint with the commissioner respecting that decision.
- (4) A complaint under subsection (3) shall be filed in writing not later than 15 business days after the third party is informed of the decision of the head of the public body.
- (5) The commissioner may allow a longer time period for the filing of a complaint under this section.
- (6) A person or third party who has appealed directly to the Trial Division under subsection 52(1) or 53(1) shall not file a complaint with the commissioner.
- (7) The commissioner shall refuse to investigate a complaint where an appeal has been commenced in the Trial Division.
- (8) A complaint shall not be filed under this section with respect to
 - (a) a request that is disregarded under section 21;
 - (b) a decision respecting an extension of time under section 23;
 - (c) a variation of a procedure under section 24; or
 - (d) an estimate of costs or a decision not to waive a cost under section 26.
- (9) The commissioner shall provide a copy of the complaint to the head of the public body concerned.

Direct appeal to Trial Division by an applicant

52. (1) Where an applicant has made a request to a public body for access to a record or correction of personal information and has not filed a complaint with the commissioner under section 42, the applicant may appeal the decision, act or failure to act of the head of the public body that relates to the request directly to the Trial Division.
- (2) An appeal shall be commenced under subsection (1) not later than 15 business days
- (a) after the applicant is notified of the decision of the head of the public body, or the date of the act or failure to act; or
- (b) after the date the head of the public body is considered to have refused the request under subsection 16(2).
- (3) Where an applicant has filed a complaint with the commissioner under section 42 and the commissioner has refused to investigate the complaint, the applicant may commence an appeal in the Trial Division of the decision, act or failure to act of the head of the public body that relates to the request for access to a record or for correction of personal information.
- (4) An appeal shall be commenced under subsection (3) not later than 15 business days after the applicant is notified of the commissioner's refusal under subsection 45(2).

Appendix A

+ Review of Churchill Falls Inflow Series



April 2025

Churchill Falls (Labrador) Corporation Limited

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HATCH

Scope of Work

- Purpose: to determine whether there are any trends or anomalies in the series of CF total inflow, such as continuously increasing or decreasing trends, or step changes due to some external factor.
- Approach:
 - Standard hydrological plotting methods
 - Quantitative statistical tests (necessary to assess the significance of any apparent finding)

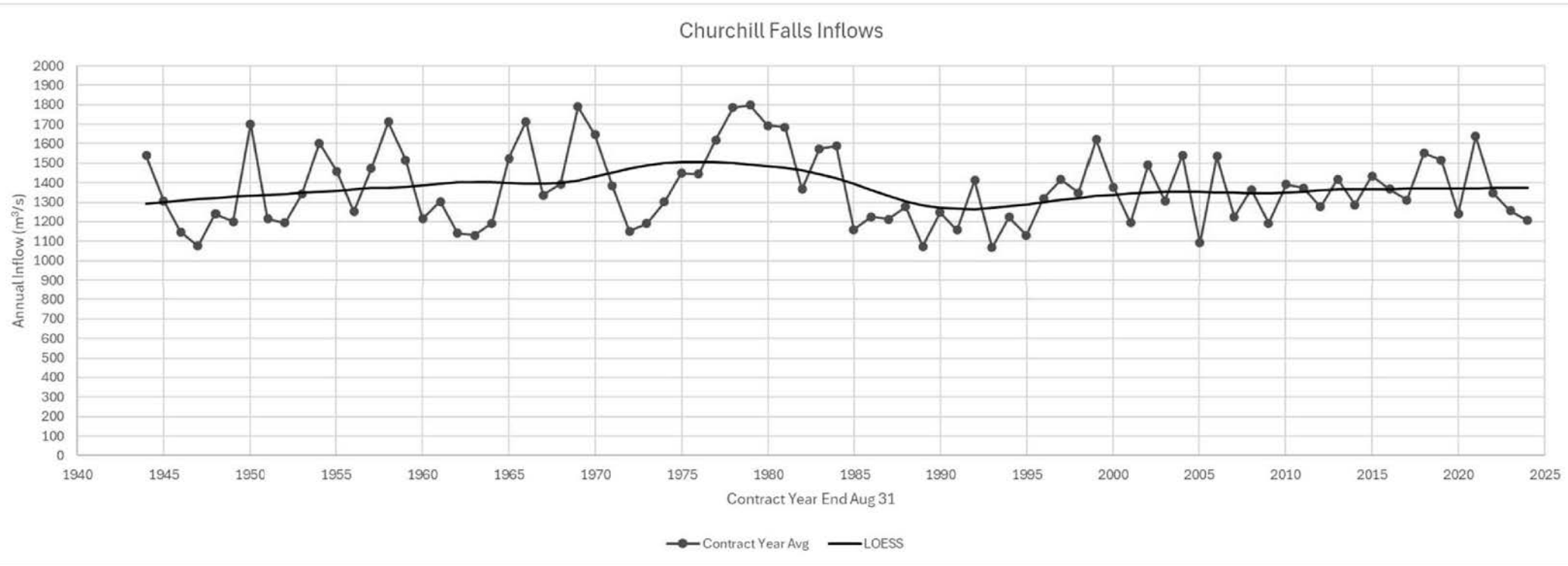
Data

- CF historic inflows 1943-2024
 - Note: contract years defined as Sep 1 to Aug 31 (n=81)
- Reference inflow sequence of synthesized values
- Purpose is to represent the long-term historic average and variability of the inflows in the system
 - 1943 to late 1950s: correlations to regional flow data
 - Late 1950s to mid 1970s: Twin Falls, Churchill River flow gauges, reservoir levels and discharges during CF construction/impoundment
 - Mid 1970s-2024: Post CF commissioning (agreed values between CF and HQ, CFLCo calculated inflows)

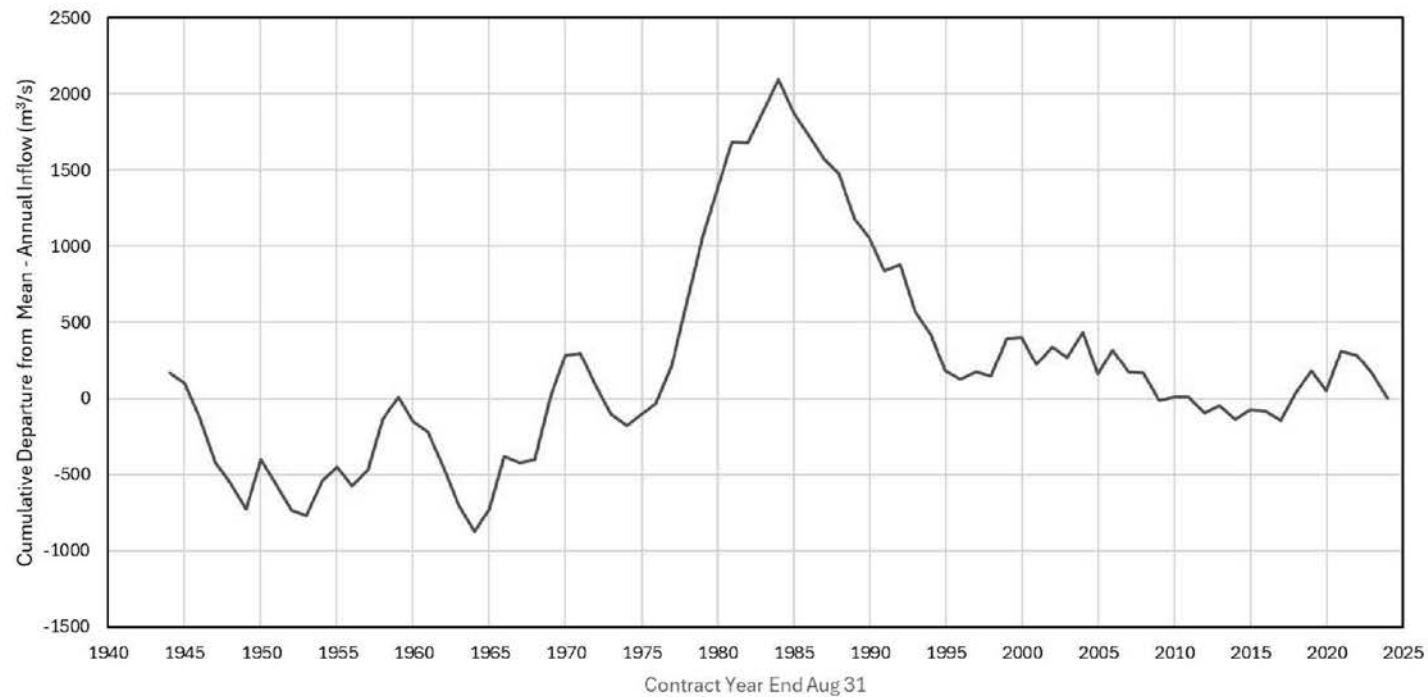
Graphical Techniques

- Time series plot with LOESS (Locally Estimated Scatterplot Smoothing)
 - Efficient smoothing algorithm that helps visualize trends, runs and cycles of dry and wet periods
- Cumulative Departure from Mean
 - Useful in detecting potential step change points
- Boxplots
 - Graphically compares sample median and variability before and after potential step change points
- Mass Curve
 - Useful in detecting changes in consistency/homogeneity

Time Series Plot with LOESS curve

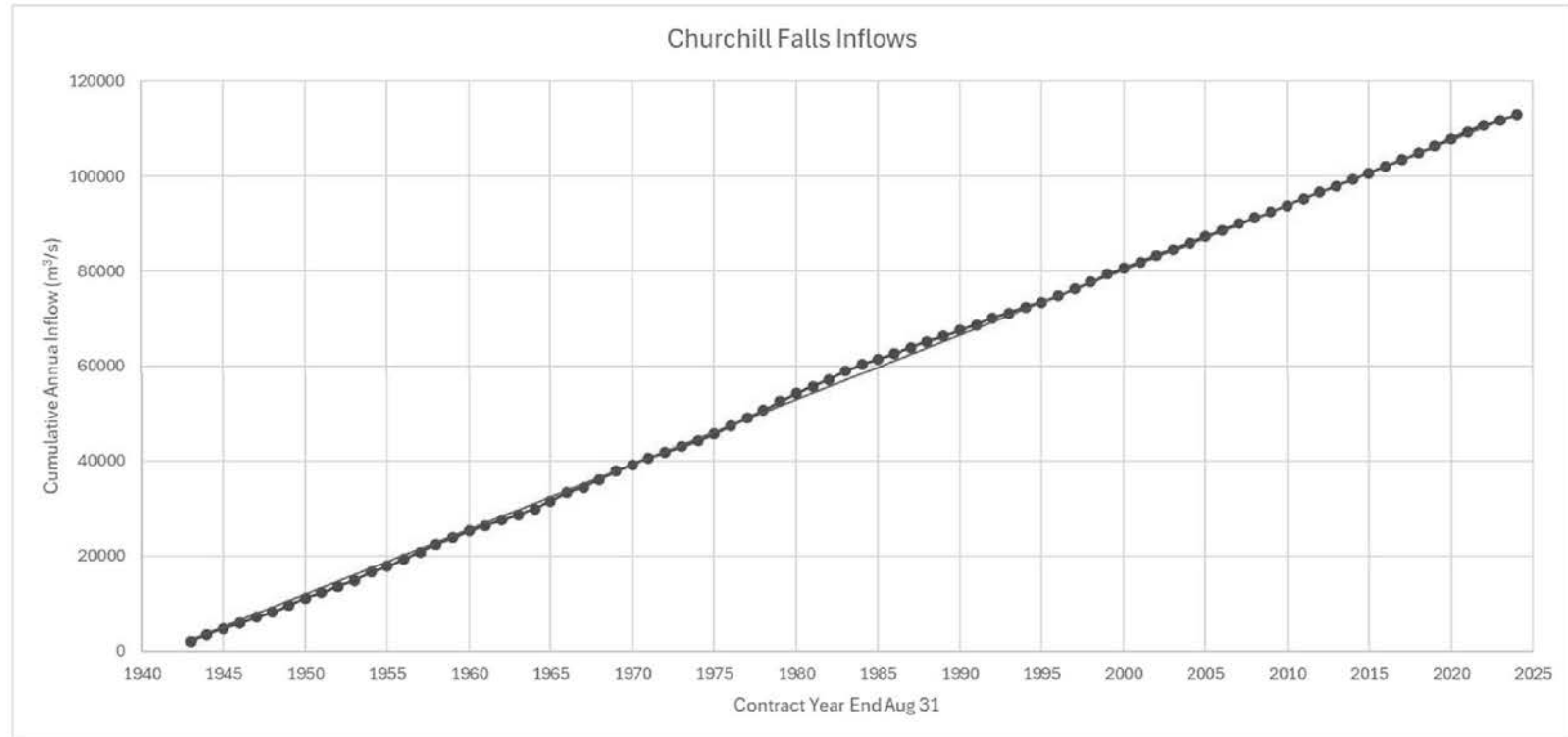


Cumulative Departure from Mean



- No anomalous behaviour noted.
- 1970s-early 1980s wet period and early 1980s-mid 1990s dry period are evident.

Mass Curve



- No anomalous behaviour noted.
- 1970s-early 1980s wet period and early 1980s-mid 1990s dry period are evident.

Statistical Tests

- Monotonic Trend Test
 - Purpose: to test for a trend that is continuously increasing or decreasing with time
 - **Mann-Kendall test** is commonly used to analyze trends in hydrological time series
 - Looks for correlation between the ranks of the data values and the time order of the data values.
 - Null hypothesis H_0 : there is no change in the median of the observations over time (i.e., no trend)
 - If the test statistic (p-value) < 0.05 , the null hypothesis is rejected (i.e., we conclude that there is a trend)

Statistical Tests (cont.)

- Step Change Test
 - Purpose: to test for changes in the data before and after a specified point in time (potential change point) or gap in record
 - **Wilcoxon test** (aka Mann-Whitney) looks for differences in the median between two independent samples (i.e., before and after)
 - Null hypothesis H_0 : there is no difference between the medians of the two samples (i.e., no step change)
 - If the test statistic (p-value) < 0.05 , the null hypothesis is rejected (i.e., we conclude that there is a step change)

Statistical Significance

- Significance level used in the quantitative tests is **5% (p-value = 0.05)**.
 - When the test statistic (p-value) is less than 0.05, the null hypothesis (that there is no trend or step change) is rejected.
 - This level is commonly used in statistical hydrology and represents a high threshold of evidence (>95% probability) that must be met before concluding that a trend or step change is present.
 - That is, the probability that the appearance of trend/change is due only to random chance is less than 5%.
 - Statistical significance means only that we conclude there is a difference (trend or change). By itself, it does not explain the difference.

Possible Explanations for Trend

- Regional hydrologic conditions
 - Natural wet/dry periods
 - Natural climate oscillations (ENSO, NAO, etc.)
 - Anthropogenic global warming
- If trend has a hydrologic origin, similar trends should be observed in other data records from the same region.
 - Water Survey of Canada hydrometric gauges
 - Environment Canada precipitation records
- If similar trends are not observed in other records, the trend is less likely to have a hydrologic origin, more likely to be an issue unique to the watershed or record of interest
- Gradual changes in watershed physical characteristics over time
 - land use/land cover
- Gradual changes in physical infrastructure
 - degradation of turbine efficiency

Possible Explanations for Step Change

- Different periods in the record that use different flow estimation calculation techniques (most common)
- Rapid change in watershed physical conditions (e.g., clear-cutting, forest fire, diversion)
- Some changes in regional hydrologic conditions can appear as a step change
 - A **hydrologic trend** is a gradual change expected to continue into the future, whereas a **hydrologic step change** represents a shift of the climate system to a new regime that is expected to remain relatively constant until another shift occurs (McCabe & Wolock, 2002).
- Note: a time series with a step change may test positive for a statistically significant monotonic trend, even if there is no trend in the partitioned series before and after the step change (Villarini et al., 2009)

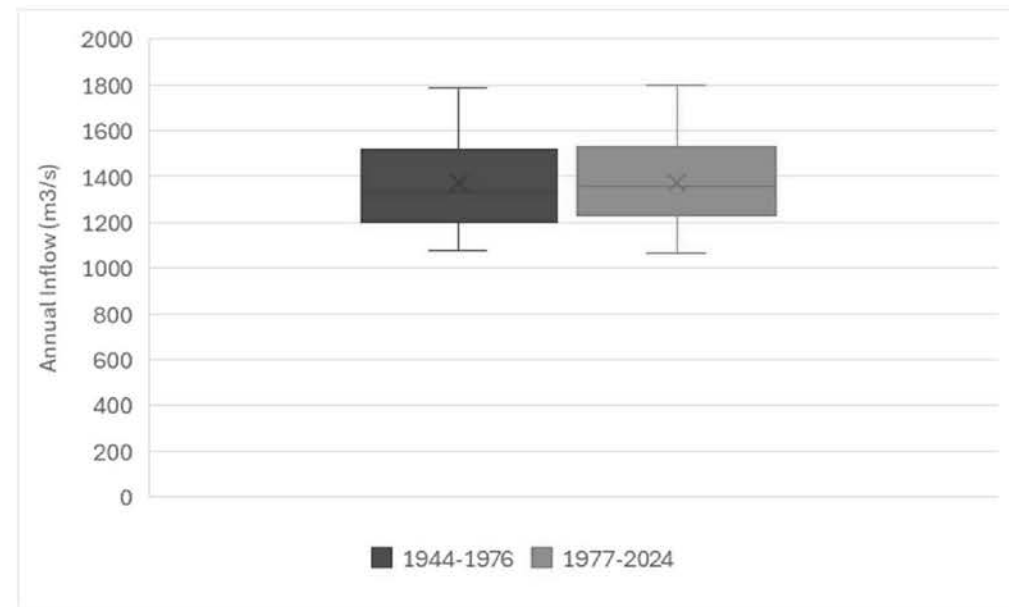
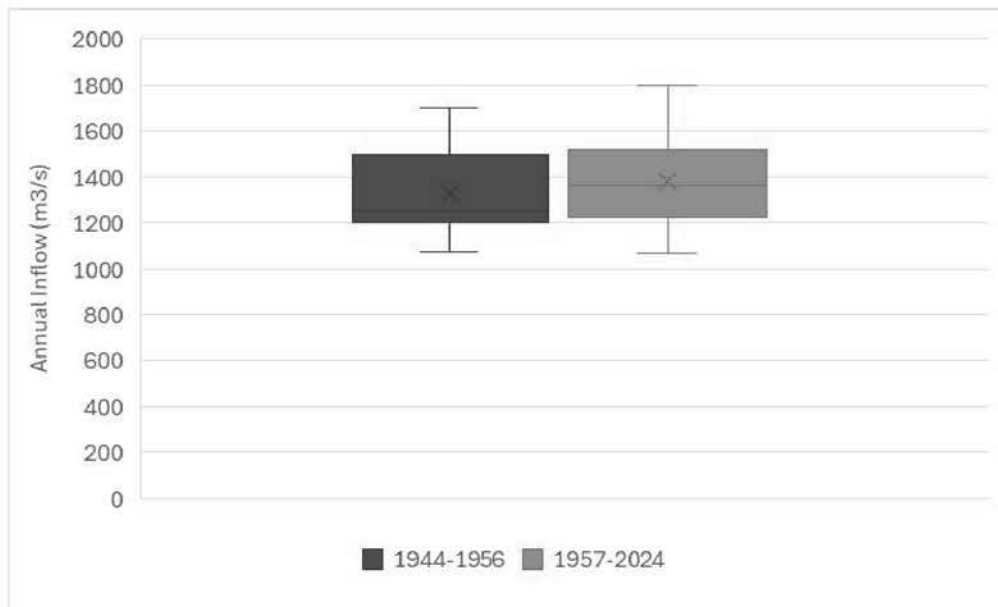
Mann-Kendall Trend Test

Analysis Period	Sample Size n	p-value	Mean (m ³ /s)	Remarks
1944-2024	81	0.990	1373	No trend
1944-1956	13	0.502	1329	No trend
1957-1976	20	0.922	1400	No trend
1977-2024	48	0.419	1374	No trend

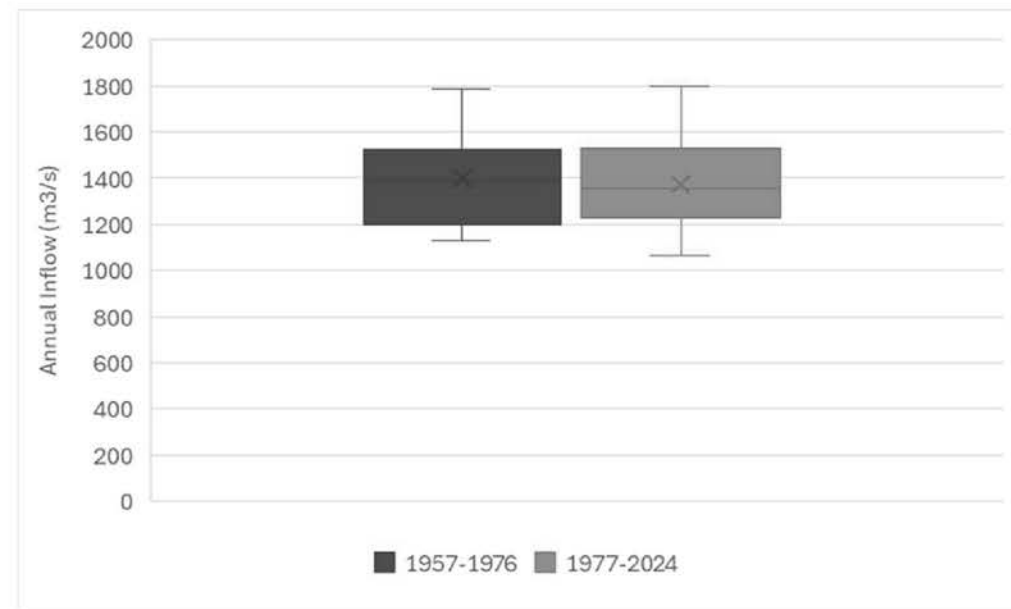
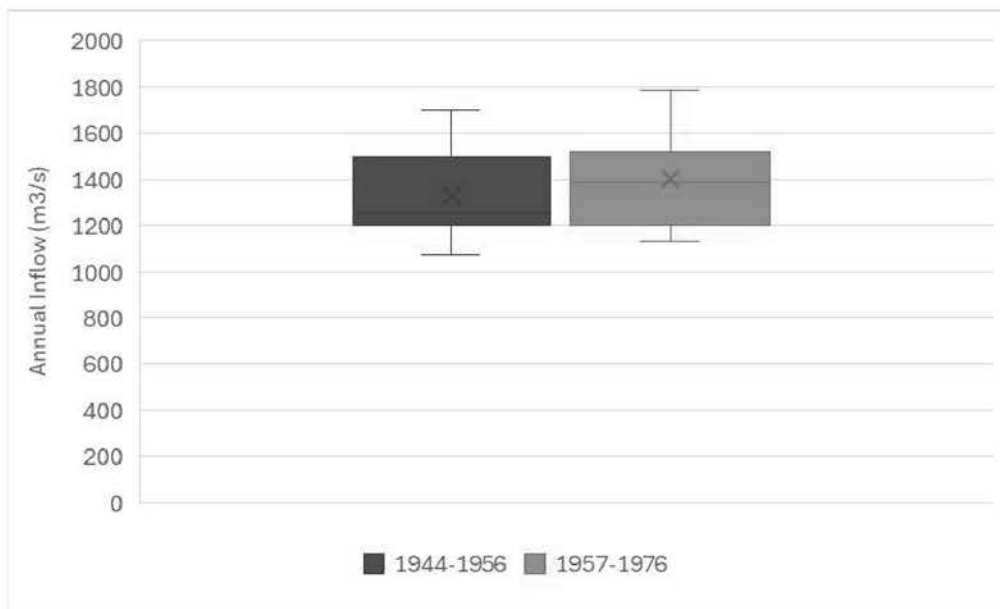
Wilcoxon Step Change Test

Period 1	Period 2	Sample Size n_1, n_2	p-value	Remarks
1944-1956	1957-2024	13, 68	0.344	No change
1944-1976	1977-2024	33, 48	0.821	No change
1944-1956	1957-1976	13, 20	0.428	No change
1957-1976	1977-2024	20, 48	0.701	No change

Boxplots

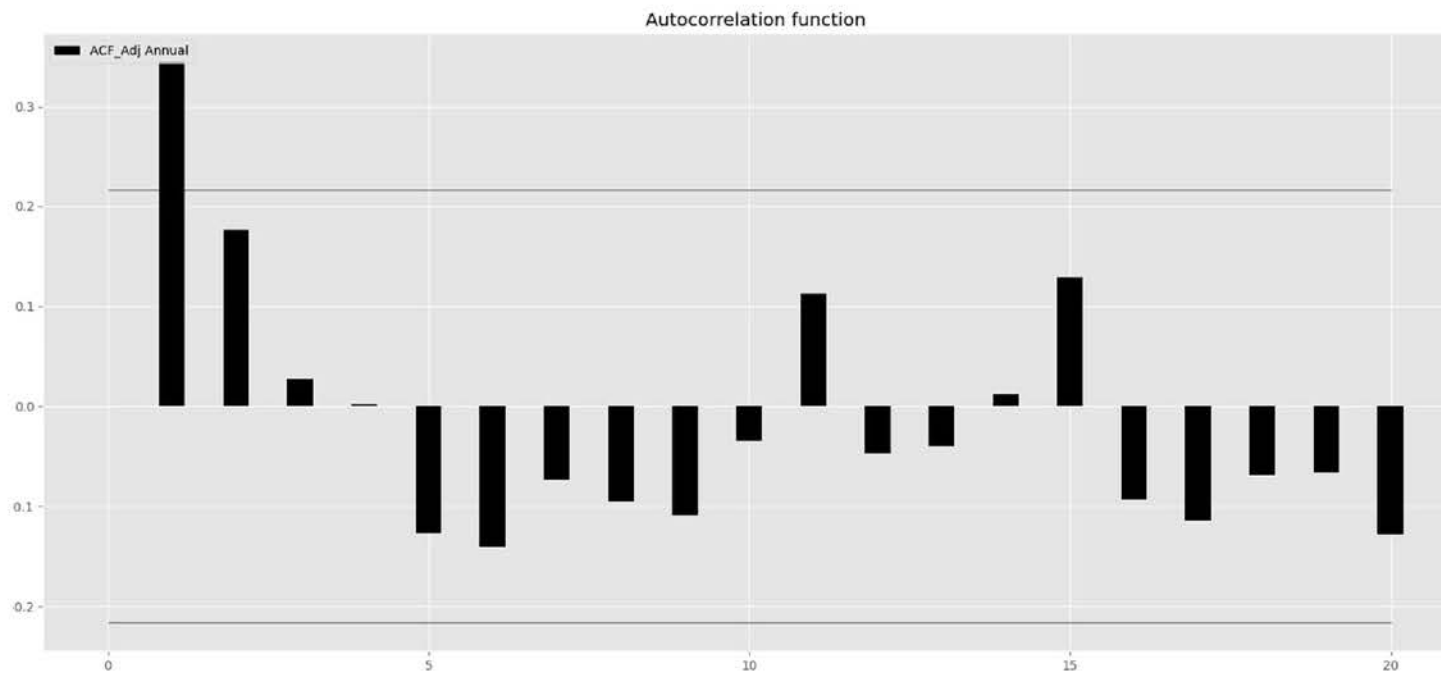


Boxplots (cont.)



Time Series Modelling

- Annual Inflows Autocorrelation



ARIMA Model

- Several models fitted (different AR or MA order)
- Selected Model

$$Q_t = Q_{avg} + 0.4043 * (Q_{t-1} - Q_{avg}) + e(t)$$

where Q_{avg} is average annual flow,

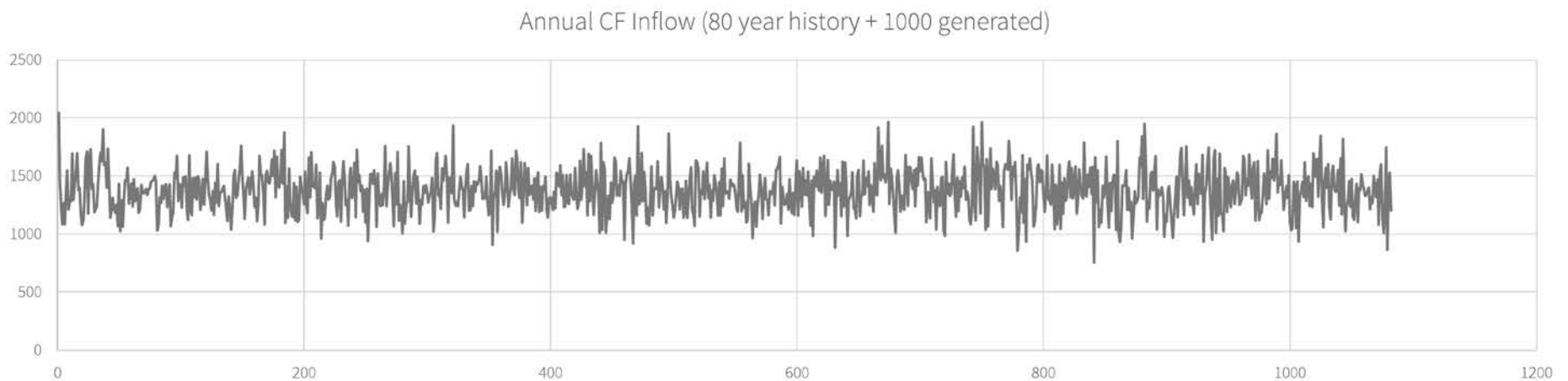
and $e(t)$ is the residual error normally distribute with zero mean and variance u

Fitted:

AR(1)	0.4043
St.Dev	186.42

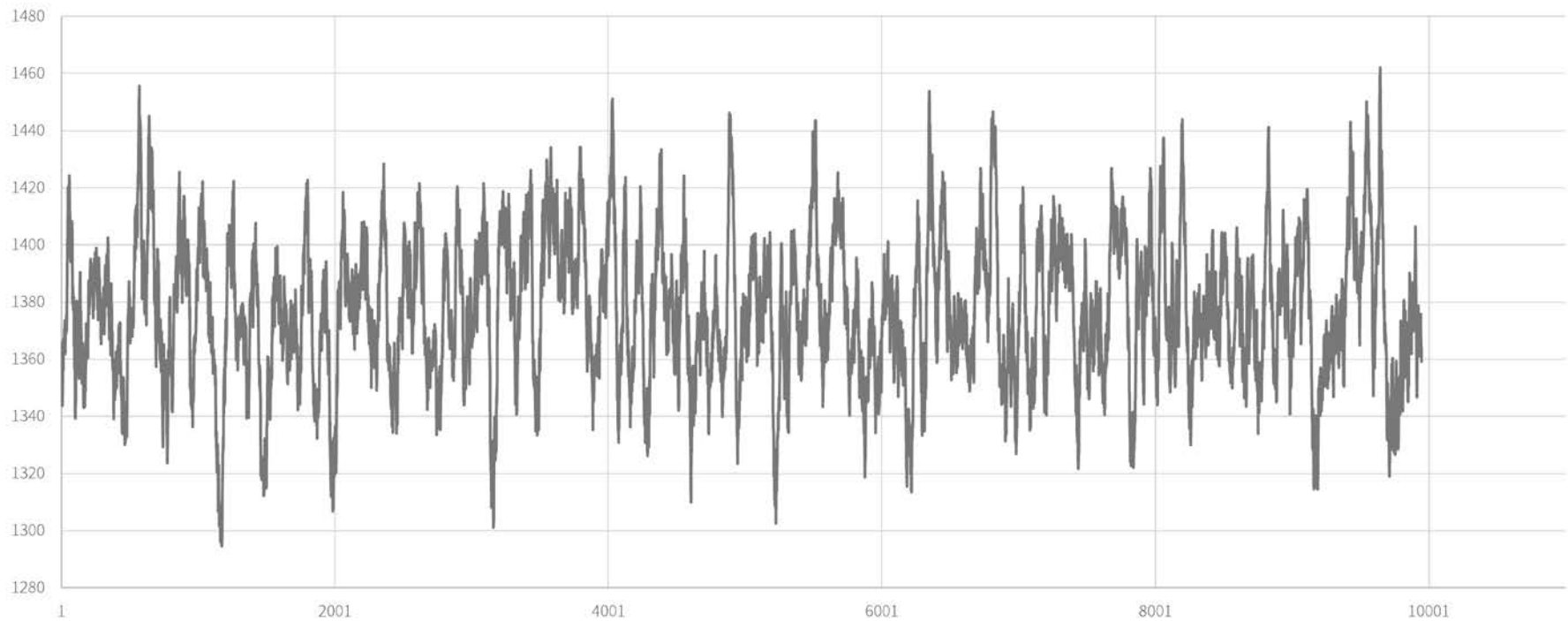
Synthesized Time Series

- ARIMA model and Monte Carlo Simulation used to synthesize inflows



Moving Average

51 Year Moving Average



Conclusions

- No evidence of trends or step changes in the total CF inflow series.
- The current review by Hatch has examined the inflows on a total watershed basis only. Review of inflows for individual sub-basins would have to be done if it was desired to characterize spatial distribution.
- The current review by Hatch has not examined other data such as regional observed streamflow and precipitation records for comparison to the CF inflow series.

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Thank you.

For more information,
please visit www.hatch.com



Section A

ANNEXE / APPENDIX XIV

HYDRO-QUÉBEC
DIRECTION PLANS ET PROGRAMMES D'ÉQUIPEMENTS DE PRODUCTION
SERVICE PRÉVISIONS ET RESSOURCES HYDRIQUES

CHURCHILL FALLS INFLOWS
HARMONIZATION OF HYDRO-QUÉBEC
AND CF(L)Co. DATA BASES

Prepared by: Marc Durocher, Ph.D.
René Roy, Ph.D.
Équipe Prévisions des apports
Service Prévisions et ressources hydriques

April 1998 (2nd edition)

HARMONIZATION OF HYDRO-QUÉBEC AND CF(L)Co DATA BASES

1975 - 1997

After having observed differences between their respective data base and in order to have a unique set of hydraulic data, HQ and CF(L)Co agreed to correct and adjust their data base to the same level.

A Report entitled "Churchill Falls Inflows, Harmonization of Hydro-Québec and CF(L)Co Data Bases" was issued in May 1995 which contained the methodology and, in Appendix C, the official Data Base.

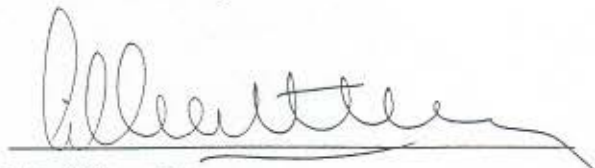
The present Report (April 1998) is the 2nd edition of the May Report. Compared to the latter, the following modifications have been made to the Appendix C :

- Spill flows at Jacopie (from September 1976 to December 1997) are calculated using the method accepted by the parties and as described in the May 19, 1979, Manual entitled "Determination and Adjustments of Technical Operational Characteristics". This method takes into account the exact characteristics of the spillage : gate movement, levels and duration of spillage.
- Ossokmanuan, Smallwood, East and West Forebays elevations on August 31th, 1976 to 1996 (by step of 4 years) were checked and corrected to ensure they are conformed with the determination of Water-to-Energy factor according to the Power Contract (Article IX, Section 9.2).
- The following data are also included :
 - Lobstick elevations from 1975 to 1997 ;
 - Data set from 1995 to 1997.

Appendix C will be updated annually with the current figures.

Both parties agree hereto to replace the May 1995 Report by this edition (April 1998) which constitutes the new official Data Base.

FOR HYDRO-QUÉBEC :



Mr. Gilbert Neveu
Generation Group
Principal Member of the Operating Committee

FOR CF(L)Co :



Mr. James R. Haynes
General Manager
Principal Member of the Operating Committee

CONTENTS

1.	INTRODUCTION	1
2.	HARMONIZATION PROCEDURE	2
2.1	Harmonization of inflow calculation methods	2
2.2	Harmonization of the data bases	4
3.	VALIDATION OF MONTHLY INFLOW	5
4.	RESULTS OF THE HARMONIZATION	6
5.	ACTIONS TO CORRECT THE SITUATION	12

APPENDIX A

A.	SMALL WOOD STORAGE CALCULATION METHOD	13
A.1	Calculation method	14
A.2	Recalculation of historical data bases	15

APPENDIX B

B.	CHURCHILL FALLS TOTAL INFLOW RECONSTITUTION	19
B.1	Churchill Falls unlikely low flows	21
B.2	Churchill simulated monthly inflows	23
B.3	Regression equation and total Churchill monthly inflow reconstitution	27
B.4	Annual water balance	28

APPENDIX C

C.	HARMONIZED DATA BASE: MONTHLY VALUES	31
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1. INTRODUCTION

In 1989, Hydro-Québec undertook a study to examine and, if necessary, to improve the quality of Churchill Falls watershed natural inflows. While doing this study, Hydro-Québec realised:

- that, since 1975, there were significant differences between CF(L)Co and Hydro-Québec hydraulic data bases;
- that if nothing is done, this problem will carry on given that the data transmission system is still not adequate.

This situation produces uncertainties in regard to our hydraulic information. This is a problem which prevents H.Q. from having a confident estimation of its forecasted imports from Churchill Falls. Also, this situation may have an impact on future contracts if a unique revised data base is not acceptable by both parties, and if the data transmission problem is not solved.

Therefore, the Working Committee CF(L)Co / Hydro-Québec decided to set up a task group :

- to investigate those differences;
- to harmonize the two historical hydraulic data bases from 1975 to 1993;
- to take actions to make sure that differences between the two data bases will not occur in the future.

This task was carried out by Service Prévisions, Direction Production et Échanges d'énergie of Hydro-Québec. This report gives the results obtained by the task

group. It summarizes the harmonization procedure which was undertaken (section 1), gives the results of a small data validation procedure made on the harmonized data base (section 2), shows the results of the harmonization (section 3), and proposes actions to be done to make sure that this problem will not occur again (section 4).

2. HARMONIZATION PROCEDURE

The data harmonization procedure was done in two phases. First, we compared the inflow calculation methods of CF(L)Co and HQ. Differences between the methods were found, and HQ method was adjusted accordingly. After recalculation of inflows with the updated method, there was still important differences between CF(L)Co and HQ. It was therefore decided to compare and to harmonize all data values used for inflows calculation. This is phase 2, and it is an important task as it means the harmonization of all daily values of water elevation and discharge of the four reservoirs of Churchill Falls hydroelectric complex.

2.1 Harmonization of inflow calculation methods

The methods used by each company for inflow calculation were compared. Differences were found and **Hydro-Québec adjusted its calculation to CF(L)Co method**. The following corrections were made:

- for east and west forebays, application of updated equations for the relation between elevation and volume;
- volume of west forebay is calculated from Jacopie elevation instead of Whitefish elevation;

- inflows of east and west forebays are now calculated together (i.e. a unique watershed including two reservoirs);
- adjustment of flow delay from 0 to 3 days between Lobstick and the Forebays for calculation of Forebays inflows,

Since 1987, HQ used a different method to calculate natural inflow for Smallwood reservoir. Instead of using Lobstick elevation only for Smallwood volume calculation, HQ used the readings at Lobstick, Orma and Hook when available. Smallwood reservoir is therefore subdivided in three parts, and volume variations are calculated individually for Lobstick Lake, Orma Lake and Hook Bay (3 relations elevation-volume). It is assumed that such method is necessary to improve volume calculation for low water levels. CF(L)Co did not use this methodology until 1994, and we must therefore expect differences in Smallwood inflow from 1987 to 1994 between the two data bases. The impact of using three equations instead of one for the relation elevation - volume is explained in more details in appendix A of this report.

After applying those corrections, HQ inflows from 1975 to 1987 were recalculated and were compared again to the CF(L)Co values (HQ and CF(L)Co inflows calculation methods were identical during this time period). Despite those adjustments, important differences were still present. This indicated that an harmonization of all values of the data bases (elevations and discharges) was necessary.

2.2 Harmonization of the data bases

The purpose is to harmonize HQ and CF(L)Co monthly natural inflow values from 1975 to 1993. However, to do so, we have to compare and to harmonize all daily values of elevation and discharge, as HQ uses those daily values to calculate monthly inflows. Since CF(L)Co values were only available on paper from 1975 to 1990, it was not possible to use computer routines to facilitate and to improve the harmonization process. Most of the work was done manually, and it was not possible to compare and to adjust all non identical values given the size of the data bases (more than 180 000 values). Consequently, **after harmonization the two data bases are still not identical**, because we focused mainly on the correction of large discrepancies between values.

The harmonization procedure was the following:

- comparison of **all** monthly values of inflows for each reservoir;
- where significant differences in inflow monthly values were detected (larger than 10 cms): comparison of all daily values of elevation and discharge;
- where HQ and CF(L)Co daily values were different, **HQ used CF(L)Co values** unless obvious errors in CF(L)Co were detected.

The results of this harmonization procedure will be shown in section 4 of this report.

3. VALIDATION OF MONTHLY INFLOW

As mentioned in the introduction of this report, the purpose of this study was not to validate natural inflow values, but to harmonize the values in order to propose a common data base for HQ and CF(L)Co. We did not effectuate an intensive validation procedure. We assumed that CF(L)Co values were valid, and we used them to replace HQ values where data discrepancies were detected.

However, once the harmonization procedure completed, we observed monthly inflow values that were completely unrealistic from an hydrological point of view. Those cases corresponded to negative or very small inflows in winter at reservoir Smallwood for some dry years. We assumed those unlikely values to be caused by errors in Smallwood volume estimation from Lobstick elevation in drought period when, because of the bed configuration, Lobstick Lake is not properly connected to Orma Lake and Hook Bay (elevation below 469.08m).

In order to improve those unrealistic Smallwood inflows values, we used two approaches. First, since 1987 we can take advantage of water level readings taken in the field at Orma Lake and Hook Bay. Using those readings, we calculated individually daily volume variation for the three reservoirs of Smallwood, and we reconstituted natural inflow accordingly. Before 1987, since no field readings were available, we reconstituted unrealistic Smallwood inflows using (1) HQ mathematical model to simulate watershed discharges, and (2) natural inflows values at nearby reservoirs. This reconstitution procedure was applied to winter values of 1982 and 1986.

The validation and reconstitution procedures are explained in more details in appendix B of this report.

4. RESULTS OF THE HARMONIZATION

Table 1 shows the annual differences, after harmonization, in Churchill Falls total inflows between HQ and CF(L)Co data bases from 1975 to 1993 (values in hydraulic year, i.e. October to September). It can clearly be seen that remaining differences are very small, as they are less than 1% in most cases.

From 1989, inflows differences are higher. This is assumed to be caused by the updated way of calculating Smallwood inflows by HQ from 1987 to 1993 (as indicated in section 1.1). This assumption is supported by results in tables 2 and 3. Those tables show inflows differences according to each month (average of monthly values) before and after 1987. It can clearly be seen that inflows differences are much higher after 1987, when HQ and CF(L)Co were not using the same calculation method for Smallwood inflows. Differences occurred mainly in winter (with a repercussion on spring time) when water elevations are low. This is the condition when the use of Orma Lake and Hook Bay elevations for calculating Smallwood inflows gives significant different results than using Lobstick Lake elevation only. Table 4 shows inflows differences per month for the whole period (1975 to 1993).

Figure 1 illustrates the improvement brought by the harmonization procedure. It shows the annual total inflows differences between HQ and CF(L)Co before and after harmonization from 1975 to 1989 (years 1990 to 1993 are excluded because HQ does not have the information before harmonization). This figure shows that the improvement is particularly noticeable between 1981 and 1989.

As mentioned earlier in section 2.2, after harmonization there are still differences between HQ and CF(L)Co data bases. Those differences are very small when we were using the same inflows calculation method (i.e. before 1987). After 1987, data bases differences are very significant but necessary as the proposed common data base is improved. Modifications made after 1987 improved considerably Smallwood inflows. Consequently, HQ and CFL(Co) authorities found those remaining differences to be acceptable for approval of a common data base. The data base (daily values) is available on microdisk (ASCII format), and the monthly values are given in appendix C.

TABLE 1. Annual inflows differences after harmonization (total Churchill Falls)

year (oct. to sept.)	HQ (cms)	CF(L)Co (cms)	HQ - CF(L)Co (cms)	HQ - CF(L)Co (%)
75-76	1584	1577	7	0.4
76-77	1620	1612	8	0.5
77-78	1726	1724	2	0.1
78-79	1810	1809	1	0.0
79-80	1623	1625	-1	-0.1
80-81	1703	1695	7	0.4
81-82	1407	1410	-4	-0.2
82-83	1551	1548	3	0.2
83-84	1555	1556	-1	-0.1
84-85	1145	1146	0	-0.0
85-86	1280	1279	1	0.1
86-87	1225	1231	-6	-0.5
87-88	1252	1251	1	0.1
88-89	1051	1045	7	0.6
89-90	1268	1254	14	1.1
90-91	1128	1127	1	0.1
91-92	1480	1477	3	0.2
92-93	1007	993	14	1.4
mean from 11/75 to 09/86	1545	1543	2	0.1
mean from 10/86 to 09/93	1194	1187	7	0.6
mean from 11/75 to 09/93	1405	1401	4	0.3

* october 1975 is excluded from 75-76 mean value

TABLE 2. Inflows differences for each month
Mean values from 1975 to 1986

month	HQ (cms)	CF(L)Co (cms)	HQ - CF(L)Co (cms)	HQ - CF(L)Co (%)
Oct	1381	1383	-2	-0.2
Nov	1113	1104	9	0.7
Dec	796	798	-3	-0.3
Jan	586	585	1	0.1
Feb	421	391	29	7.5
March	363	310	52	17.0
April	670	683	-13	-1.9
May	3359	3418	-59	-1.7
June	4447	4456	-9	-0.2
July	2310	2306	4	0.2
Aug	1512	1506	6	0.4
Sept	1497	1492	5	0.3

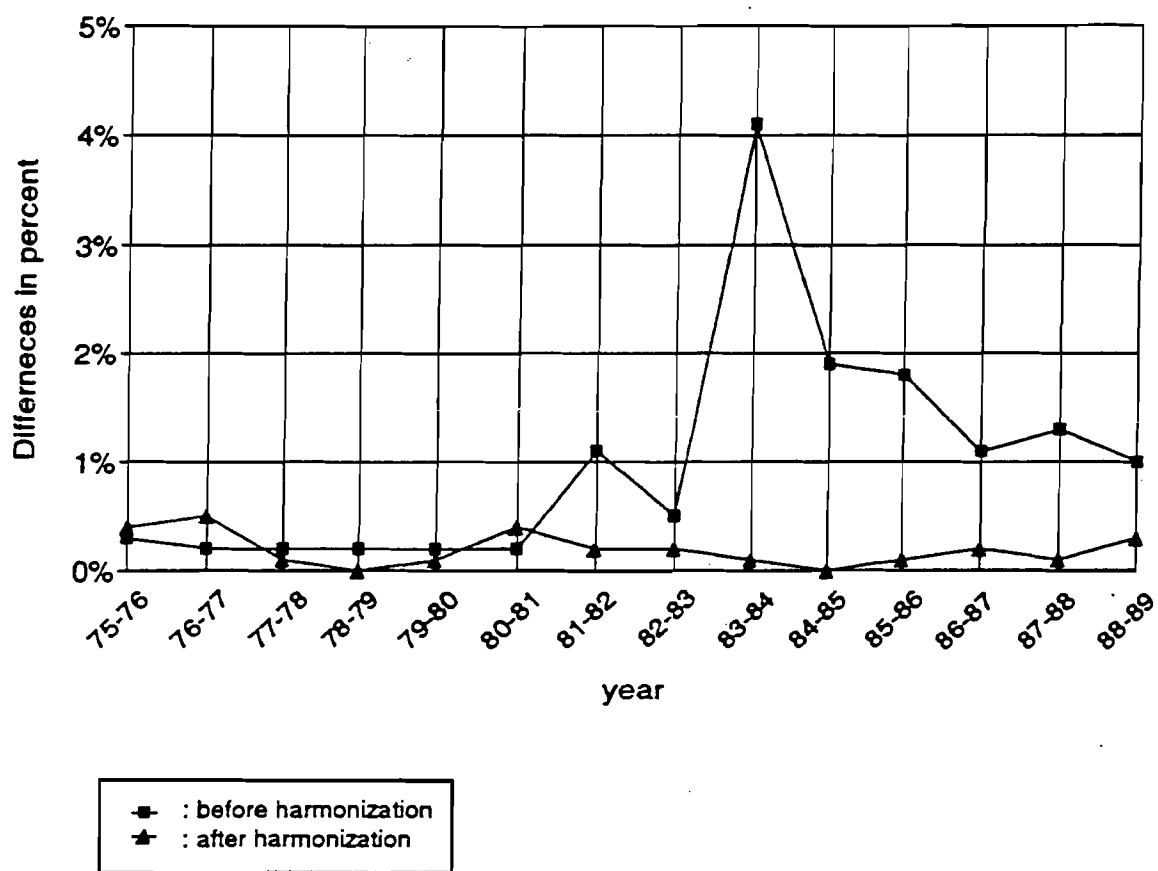
TABLE 3. Inflows differences for each month
Mean values from 1987 to 1993

month	HQ (cms)	CF(L)Co (cms)	HQ - CF(L)Co (cms)	HQ - CF(L)Co (%)
Oct	1526	1577	-51	-3.3
Nov	1116	1065	51	4.8
Dec	662	588	74	12.6
Jan	461	114	347	304.8
Feb	273	228	45	19.8
March	301	451	-150	-33.4
April	580	658	-78	-11.9
May	2107	2405	-297	-12.4
June	3210	3262	-50	-1.6
July	1629	1516	112	7.4
Aug	1185	1220	-35	-2.9
Sept	1323	1209	114	9.4

TABLE 4. Inflows differences for each month
Mean values from 1975 to 1993

month	HQ (cms)	CF(L)Co (cms)	HQ - CF(L)Co (cms)	HQ - CF(L)Co (%)
Oct	1453	1477	-24	-1.6
Nov	1132	1105	27	2.4
Dec	757	727	30	4.1
Jan	537	402	135	33.7
Feb	363	328	35	10.8
March	339	365	-26	-7.2
April	635	673	-38	-5.7
May	2872	3024	-152	-5.0
June	3966	3992	-25	-0.6
July	2045	1999	46	2.3
Aug	1385	1395	-10	-0.7
Sept	1429	1382	47	3.4

Figure 1.
Differences between HQ and CF(L)Co. annual inflows
(in percent in relation to CF(L)Co. data)



N.B. Discrepancies are calculated from the differences in absolute values between HQ and CF(L)Co. monthly inflows

5. ACTIONS TO CORRECT THE SITUATION

As mentioned in the introduction of this report, there are still problems in the automatic data transmission system which prevent HQ and CF(L)Co from having identical hydraulic information. If the problem is not solved, an harmonization study will have to be done again in the future, and uncertainties in hydrological forecasting and in contracts between the parties will occur.

To correct the situation, since 1994 CF(L)Co is transmitting manually (by FAX) its hydraulic data base (daily values) once a week. Those values are manually put into HQ data base and they replace the incorrect ones transmitted automatically in real time. Doing so, HQ and CF(L)Co daily hydraulic values are now identical since the beginning of 1994. However, this is a temporary measure which is not satisfactory. First, such data acquisition mechanism causes non acceptable time delay for HQ inflows forecasts (no information in real time). Moreover, HQ values at smaller time intervals than daily (e.g., 15 min. elevation) are still incorrect.

In order to correct this situation, HQ is actually studying its real time data acquisition system. The cause of the problem has been found. It is an imprecision generated by HQ data transmission real time system when converting from binary to analog format. It is a hardware problem that cannot easily be solved. We hope that a solution to this problem will be found as soon as possible, so that this problem will be solved definitively.

APPENDIX A
SMALLWOOD STORAGE CALCULATION METHOD

A. SMALLWOOD STORAGE CALCULATION METHOD

A.1 Calculation method

In the past, Smallwood storage has been calculated using Lobstick elevation assuming that Orma Lake and Hook Bay were exactly at the same elevation. However, water elevations taken in the field at Orma Lake and Hook Bay have shown that this assumption is rarely true, specially in drought periods. Given this consideration, it was important to find a unique calculation method that both companies should use. To adjust to this fact, Hydro-Québec has developped a calculation method using the three reservoirs elevation. Monthly readings provided by CF(L)Co were used to evaluate a virtual elevation based on the Lobstick elevation.

Harmonization of CF(L)Co and Hydro-Québec data bases has provided an agreement on a unique storage calculation method that should be used to keep an harmonization between the two data bases. When daily water elevation at lake Orma Lake and Hook Bay will be available, Smallwood storage should be calculated using

$$S_{SW} = S_L + S_H + S_O$$

where: S_{SW} is Smallwood storage,
 S_L is Lobstick storage,
 S_H is Hook Bay storage and
 S_O is Orma Lake storage.

Daily total inflow (I_{SW}) should be calculated using

$$I_{SW} = \Delta S_{SW} + Q_{SW}$$

where: Q_{SW} is Smallwood total discharge.

Knowing that the only regulated inflow is from Gabbro natural inflows for réservoir Smallwood (N_{SW}) should be calculated as

$$N_{SW} = I_{SW} - Q_G$$

where: Q_G is discharge at Gabbro.

By using this calculation method, CF(L)Co and Hydro-Québec data bases should be comparable.

A.2 Recalculation of historical data bases

Before considering recalculation of all historical figures, it is imperative to study the difference between the two methods used in the past (before 1987) by CF(L)Co and Hydro-Québec. CF(L)Co was, and is still using the same methodology for the Smallwood storage calculation considering the three reservoirs storage using only Lobstick elevation and assuming that Orma Lake and Hook Bay are exactly at the same elevation (figure A1). Hydro-Québec was calculating Smallwood storage differently, using only Lobstick elevation and a unique storage curve (figure A1). The difference between the two methods is shown in figure A2. Maximum difference seems to appear around 472,50m representing high elevation. The difference is about 25 Mcm (corresponding to a 0,1% error in the storage calculation at this elevation), which represents **less than**

1cm on the water elevation (around 4mm). Taking note of this, **it is not required to recalculate Smallwood historical storage and inflows** from 1975 to 1987.

Figure A1. **SMALLWOOD RESERVOIR**
storage curves

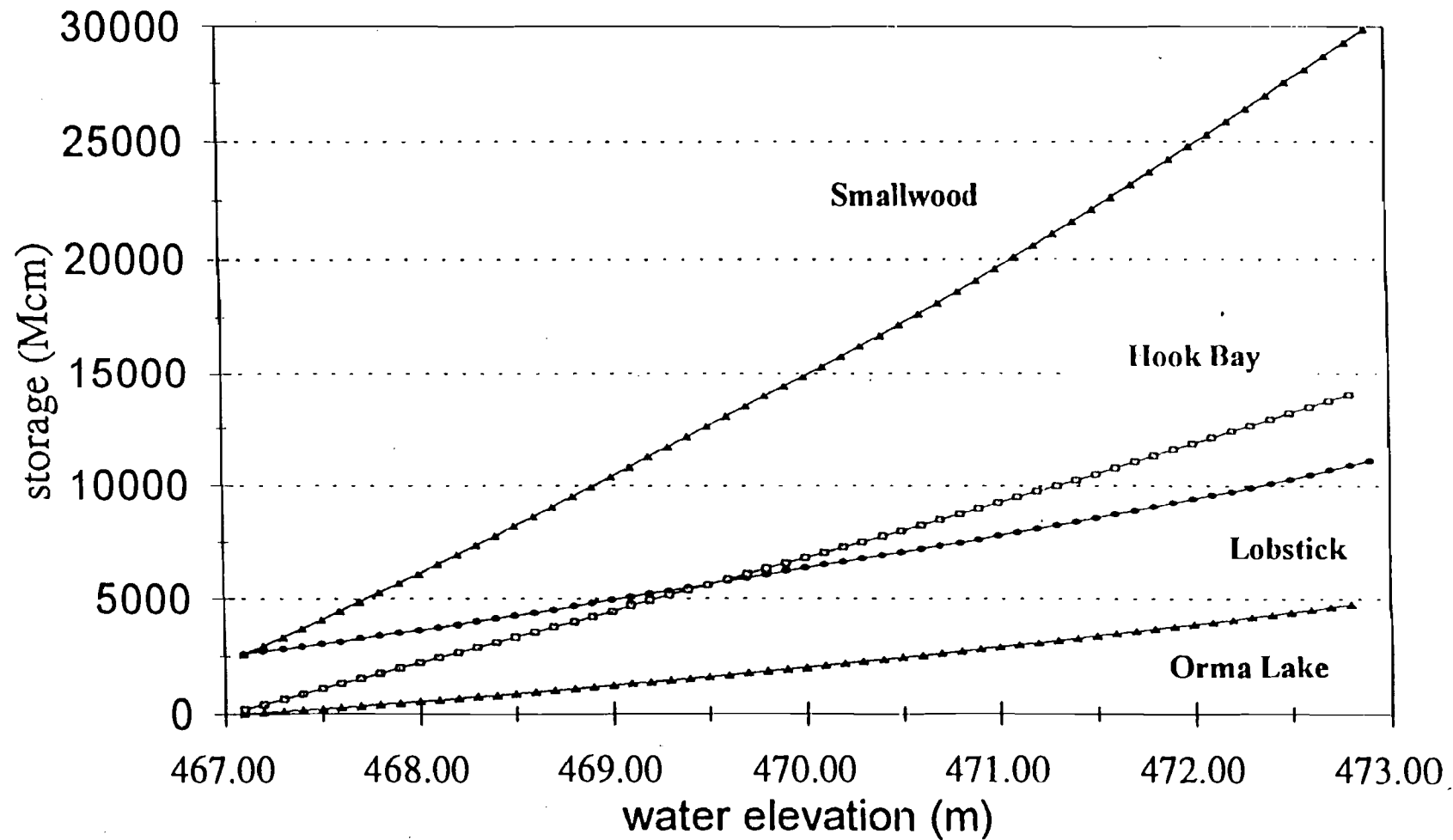
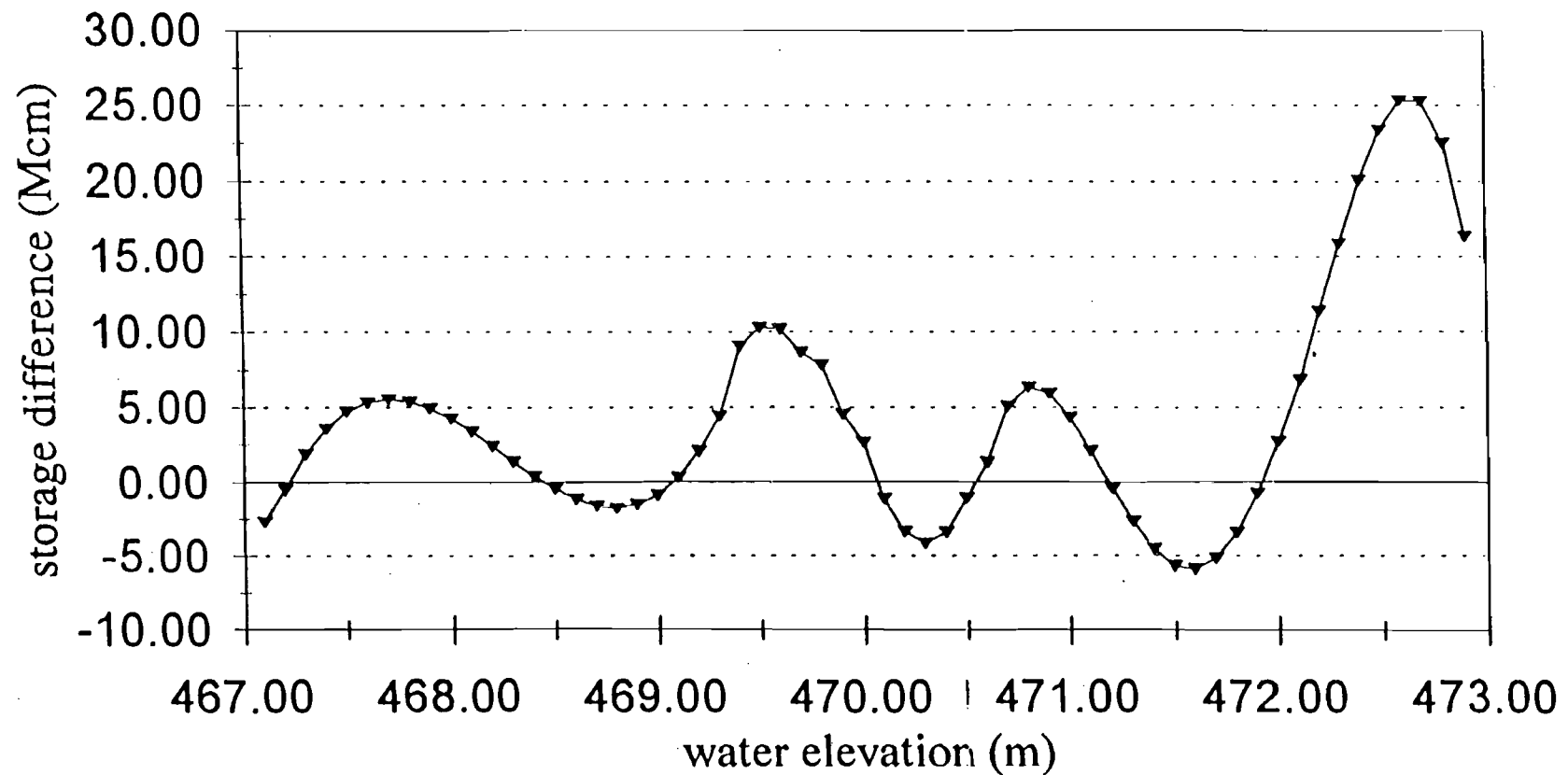


Figure A2.

SMALLWOOD STORAGE

Differences between the two methods



NOTE: method 1 using Lobstick elevation; method 2 using the three reservoirs elevations
Mcm = million of cubic meters

APPENDIX B
CHURCHILL FALLS TOTAL INFLOWS RECONSTITUTION

B. CHURCHILL FALLS TOTAL INFLOWS RECONSTITUTION

Smallwood reservoir bed configuration does not allow, in drought period, the Orma Lake and Hook Bay to be connected to lake Lobstick. As a consequence, negative (or very small and improbable) February or March total Churchill inflows may be measured for some dry years. Those values are associated with the unlikely calculated Smallwood inflows.

In order to avoid those problems, we have generated monthly inflows for the months where the bed morphology induces wrong inflow values.

- i) since 1987, we can take advantage of the levels taken in the field at Orma Lake and Hook Bay, and calculate the total Churchill monthly inflows according to :

$$C_i = S_i + O_i + F_i \quad (1)$$

where :

- C_i = total Churchill monthly inflows
- S_i = Smallwood monthly inflows
- O_i = Ossokmanuan monthly inflows
- F_i = forebays monthly inflows

Orma Lake and Hook Bay elevations are taken manually at weekly or monthly intervals. We reconstituted missing daily values by using linear interpolation.

ii) before 1987, since no field readings were available, and knowing that the unlikely Churchill monthly inflow values are caused by wrong Smallwood inflows, we have reconstituted unlikely monthly inflows at Smallwood in order to obtain the total Churchill reconstituted monthly inflows according to :

$$C_i = S_i + O_i + F_i \quad (2)$$

where :

C_i = total Churchill reconstituted monthly inflows

S_i = Smallwood reconstituted monthly inflows

The procedure leading to the estimation of S_i is described in details at section B.3.

B.1 Churchill Falls unlikely low flows

Tables B1 and B2 present the different components required to calculate, according to equation (1), the total Churchill monthly inflows for the two years where inflows have been reconstituted prior to 1987 (1982 and 1986). The shaded Churchill inflow values need to be reconstituted, according to the procedure which is presented at section B.3.

Table B1 Churchill Falls system inflows for year 1982

year	month	inflows (m ³ /s)			
		Churchill	Smallwood	Ossokmanuan	forebays
1982	1	497	341	195	-39
	2	252	274	15	-37
	3	-236	-247	47	-36
	4	233	13	233	-13
	5	2726	2175	422	129
	6	5266	3349	1764	153
	7	2412	1293	1023	96
	8	1434	830	552	52
	9	1703	1045	581	77
	10	937	528	379	30
	11	807	505	305	-3
	12	739	490	253	-4

Table B2 Churchill Falls system inflows for year 1986

year	month	inflows (m ³ /s)			
		Churchill	Smallwood	Ossokmanuan	forebays
1986	1	240	70	210	-40
	2	-102	-123	59	-38
	3	-35	1	41	-77
	4	796	653	181	-38
	5	4519	3377	1004	138
	6	2592	1518	1021	53
	7	2101	1344	725	32
	8	1046	598	468	-20
	9	1325	827	476	22
	10	1241	730	482	29
	11	772	475	322	-25
	12	463	248	232	-17

In order to obtain representative Churchill inflows for dry years winter months prior to 1987, we have calibrated a regression equation which enables us to substitute to Smallwood inflow (in the equation 1), a reconstituted more reliable inflow (equation 2) with :

- dependant variable : - Churchill monthly inflows
- independant variables: - Ossokmanuan monthly inflows
- Churchill simulated monthly inflows

B.2 Churchill simulated monthly inflows

In order to efficiently manage the water resource, Hydro-Québec is operating a daily inflow forecast system since 1976 for all the watersheds equipped with control structures or power houses in the Quebec province as well as for the Churchill Falls watershed. Weather forecasts and basin climatology are used for producing inflow forecasts which are used as input to generation management.

By using past meteorological data, this model has been performed to obtain simulated Churchill total daily inflows from 1975 to 1991. The following section describes the deterministic model HSAMI, which has been performed.

Model description and application

Any watershed for which hydraulic discharges are measured can be considered to be a transfer function having as input, the meteorological conditions and as output, the discharges.

The goal of the mathematical model HSAMI used to simulate watershed discharges is to determine this transfer function. It is necessary to simulate as

nearly as possible the physical phenomena while keeping in mind that a mathematical tool is not a true physical representation.

The required mathematical model represents a water balance (global model). It is a matter of determining the routing of water after precipitation. The model is based on the following relationship:

$$P = Q + E + \Delta S \quad (3)$$

where:

- P = precipitation
- Q = discharge
- E = evapotranspiration
- ΔS = storage difference

This equation can be illustrated schematically as follows:

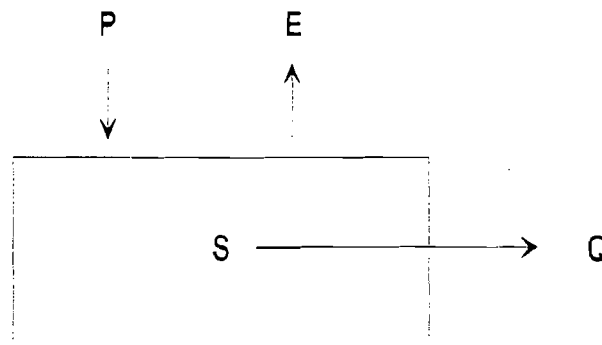


Figure B1 Schematic representation of the water balance equation

In order to simulate as nearly as possible the natural runoff; one attempts to mathematically translate the principal elements of the phenomena that are observed in a drainage basin.

Thus, the soil is divided into two superimposed beds. The surface separating the two beds corresponds to the upper limit of the phreatic table. In fact, each bed can be compared to a variable reserve of water with time. The upper bed (R) is a zone considered to be aerated (more or less humid) and the deeper bed (S) is considered to be saturated.

The runoff due to the rainfall occurs partly on the ground surface, the remaining portion penetrating into the soil and running off later or evaporates partially. A schematic for the model is as follows:

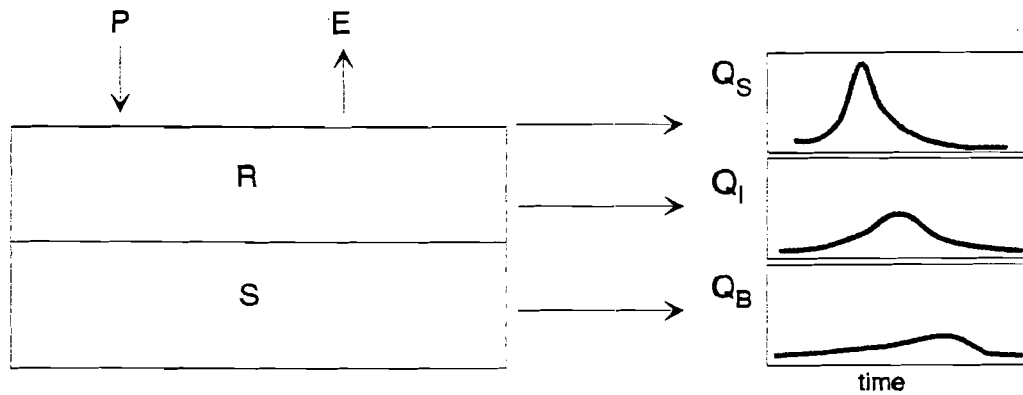


Figure B2 Schematic representation of the three components flows

and the total inflow is calculated according to :

$$Q_T = Q_S + Q_I + Q_B \quad (4)$$

where:

Q_T = total discharge

Q_S = surface flow

Q_I = subsurface flow

Q_B = base flow

According to the simulation model HSAMI, together with the historical meteorological information required, we have simulated the Churchill Falls daily inflows for 1982 and 1986, and cumulated those daily values to obtain monthly inflows. Table B3 lists the calculated and simulated total Churchill monthly inflows for 1982 and 1986.

Table B3 Churchill Falls calculated and simulated inflows

		Churchill inflows (m ³ /s)				Churchill inflows (m ³ /s)	
year	month	calculated	simulated	year	month	calculated	simulated
1982	1	497	457	1986	1	240	335
	2	252	306		2	-102	239
	3	-236	217		3	-35	155
	4	233	186		4	796	353
	5	2726	964		5	4519	3916
	6	5266	6015		6	2592	3474
	7	2412	3428		7	2101	1887
	8	1434	2014		8	1046	1172
	9	1703	1689		9	1325	1295
	10	937	1178		10	1241	1195
	11	807	857		11	772	740
	12	739	683		12	463	558

B.3 Regression equation and total Churchill monthly inflow reconstitution

Considering the monthly inflows of the different components required for the calculation of the Churchill total monthly inflows, together with the total Churchill monthly simulated inflows, we can obtain the correlation matrix presented at table B4.

Table B4 Pearson correlation matrix

	Churchill	Smallwood	Ossokmanuan	forebays	simulation
Churchill	1,000				
Smallwood	0,988	1,000			
Ossokmanuan	0,968	0,922	1,000		
forebays	0,767	0,720	0,734	1,000	
simulation	0,929	0,899	0,943	0,666	1,000

From this correlation matrix , we can see that, as a matter-of-fact, the three components used to calculate the total Churchill inflows are closely correlated to this later one as well as the simulated values. In terms of explained variance, we could have taken, as independant variable, only Ossokmanuan to calibrate the regression model in order to estimate the Smallwood inflows. We decided, despite the fact that we could have obtained a very good regression model by only using the Ossokmanuan inflows, to consider also the information given by the simulated inflows, these later ones being simulated according to physical considerations. In fact the unique contribution of the simulated values in the regression model are not statistically significant, but we know that this deterministic variable provides an input which translates the physical processes occuring under given meteorological real conditions at the watershed scale, which is quite relevant in this case.

The final Smallwood reconstitution model ($r^2 = 0,857$), is given by the following equation:

$$S_i = 83,356 + [1,194 O_i] + [0,137 \tilde{M}_i] \quad (5)$$

where :

$$\tilde{M}_i = \text{Churchill total simulated monthly inflows}$$

By substituting equation (5) into equation (2), we obtain the equation used to reconstitute the total Churchill monthly inflows for the three negative month prior to 1987:

$$C_i = \{83,356 + [1,194 O_i] + [0,137 \tilde{M}_i]\} + O_i + F_i \quad (6)$$

or

$$C_i = 83,356 + 2,194 O_i + 0,137 \tilde{M}_i + F_i \quad (7)$$

The so reconstituted Churchill total monthly inflows are presented in table B5.

B.4 Annual water balance

In order to keep the hydric balance on a yearly basis, the volume of water which has been added to the negative months, had to be removed from the spring freshet months. For example in 1982, the original Churchill total monthly inflow was -236 m³/s, and the reconstituted value :181 m³/s. The overall difference of 417 m³/s had to be removed from May and June monthly inflows also according to the reconstituted values. The month of may and june reconstituted inflows are respectively 1270 and 4931 m³/s, while the calculated inflows are 2726 and 5266 m³/s for the same two months. The differences between the calculated and reconstituted values are respectively 1456 and 336 m³/s for May and June, the

reconstituted values being systematically smaller than the observed ones. For those two months, the total reconstituted deficit in regard to the calculated inflows is 1792 m³/s, with a proportion of 81% in may (1456/1792) and 19% in June (336/1792). Those proportions were applied to remove from those two months the 417 m³/s added to the March inflow. We then come with 2387 m³/s in May (2726 [0,81* 417]) and 5188 m³/s in June (5266-[0,19*417]).

The calculated, reconstituted and proposed Churchill total inflows are presented graphically in figure B3 and listed in table B5, where the shaded values are the ones that are proposed to be changed.

Table B5 Calculated, reconstituted and proposed Churchill total monthly inflows

year 1982 Churchill inflows (m ³ /s)				year 1986 Churchill inflows (m ³ /s)			
month	calculated	reconstituted	proposed	month	calculated	reconstituted	simulated
1	497	537	497	1	240	550	240
2	252	122	252	2	-102	208	208
3	-236	181	181	3	-35	121	121
4	233	609	233	4	796	491	720
5	2726	1270	2387	5	4519	2961	4129
6	5266	4931	5188	6	2592	2852	2592
7	2412	2893	2412	7	2101	1965	2101
8	1434	1622	1434	8	1046	1251	1046
9	1703	1665	1703	9	1325	1327	1325
10	937	1107	937	10	1241	1334	1241
11	807	868	807	11	772	866	772
12	739	730	739	12	463	652	463

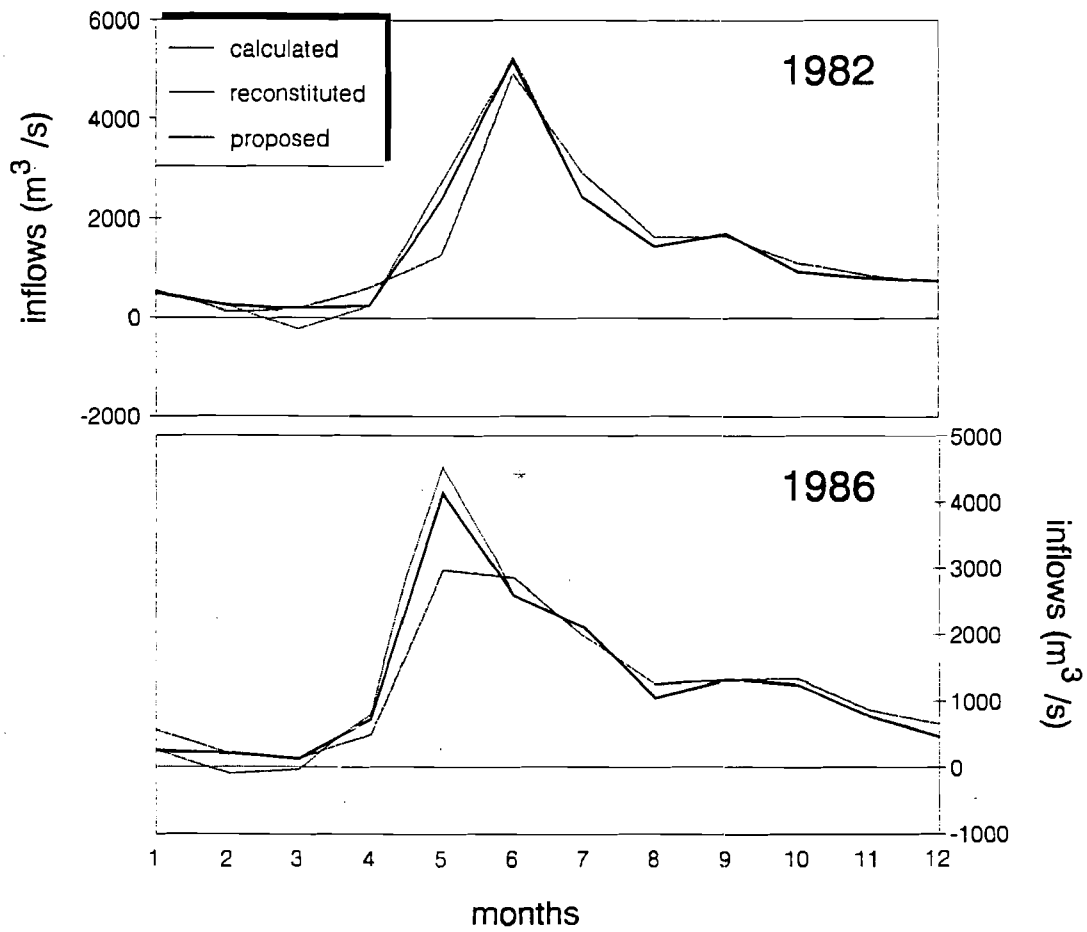


Figure B3 Calculated, reconstituted and proposed Churchill total monthly inflows

APPENDIX XIV
CHURCHILL FALLS INFLOWS
HARMONIZATION OF HYDRO-QUEBEC AND CF(L)Co DATA BASES

APPENDIX C
HARMONIZED DATA BASE : MONTHLY VALUES
1975 – 2003



Water Elevation: Gabbro (m)
(end of month)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	473,84	473,87	472,44	468,66	469,91	473,14	473,87	473,81	479,21	479,08	477,68	477,38
1976	477,35	477,32	477,16	475,34	477,93	478,99	479,18	479,20	479,05	479,05	477,50	477,26
1977	477,29	475,95	474,76	474,57	476,77	478,66	479,12	479,15	479,18	479,15	479,08	479,12
1978	478,93	477,99	475,95	474,73	476,31	478,17	479,18	479,15	479,15	479,12	479,08	479,12
1979	478,54	476,40	475,06	474,21	477,74	479,15	479,05	479,08	479,15	479,14	479,08	479,08
1980	479,11	476,82	475,33	474,51	476,79	479,02	479,14	479,12	479,15	479,08	479,11	479,08
1981	479,11	476,95	475,48	474,63	476,73	478,81	479,08	479,08	479,11	479,08	479,11	479,08
1982	479,05	476,67	475,00	473,96	475,39	477,83	479,11	478,96	479,17	479,11	479,05	479,11
1983	479,02	476,76	475,24	474,54	477,59	478,99	479,05	479,15	479,15	479,05	479,08	478,99
1984	478,93	477,07	475,43	474,00	476,62	477,44	479,02	479,05	479,15	478,93	479,05	479,02
1985	478,75	476,60	475,03	474,00	474,57	476,48	477,07	477,43	478,40	479,15	479,15	479,05
1986	479,15	477,80	475,64	473,90	476,19	477,25	477,32	477,40	478,74	479,15	479,05	479,02
1987	479,02	477,93	475,79	474,94	475,70	476,34	476,40	478,05	479,12	479,08	479,08	479,10
1988	479,08	477,77	475,85	473,69	476,40	476,59	476,98	477,26	478,26	479,05	479,05	479,15
1989	479,05	476,65	474,94	474,02	476,10	476,65	476,65	477,38	478,66	479,05	479,05	479,15
1990	479,05	476,65	474,94	474,02	476,09	476,64	476,64	477,37	478,65	479,03	479,11	479,05
1991	479,05	477,89	475,76	475,03	475,36	475,67	476,98	477,31	478,08	479,08	479,12	479,12
1992	479,12	478,59	476,22	474,88	476,45	477,16	477,62	477,87	478,44	479,11	479,08	479,14
1993	479,02	478,87	476,28	475,06	475,57	476,73	476,67	477,65	478,26	479,11	479,08	479,05
1994	479,05	477,40	475,51	474,45	475,54	476,49	476,12	476,95	478,29	479,14	479,05	479,02
1995	478,99	479,08	476,52	475,24	476,34	476,52	476,34	476,73	477,28	478,41	479,05	479,05
1996	478,93	477,46	475,60	474,81	476,00	476,55	476,95	477,40	477,77	478,89	479,05	479,11
1997	478,98	477,80	475,80	474,53	475,78	477,12	476,34	477,22	478,26	479,07	479,03	479,00
1998	479,05	478,18	476,18	475,18	477,11	476,66	476,41	476,39	477,58	479,12	479,10	479,00
1999	479,02	478,88	476,55	475,39	477,83	477,32	476,78	477,77	478,68	478,99	478,94	479,03
2000	479,08	478,45	476,33	475,28	476,08	476,61	477,31	477,11	477,66	478,48	479,09	479,09
2001	478,99	477,85	475,92	474,79	476,49	475,58	477,33	477,71	478,55	479,06	478,98	479,07
2002	478,98	478,35	476,23	475,07	475,18	477,43	477,54	478,40	478,86	478,95	479,09	478,94
2003	478,82	478,81	476,43	475,22	477,47	477,77	477,61	477,80	478,55	478,82	479,09	479,04

Water Elevation: Hook Bay (m)
(end of month)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1976	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	472,66	-1,00	-1,00	-1,00	-1,00
1977	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1978	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1979	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1980	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1981	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1982	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1983	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1984	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1985	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1986	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	469,09
1987	468,58	468,24	467,65	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1988	468,55	467,92	467,52	467,18	467,70	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1989	467,88	467,55	467,27	467,01	-1,00	468,47	468,57	468,50	468,41	468,86	469,04	468,67
1990	468,06	467,67	467,42	467,05	467,15	468,65	469,13	469,15	469,07	469,61	469,50	469,23
1991	468,55	467,99	467,60	467,24	467,10	468,29	468,81	468,65	468,85	468,92	469,00	468,55
1992	468,12	467,62	467,40	467,19	467,15	469,54	470,58	470,96	471,43	471,42	471,04	470,47
1993	469,66	469,09	468,38	467,94	468,28	469,03	469,35	469,25	469,17	469,25	468,98	468,49
1994	467,81	467,53	467,22	466,98	467,12	468,41	469,42	469,51	469,55	469,68	469,46	468,94
1995	468,25	467,74	467,36	467,15	467,58	468,43	468,73	468,40	468,37	468,38	468,43	467,98
1996	467,54	467,27	467,06	466,99	467,90	469,54	470,21	470,26	469,99	469,47	469,45	469,11
1997	468,46	467,93	467,52	467,18	467,30	469,11	470,37	470,77	470,78	470,57	470,24	469,81
1998	469,06	468,42	467,91	467,44	468,33	469,61	469,94	469,98	469,95	470,01	469,94	469,44
1999	468,73	468,12	467,68	467,29	468,83	470,57	470,94	471,02	471,04	471,14	471,05	470,56
2000	469,87	469,18	468,62	468,14	468,41	470,21	470,85	470,89	470,69	470,44	470,02	469,46
2001	468,68	468,09	467,57	467,21	467,97	468,97	469,33	469,57	469,73	469,94	470,02	469,73
2002	469,08	468,44	467,93	467,53	467,37	469,42	470,14	470,32	470,29	470,58	470,36	469,83
2003	469,18	468,49	467,95	467,60	467,86	468,93	469,61	469,68	469,38	469,47	469,49	469,10

Water Elevation: Orma Lake (m)
(end of month)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1976	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	472,72	-1,00	-1,00	-1,00	-1,00
1977	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1978	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1979	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1980	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1981	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1982	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1983	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1984	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1985	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1986	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1987	468,67	-1,00	467,68	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1988	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00
1989	467,94	468,62	467,32	467,12	-1,00	468,63	468,65	468,57	468,58	469,01	469,13	468,71
1990	468,08	467,12	467,33	467,12	467,27	468,68	469,22	469,12	469,15	469,61	469,58	469,34
1991	468,67	468,10	467,67	467,28	467,20	467,35	468,87	468,92	468,83	468,99	469,01	468,66
1992	468,23	467,70	467,49	467,28	467,30	469,55	470,42	470,96	471,39	471,47	471,15	470,55
1993	469,83	469,13	468,51	468,51	468,32	469,06	469,39	469,31	469,27	469,26	469,05	468,52
1994	467,94	467,65	467,26	466,93	467,19	468,44	469,42	469,60	469,59	469,76	469,52	469,00
1995	468,33	467,81	467,43	467,19	467,64	468,46	468,77	468,54	468,34	468,33	468,47	468,01
1996	467,64	467,33	467,11	466,98	467,94	469,58	470,28	470,37	470,04	469,53	469,51	469,24
1997	468,56	468,01	467,59	467,25	467,37	469,13	470,44	470,84	470,78	470,67	470,33	469,92
1998	469,17	468,51	468,01	467,53	468,39	469,58	469,93	469,99	470,00	469,95	469,98	469,49
1999	468,80	468,20	467,77	467,35	468,82	470,64	471,01	471,11	471,09	471,24	471,13	470,62
2000	469,92	469,25	468,69	468,21	468,47	470,21	470,86	470,89	470,68	470,45	470,02	469,47
2001	468,70	468,11	467,57	467,22	467,92	468,96	469,33	469,65	469,79	470,02	470,03	469,71
2002	469,08	468,43	467,94	467,50	467,37	469,39	470,09	470,29	470,25	470,55	470,32	469,82
2003	469,15	468,48	467,94	467,59	467,83	468,91	469,60	469,73	469,36	469,48	469,47	469,11

Water Elevation: Lobstick (m)
(end of month)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	471,80	471,43	471,16	471,02	471,04	472,47	472,74	472,53	472,62	472,50	472,47	472,17
1976	471,65	471,22	470,73	470,67	471,68	472,56	472,59	472,67	472,78	472,65	472,71	472,38
1977	472,01	471,77	471,31	470,49	470,79	472,04	472,38	472,56	472,81	472,74	472,71	472,26
1978	471,74	471,28	470,67	470,12	470,55	472,32	472,74	472,68	472,59	472,50	472,17	471,53
1979	470,92	470,34	469,61	469,12	471,34	472,53	472,74	472,62	472,74	472,68	472,59	472,23
1980	471,76	471,46	471,00	470,48	471,28	472,59	472,74	472,65	472,40	472,47	472,16	471,64
1981	470,97	470,70	470,15	469,81	470,67	472,68	472,74	472,62	472,47	472,16	471,64	471,00
1982	470,18	469,66	468,82	467,90	468,52	470,33	470,70	470,76	470,97	470,85	470,51	470,03
1983	469,30	469,05	468,75	468,63	470,79	471,77	472,23	472,26	472,38	472,68	472,56	472,26
1984	471,56	471,19	470,70	470,29	471,04	472,23	472,53	472,56	472,47	472,26	471,98	471,43
1985	470,82	470,40	469,82	469,33	469,33	470,76	471,07	471,13	470,86	470,64	470,33	469,79
1986	468,84	468,00	467,25	466,86	469,09	469,84	470,52	470,50	470,36	470,25	469,85	469,09
1987	467,75	466,65	465,86	466,95	468,59	469,00	469,54	469,64	469,67	469,76	469,64	469,00
1988	467,75	466,28	465,43	465,00	468,10	469,15	469,15	469,09	469,06	468,93	468,72	467,93
1989	466,65	466,04	465,12	464,36	467,50	468,63	468,60	468,57	468,39	468,97	469,07	468,42
1990	466,68	464,91	464,73	464,30	466,58	468,90	469,06	468,93	469,03	469,54	469,54	469,18
1991	468,11	467,62	466,74	465,70	466,65	468,66	468,78	468,83	468,72	469,00	468,93	468,39
1992	467,66	466,68	466,77	466,22	467,11	469,91	470,62	471,19	471,34	471,31	471,01	470,36
1993	469,61	468,69	468,08	467,44	468,41	469,08	469,36	469,21	469,09	469,20	468,81	468,17
1994	466,43	464,94	465,15	464,45	466,25	468,78	469,26	469,45	469,66	469,54	469,33	468,69
1995	467,50	465,73	465,97	465,21	467,93	468,42	468,50	468,42	468,05	468,14	468,32	467,56
1996	465,88	465,70	466,37	466,77	468,29	469,60	470,21	470,27	469,90	469,54	469,45	468,96
1997	468,05	467,22	466,22	465,39	466,72	469,37	470,41	470,84	470,78	470,61	470,25	469,81
1998	468,88	468,27	467,39	466,41	468,82	469,63	469,87	469,94	469,79	470,14	469,93	469,30
1999	468,42	467,29	466,86	466,33	469,53	470,61	470,95	470,92	471,25	471,13	471,10	470,54
2000	469,82	469,06	468,53	468,02	468,67	470,28	470,82	470,84	470,61	470,40	470,00	469,32
2001	468,31	467,34	466,83	466,21	468,51	469,01	469,34	469,54	469,62	469,90	469,98	469,65
2002	468,82	467,96	467,16	466,47	466,80	469,64	470,19	470,24	470,25	470,56	470,33	469,81
2003	468,90	467,83	467,18	466,22	468,12	468,98	469,67	469,57	469,38	469,51	469,49	469,00

Water Elevation: Jacopie (m)
(end of month)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	452,17	452,66	452,72	452,81
1976	452,72	452,78	452,81	452,14	452,17	452,69	452,08	452,37	452,63	452,78	452,69	452,87
1977	452,78	452,81	452,81	452,81	451,74	452,17	452,35	452,32	452,51	452,72	452,63	452,87
1978	452,78	452,84	452,81	452,75	452,14	451,93	452,54	452,72	451,23	452,26	452,60	452,87
1979	452,87	452,78	452,84	452,84	451,59	451,90	451,84	451,10	452,41	452,54	452,81	452,81
1980	452,78	452,81	452,78	452,78	452,78	452,48	451,07	451,10	451,96	452,81	452,78	452,75
1981	452,81	452,72	452,72	451,74	451,59	452,02	452,41	452,17	451,59	452,14	452,72	452,81
1982	452,78	452,81	452,75	452,81	451,74	451,62	451,81	451,59	451,50	451,53	452,32	452,84
1983	452,81	452,81	452,75	452,69	451,65	450,59	450,59	451,38	451,29	451,38	452,75	452,84
1984	452,78	452,78	452,78	452,45	451,84	451,71	452,01	451,23	450,82	451,23	452,87	452,74
1985	452,69	452,75	452,75	452,69	452,14	452,72	451,35	450,64	451,50	452,14	452,17	452,59
1986	452,57	452,60	452,69	452,23	451,74	451,25	451,74	451,60	451,28	451,26	452,57	452,57
1987	452,60	452,72	452,63	452,51	451,20	451,59	451,62	451,44	451,04	451,32	452,69	452,60
1988	452,66	452,57	452,66	451,68	451,10	450,71	452,41	451,62	451,71	452,81	452,66	452,57
1989	452,66	452,57	452,57	452,69	452,35	451,71	451,56	451,13	451,81	451,84	452,35	452,65
1990	452,65	452,62	452,59	452,63	452,26	451,34	451,65	450,82	451,92	451,23	452,59	452,68
1991	452,71	452,53	452,68	452,60	450,55	450,56	451,40	451,01	451,29	450,86	452,62	452,65
1992	452,60	452,59	452,63	452,54	451,74	451,62	451,59	451,56	450,95	452,17	452,54	452,65
1993	452,66	452,66	452,63	452,53	450,55	451,37	451,98	451,38	451,16	451,86	452,71	452,59
1994	452,77	452,83	452,71	452,71	451,13	451,52	451,40	452,16	451,46	451,59	452,59	452,53
1995	452,59	452,78	452,71	452,29	450,85	450,82	450,79	450,61	451,07	451,28	452,10	452,50
1996	452,53	452,59	452,62	452,29	451,31	451,16	450,61	451,57	451,78	451,29	452,72	452,76
1997	452,65	452,66	452,70	451,72	451,54	451,13	451,58	451,49	451,38	451,90	452,72	452,54
1998	452,60	452,73	452,72	452,25	450,87	450,63	451,82	452,04	451,44	451,80	452,65	452,72
1999	452,68	452,58	452,65	452,24	451,60	451,11	450,88	451,69	451,55	451,47	452,58	452,02
2000	452,54	452,70	452,64	452,32	451,82	451,27	451,87	451,16	450,66	450,90	452,69	452,62
2001	452,72	452,63	452,55	452,46	450,74	450,70	451,11	451,94	451,89	451,65	452,60	452,64
2002	452,67	452,64	452,55	451,63	451,35	451,82	451,07	452,21	451,79	450,77	452,54	452,65
2003	452,70	452,66	452,58	452,56	451,63	451,15	451,81	451,35	451,85	451,69	452,43	452,73

Water Elevation: Plant (m)
(end of month)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	-1,00	448,33	448,00	447,42	448,08
1976	447,93	448,30	448,42	447,90	447,87	448,21	448,45	448,45	448,27	447,90	448,27	448,24
1977	448,27	447,81	448,06	448,18	448,06	448,42	448,42	448,45	448,42	448,18	447,42	448,48
1978	448,30	448,27	448,24	447,96	448,09	448,45	448,39	446,11	445,95	445,95	447,51	448,42
1979	448,48	447,84	447,78	448,39	447,29	445,98	445,98	446,38	448,36	448,26	448,12	447,60
1980	447,59	447,75	448,11	448,11	448,12	448,42	448,36	448,39	448,23	447,59	447,69	446,86
1981	448,08	448,20	447,72	447,84	447,87	448,26	447,93	447,72	447,90	447,99	448,08	447,72
1982	447,84	447,69	448,20	448,09	447,72	448,17	447,44	447,93	447,96	448,29	447,32	447,69
1983	447,93	447,96	447,45	448,12	447,78	447,90	448,00	447,87	448,18	447,90	447,72	447,57
1984	448,12	448,12	447,93	447,63	447,90	447,48	448,27	448,30	448,23	448,12	448,14	447,60
1985	447,51	447,63	447,96	447,78	447,81	445,65	445,98	445,89	447,90	447,57	447,26	447,45
1986	447,84	447,72	447,41	447,42	447,54	447,68	447,81	448,36	448,48	448,30	447,78	447,90
1987	447,23	447,81	447,96	447,82	447,90	448,33	447,20	448,15	448,33	448,36	447,84	447,45
1988	448,15	447,97	447,54	447,69	448,06	448,45	448,48	448,42	448,36	447,54	448,03	448,00
1989	447,75	447,63	448,00	447,78	447,96	448,03	448,45	448,36	448,39	448,39	447,51	448,06
1990	447,51	446,71	447,78	447,96	447,60	448,42	448,48	448,45	448,45	448,51	447,60	447,60
1991	447,63	447,84	448,30	447,96	448,45	448,45	448,42	448,45	448,42	448,39	447,62	447,93
1992	447,17	447,75	448,15	447,84	447,99	448,02	448,39	445,89	446,53	448,14	448,23	447,29
1993	447,96	447,54	448,08	447,62	448,11	448,39	447,26	446,01	448,12	448,42	447,14	447,59
1994	447,47	447,71	447,62	447,85	448,11	448,23	448,45	448,32	448,34	448,50	447,39	447,73
1995	447,74	447,49	447,71	447,92	447,99	448,47	448,48	448,36	448,42	448,42	446,71	448,02
1996	447,44	448,03	447,60	447,53	448,20	448,33	448,38	448,38	448,42	448,45	447,64	447,64
1997	447,49	447,51	447,94	447,90	448,15	447,50	448,00	447,84	447,68	447,79	448,07	447,83
1998	447,83	448,38	447,76	447,83	447,90	448,10	448,03	448,13	448,38	447,88	447,80	447,71
1999	447,68	447,88	447,92	447,94	447,61	448,02	448,10	448,04	448,14	448,13	447,72	447,30
2000	448,16	447,77	448,22	448,05	447,77	448,13	448,42	448,39	448,06	448,18	448,15	448,11
2001	448,02	447,96	447,62	448,12	447,78	448,05	448,00	448,09	448,13	447,81	447,35	447,78
2002	448,34	447,93	447,94	448,05	448,09	448,04	448,05	448,07	448,10	447,96	447,95	447,75
2003	447,98	447,40	448,03	447,70	448,00	448,06	448,00	448,13	448,13	448,03	448,00	448,01

Discharge: Ossokmanuan (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	0,0	0,0	0,0
1976	0,0	0,0	0,0	0,0	4,5	520,0	22,3	0,0	0,0	0,0	0,0	0,0
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
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
1979	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
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
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
1982	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1983	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
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
1985	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1986	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1987	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
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
1989	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1990	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1991	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1992	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1993	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1994	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1995	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1996	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1997	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1998	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1999	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2000	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2001	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2002	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2003	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Discharge: Gabbro (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	172,5	100,6	527,7	682,1	286,1	719,4	671,4	619,8	-1,0	424,4	715,8	369,7
1976	210,1	172,5	173,0	590,7	644,2	655,3	482,1	580,9	864,4	709,5	819,0	359,6
1977	238,2	458,2	351,1	116,5	377,0	1301,9	604,1	596,1	618,9	751,6	544,3	359,7
1978	319,1	449,6	614,4	351,2	561,4	1483,6	946,2	603,5	511,1	596,1	411,5	230,0
1979	320,0	707,1	403,0	285,8	1100,2	1106,5	1133,3	791,3	622,5	605,2	610,0	336,3
1980	232,1	765,3	473,1	285,2	631,8	1117,0	793,7	516,0	433,4	521,5	390,3	322,4
1981	219,5	749,5	499,8	310,8	453,5	1653,0	1009,2	569,5	336,9	456,9	324,0	284,5
1982	205,2	726,9	429,8	233,0	345,0	1147,3	651,7	601,6	508,2	399,4	325,5	233,0
1983	205,0	742,5	456,0	320,2	1109,3	1098,0	850,6	488,1	552,5	779,9	495,9	377,1
1984	246,3	628,2	498,6	310,6	633,2	1340,2	588,0	521,2	439,8	433,6	298,5	284,9
1985	294,8	694,4	431,8	237,9	247,5	1012,5	648,8	513,5	101,0	216,0	413,5	282,5
1986	176,4	494,4	573,5	319,0	739,3	750,6	707,4	447,7	101,1	350,1	356,8	241,8
1987	164,6	407,3	595,4	509,2	731,7	656,0	524,8	311,8	178,5	548,3	477,7	381,6
1988	209,1	483,3	596,1	359,0	576,6	1155,5	639,9	282,8	139,8	240,9	446,4	254,3
1989	199,2	724,6	425,0	224,8	510,2	906,9	398,9	172,8	68,6	505,0	584,2	349,9
1990	203,0	526,8	561,8	304,8	427,0	985,7	597,9	223,8	99,9	522,7	481,5	330,4
1991	179,9	440,2	597,5	324,2	348,0	912,7	574,7	310,2	111,3	204,7	525,3	285,2
1992	218,7	253,8	698,0	386,6	340,1	1158,3	721,4	595,9	480,8	302,6	371,1	191,7
1993	181,5	174,2	683,9	398,7	494,3	710,8	561,9	134,4	190,7	309,8	404,3	281,0
1994	196,8	549,0	535,2	304,3	378,7	1051,9	996,6	580,0	322,6	302,6	446,6	291,1
1995	206,1	141,6	718,8	431,9	661,9	981,2	553,0	333,8	66,2	65,5	234,4	301,5
1996	225,3	525,7	548,0	324,1	625,2	1080,1	817,7	525,8	208,4	70,6	553,0	423,8
1997	275,2	466,4	592,3	338,0	553,9	1214,0	1161,8	555,7	212,8	295,1	368,3	256,0
1998	158,6	365,4	660,6	403,2	844,1	1227,7	649,5	444,0	241,7	327,6	579,4	353,8
1999	212,2	220,1	738,1	453,7	983,5	1500,8	823,7	276,3	248,2	305,8	501,0	332,3
2000	186,5	327,6	695,7	426,8	567,2	1154,3	759,9	533,8	166,8	118,0	159,0	267,5
2001	231,6	441,2	609,4	355,7	679,0	1003,8	410,3	381,7	194,6	399,6	544,2	392,5
2002	274,0	313,2	677,3	402,8	312,1	1182,6	852,4	463,5	401,1	559,2	450,3	343,4
2003	241,3	173,2	691,6	419,7	481,6	921,6	745,6	393,3	146,7	329,3	373,8	355,0

Discharge: Lobstick (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	1279,9	1237,8	1412,1	1499,2
1976	1543,6	1432,7	1412,4	1289,4	1173,5	1567,0	1389,4	1350,0	1824,4	1741,6	1332,6	1608,6
1977	1576,0	1450,1	1414,3	2121,1	1230,6	2229,8	1160,4	1284,4	1510,1	1760,8	1695,3	2005,0
1978	1966,3	1905,3	1916,9	1699,0	1330,6	1085,2	1465,6	2071,8	1598,3	1581,9	1770,0	1918,8
1979	1921,7	1994,0	1866,7	1671,4	1177,8	1021,5	2487,2	1952,0	1435,6	1649,1	1793,2	1651,0
1980	1734,6	1753,6	1748,8	1672,2	1412,6	1338,4	1870,8	1546,0	1451,0	1498,9	1771,8	1926,6
1981	1962,2	1791,0	1729,0	1369,2	778,1	1301,9	2370,8	1656,4	1488,4	1555,3	1917,5	1962,5
1982	2012,2	1979,0	1996,5	1742,1	1215,2	1292,0	1287,2	1323,4	1156,7	1147,4	1462,5	1558,6
1983	1664,3	1591,0	1434,0	1225,9	833,8	929,5	1063,7	1220,5	1208,1	1247,4	1657,0	1917,3
1984	1895,0	1730,0	1713,6	1437,6	1209,3	1227,4	1340,2	1385,6	1324,2	1542,0	1774,2	1792,5
1985	1847,7	1855,0	1710,2	1411,6	1033,8	877,3	1035,2	1059,4	1248,7	1249,8	1532,9	1741,5
1986	1826,3	1844,3	1674,1	1280,9	976,1	972,4	874,7	1081,7	1184,0	1271,7	1539,3	1761,1
1987	1893,2	1872,6	1676,1	1063,0	1041,2	884,0	814,8	1126,1	1108,7	1221,1	1539,1	1751,2
1988	2029,7	2025,8	1680,8	1165,0	723,9	1052,2	1234,0	936,8	1064,7	1292,3	1464,8	1679,6
1989	1624,7	1630,6	1294,6	967,3	696,3	871,9	838,3	717,6	784,1	876,5	1297,2	1754,5
1990	1843,0	1891,4	1376,5	995,4	650,9	809,0	966,9	955,7	892,8	997,3	1235,4	1447,8
1991	1748,5	1608,2	1599,1	1284,2	851,4	804,1	862,3	809,5	837,4	770,5	1265,2	1459,8
1992	1412,9	1477,6	1287,6	1129,2	767,0	633,4	875,9	711,5	982,4	1167,1	1378,1	1664,1
1993	1759,9	1769,4	1757,1	1501,5	1088,7	930,2	769,1	834,1	1047,3	1049,2	1382,3	1521,9
1994	1858,5	1873,6	1147,3	1013,8	726,1	900,2	938,3	1072,2	891,6	1120,3	1536,0	1689,9
1995	1798,3	1813,8	1310,4	1276,6	989,6	1120,9	944,0	884,7	888,7	757,5	852,0	1623,7
1996	1675,2	1368,3	841,2	614,9	680,4	887,1	932,0	1008,1	1155,3	1226,9	1466,6	1686,9
1997	1824,9	1813,1	1706,4	1274,3	976,9	777,6	910,9	994,1	1125,8	1416,5	1671,2	1439,5
1998	1794,9	1805,5	1801,3	1595,3	1263,4	1086,1	967,2	1082,3	1238,6	1222,5	1615,8	1803,5
1999	1820,7	1840,8	1715,7	1355,9	856,7	842,0	1062,3	969,7	920,8	1264,7	1456,8	1783,8
2000	1852,5	1887,2	1773,5	1439,7	989,1	832,0	787,0	946,1	1078,7	1216,7	1501,2	1788,9
2001	1891,5	1906,3	1561,5	1254,6	969,7	883,7	720,9	879,3	935,1	963,0	1373,6	1666,5
2002	1872,6	1849,7	1780,5	1334,6	924,8	779,1	914,6	1033,5	1149,7	1175,8	1600,1	1690,5
2003	1858,6	1874,8	1805,2	1449,2	1182,8	790,0	881,5	929,0	1083,4	970,6	1136,5	1584,8

Discharge: Jacopie (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	0,0	0,0	11,7	0,0	0,0	388,4	696,3	871,1	0,0	0,0	12,2	0,0
1976	4,3	0,0	0,0	0,0	0,0	176,9	155,8	0,0	556,7	438,8	0,0	0,0
1977	0,0	0,0	0,0	645,1	29,5	1183,1	0,0	0,0	167,3	409,5	104,7	0,0
1978	56,0	0,0	0,0	30,4	0,0	0,0	361,0	1064,3	209,3	0,0	23,5	0,0
1979	30,7	0,0	0,0	0,0	0,0	0,0	1396,6	930,7	29,0	262,9	262,7	0,0
1980	26,9	0,0	0,0	0,0	0,0	24,0	512,9	177,7	0,0	0,0	0,0	0,0
1981	0,0	14,9	0,0	0,0	0,0	365,2	1044,2	328,4	0,0	0,0	0,0	0,0
1982	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1983	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
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
1985	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1986	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1987	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
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
1989	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1990	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1991	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1992	5,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1993	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1994	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1995	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1996	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1997	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	126,7
1998	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1999	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2000	14,6	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2001	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2002	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
2003	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Turbine flow: Plant (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	1324,2	1345,4	1412,3
1976	1545,2	1377,7	1377,7	1366,7	1371,8	1363,1	1359,7	1368,9	1357,7	1392,7	1358,3	1527,3
1977	1591,9	1466,5	1412,8	1580,7	1390,5	1225,5	1212,4	1310,7	1370,1	1490,3	1596,5	1898,3
1978	1883,8	1905,4	1908,9	1769,4	1506,0	1256,1	1136,3	1273,2	1523,6	1600,7	1658,0	1854,3
1979	1923,4	1945,9	1904,2	1756,0	1495,1	1156,8	1132,7	1228,1	1318,7	1437,6	1578,8	1679,0
1980	1663,3	1760,0	1767,0	1722,9	1635,0	1389,5	1468,9	1443,7	1437,1	1568,0	1745,3	1947,4
1981	1935,3	1797,6	1786,6	1420,2	940,5	1008,0	1482,7	1473,3	1493,5	1570,7	1919,9	1970,7
1982	1976,2	1951,6	1935,7	1804,8	1404,2	1423,5	1387,2	1375,1	1260,4	1145,0	1420,6	1557,1
1983	1637,8	1608,4	1483,1	1313,7	1087,8	1038,1	1081,0	1263,9	1250,3	1312,1	1606,0	1866,2
1984	1870,3	1763,7	1760,3	1540,5	1371,9	1344,7	1298,6	1400,3	1365,2	1544,3	1718,4	1755,8
1985	1783,8	1810,6	1645,2	1437,5	1188,7	1081,1	1068,7	1073,5	1115,1	1323,0	1458,5	1721,0
1986	1758,6	1806,1	1638,1	1313,7	1119,1	1041,2	894,1	1014,8	1186,5	1294,8	1478,1	1749,8
1987	1814,2	1745,3	1558,7	1082,1	1111,3	899,7	939,6	1125,3	1142,0	1271,3	1494,3	1684,5
1988	1919,4	1897,1	1672,5	1104,7	917,7	1101,1	1248,8	988,7	1064,8	1310,9	1393,1	1615,0
1989	1499,2	1478,1	1182,9	884,2	871,8	921,3	845,9	784,0	777,5	936,9	1255,3	1671,7
1990	1777,1	1742,5	1262,3	884,7	819,5	869,7	981,4	1042,0	906,7	1102,4	1282,8	1388,6
1991	1713,1	1540,3	1524,2	1294,3	954,6	904,5	887,8	841,3	851,5	865,7	1218,6	1396,4
1992	1387,5	1399,4	1219,9	1099,5	908,5	841,7	932,7	912,8	1010,2	1140,4	1327,7	1699,8
1993	1720,8	1754,9	1725,6	1593,3	1292,8	992,3	887,4	918,5	973,7	1073,5	1362,3	1513,4
1994	1773,7	1695,9	1089,4	900,1	846,7	982,2	976,6	1124,6	955,5	1157,7	1506,2	1693,8
1995	1753,3	1715,8	1256,5	1202,9	1183,1	1138,6	1007,6	928,1	935,5	837,0	890,6	1548,4
1996	1567,7	1320,8	803,5	670,6	806,4	979,1	1019,1	1041,8	1186,1	1291,0	1464,3	1688,2
1997	1790,6	1705,0	1619,9	1275,4	1109,5	972,9	987,0	1085,5	1195,4	1466,8	1656,9	1368,5
1998	1813,1	1845,8	1836,4	1680,7	1536,1	1181,5	1046,7	1140,5	1342,3	1353,6	1596,8	1808,6
1999	1863,6	1843,7	1770,4	1442,4	1125,1	938,3	1134,6	1019,5	1013,0	1314,7	1523,1	1828,6
2000	1878,2	1917,8	1875,3	1555,0	1176,5	980,3	841,1	1023,4	1175,7	1275,5	1554,2	1805,0
2001	1920,2	1903,1	1641,5	1291,9	1194,5	1002,3	819,2	952,4	1006,5	1081,2	1382,9	1717,9
2002	1882,9	1874,3	1841,2	1447,5	1112,7	976,9	992,6	1140,0	1185,3	1270,9	1610,9	1736,1
2003	1857,3	1870,3	1760,9	1490,2	1363,1	904,3	995,1	953,3	1112,7	1078,4	1141,2	1578,9

Natural Inflows Ossokmanuan (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	382,7	301,4	292,4
1976	202,4	164,3	134,9	135,6	1282,9	1493,2	565,7	580,9	821,7	709,5	367,0	298,3
1977	245,8	93,3	145,3	116,5	783,6	1813,8	749,0	606,5	629,7	741,1	522,9	370,0
1978	258,9	148,6	105,3	138,5	855,7	1968,8	1250,2	593,1	511,1	585,7	400,8	240,3
1979	139,3	98,6	91,9	280,1	1751,5	1526,1	1102,5	801,4	643,8	603,3	589,0	336,3
1980	242,2	96,3	117,0	219,8	1043,7	1740,4	833,8	505,8	447,5	497,8	400,7	312,3
1981	229,6	92,2	145,2	210,6	850,7	2222,5	1096,0	569,5	347,4	446,8	334,5	274,4
1982	195,2	15,3	47,5	233,0	421,7	1764,2	1023,3	552,1	580,5	378,9	304,7	253,1
1983	175,1	66,4	94,9	275,2	1721,3	1504,6	870,3	521,9	552,5	746,2	506,3	347,4
1984	226,9	88,6	102,9	222,1	1003,3	1550,9	1029,4	531,0	474,7	360,8	338,9	275,0
1985	209,3	69,1	66,7	237,9	247,5	1359,3	794,5	603,6	365,4	447,5	413,5	248,8
1986	210,1	59,3	41,4	102,4	1004,2	1020,8	724,8	467,9	476,1	482,1	322,0	232,0
1987	164,6	57,9	64,5	334,7	879,4	814,8	539,5	727,3	506,2	534,8	477,7	388,3
1988	202,3	80,3	121,1	169,8	892,7	1203,6	736,2	352,6	408,0	477,6	446,4	288,0
1989	165,4	7,5	47,6	224,8	753,2	1045,8	398,9	354,2	423,9	651,0	570,3	349,9
1990	216,5	91,6	30,7	177,4	559,6	1247,7	632,4	406,3	442,7	605,3	509,2	310,2
1991	179,9	68,4	70,0	157,0	418,0	985,9	893,0	392,4	316,2	500,3	539,3	285,2
1992	218,7	75,6	88,2	105,4	668,4	1339,6	837,3	660,4	640,6	509,1	360,7	212,0
1993	141,3	120,7	3,6	107,9	606,6	999,8	547,1	379,3	357,2	566,7	393,9	271,0
1994	196,8	38,4	75,1	197,0	489,3	1287,0	906,4	783,8	679,1	561,4	415,3	281,3
1995	196,3	174,5	29,2	119,9	919,7	1026,8	508,9	429,6	207,3	362,0	435,9	301,5
1996	186,3	90,6	93,4	195,5	844,1	1218,4	916,5	638,1	305,8	385,8	606,5	443,9
1997	232,1	94,0	97,6	161,1	720,4	1552,2	969,4	773,1	491,4	538,5	354,6	246,2
1998	175,0	79,0	156,5	163,6	1304,9	1112,6	588,0	439,1	547,4	766,8	572,4	320,7
1999	218,8	170,1	120,8	168,3	1580,6	1366,6	689,4	524,9	507,1	402,6	484,3	361,6
2000	203,2	120,6	153,1	171,9	753,2	1288,0	933,6	483,9	310,0	338,3	353,7	267,5
2001	198,0	79,6	130,3	132,7	1033,2	778,2	836,7	478,1	429,8	557,8	517,1	422,1
2002	244,4	104,0	138,6	126,6	335,4	1741,5	880,2	691,6	542,2	587,8	497,9	294,2
2003	203,4	169,8	66,7	126,0	1024,0	1000,8	704,5	442,1	357,9	410,4	463,8	338,3

Natural inflows Smallwood (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	551,0	629,0	492,1
1976	297,3	386,9	340,0	585,4	2415,0	2781,5	973,1	968,3	1167,9	764,3	651,1	528,3
1977	583,8	452,9	180,0	445,7	1400,7	3401,1	1248,6	1077,6	1442,9	873,9	1081,6	669,9
1978	600,9	480,6	178,4	350,1	1516,1	3111,3	1435,3	1334,7	881,4	789,6	632,6	415,9
1979	455,6	136,7	215,9	545,4	3973,4	2385,0	1818,1	894,1	1088,6	901,9	980,7	554,0
1980	554,1	364,7	410,1	414,6	2244,5	2944,6	1404,9	832,5	463,8	1125,9	711,9	564,8
1981	473,8	496,5	258,8	460,0	1819,8	3736,4	1493,6	824,2	818,6	450,4	519,4	464,6
1982	340,8	274,2	172,9	10,5	1836,7	3266,9	1293,3	830,4	1045,0	527,7	504,6	489,5
1983	230,8	389,9	487,8	705,1	3390,3	1747,0	1141,7	794,7	914,6	1111,3	891,7	906,6
1984	247,1	348,8	313,7	375,0	1925,2	2288,4	1383,5	929,0	685,6	667,1	884,1	428,6
1985	414,5	328,0	280,8	324,2	786,4	2410,2	954,8	657,8	632,6	635,5	551,4	533,7
1986	70,1	184,2	150,0	210,5	3006,5	1534,7	1343,8	598,4	827,3	729,8	474,9	248,3
1987	516,0	298,1	393,9	1232,9	1887,7	817,1	1137,7	982,4	982,3	824,5	852,6	337,3
1988	644,4	188,3	421,3	331,3	1859,5	2033,7	594,2	554,7	873,7	838,0	665,0	182,7
1989	51,5	661,0	574,5	526,8	1646,9	1758,4	391,1	448,6	551,1	1162,2	967,6	638,9
1990	201,4	274,9	420,9	286,9	1042,8	2508,3	1023,9	632,7	792,8	1323,9	684,5	600,3
1991	330,1	219,9	220,1	160,0	715,5	2066,0	930,3	548,1	675,5	745,5	875,6	396,0
1992	380,0	212,1	392,5	328,1	730,9	3521,1	1633,1	1058,5	1161,3	902,7	346,2	332,9
1993	242,5	215,9	141,9	277,0	1409,3	1436,7	721,4	500,1	787,9	789,2	466,4	354,5
1994	238,5	341,9	459,9	273,2	1034,4	2366,0	1300,9	726,5	655,3	985,9	708,2	472,3
1995	273,7	323,2	283,3	370,1	1785,5	1315,3	759,0	167,0	562,0	738,6	797,0	501,4
1996	303,0	516,5	307,5	377,1	1637,8	2382,8	1235,1	621,2	359,2	365,1	827,0	647,8
1997	385,3	275,8	308,8	292,3	1004,9	2829,7	1783,7	1189,9	856,6	779,1	683,6	448,2
1998	300,9	295,0	201,5	298,2	2398,4	1761,0	840,2	722,8	909,6	1133,2	860,1	508,3
1999	408,8	303,0	342,1	277,4	2955,6	2049,6	910,2	785,8	864,1	1052,3	801,5	522,3
2000	434,6	289,2	195,9	197,5	1035,0	2653,2	1112,7	467,1	518,5	689,0	590,0	510,3
2001	281,2	273,1	188,4	288,4	2027,8	1285,1	889,6	899,0	966,5	968,1	953,3	749,4
2002	432,3	288,1	200,8	216,7	584,8	3261,8	1195,6	812,6	713,0	1145,3	747,5	437,4
2003	397,0	271,9	256,6	269,1	1737,7	1522,7	1266,1	586,2	469,2	808,7	762,7	547,8

Natural inflows East and West Forebays (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	71,6	-39,9	-69,3
1976	19,8	-55,6	-31,3	26,3	199,0	71,5	59,5	38,1	203,9	58,9	-0,6	-40,2
1977	-2,6	-2,2	20,2	116,7	113,3	210,4	31,2	61,3	106,5	72,6	7,9	-28,2
1978	-52,2	7,5	-9,9	46,4	162,7	125,3	101,7	202,8	65,0	29,6	-5,1	25,7
1979	13,1	-52,0	28,0	69,8	190,0	52,5	222,6	115,1	5,0	56,3	71,7	-16,9
1980	-2,5	9,4	17,2	46,6	188,2	134,1	51,0	43,2	36,5	52,8	17,5	4,4
1981	11,6	-9,6	42,0	-28,0	124,3	234,0	173,8	30,0	27,2	57,7	33,2	13,5
1982	-38,8	-37,4	-37,9	-12,9	129,7	152,6	95,2	51,5	76,9	30,6	-2,3	-3,5
1983	11,5	4,8	-2,2	86,7	199,9	77,3	51,0	65,5	46,4	75,3	21,5	-35,9
1984	-15,8	24,3	34,7	21,4	163,6	83,8	27,1	-9,6	34,5	43,8	-11,7	-47,3
1985	-60,8	-54,1	-73,3	-11,8	63,5	158,0	22,7	-8,1	27,0	61,9	-32,8	-12,2
1986	-40,3	-39,8	-75,7	-38,3	137,6	53,4	32,5	-20,5	22,0	29,5	-25,1	-17,3
1987	-75,2	-104,4	-175,6	-30,6	46,0	49,6	66,4	60,4	51,3	62,7	-3,9	-49,6
1988	-81,6	-130,2	-118,2	-68,6	158,1	74,3	75,3	8,1	15,7	38,8	-38,4	-54,9
1989	-137,2	-163,4	-158,8	-84,5	150,1	46,9	15,9	13,1	61,3	72,0	-18,8	-16,9
1990	-83,1	-162,6	-167,3	-117,3	97,7	113,0	52,6	26,9	83,5	94,5	44,4	-21,8
1991	-3,7	-98,7	-50,2	-45,1	31,5	106,4	44,8	23,2	32,4	67,0	18,6	-50,6
1992	-22,5	-75,7	-66,9	-60,5	78,1	228,2	67,3	111,0	72,0	57,7	17,7	14,0
1993	-21,9	-18,2	-18,4	46,2	120,2	79,8	63,2	52,8	26,5	68,2	-17,2	7,8
1994	-48,0	-171,9	-151,8	-96,4	61,2	117,4	50,9	62,4	46,8	82,6	8,9	-19,1
1995	-24,3	-98,9	-103,3	-62,1	132,8	39,5	64,9	25,4	54,8	76,0	33,7	-8,5
1996	-78,7	-129,4	-47,9	-4,3	164,6	106,4	108,7	42,5	53,7	58,2	45,6	12,4
1997	-34,7	-114,5	-92,0	-85,6	98,2	178,1	115,6	89,5	73,7	119,0	18,9	56,3
1998	22,9	27,3	34,2	59,1	202,5	105,6	74,5	85,7	129,0	133,6	32,3	12,5
1999	31,7	7,5	32,8	31,0	238,2	87,4	69,6	70,5	74,0	106,9	95,6	41,9
2000	62,9	49,8	84,7	54,9	133,6	118,8	106,0	86,0	102,4	75,1	106,5	47,9
2001	34,1	-18,2	21,5	23,0	167,8	91,8	105,1	116,5	89,8	92,4	74,9	72,8
2002	49,7	-5,2	32,6	65,5	147,8	204,3	108,6	108,3	45,1	88,7	68,5	55,9
2003	20,3	-26,8	-61,9	-2,2	147,0	105,1	110,0	52,0	46,5	63,6	80,3	25,8

Total natural inflows CF(L)Co (cms)

	January	February	March	April	May	June	July	August	September	October	November	December
1975	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-1,0	1005,3	890,5	715,1
1976	519,6	495,6	443,6	747,3	3896,9	4346,3	1598,3	1587,3	2193,4	1532,7	1017,4	786,4
1977	827,0	544,0	345,6	678,9	2297,5	5425,2	2028,8	1745,4	2179,1	1687,6	1612,4	1011,7
1978	807,5	636,7	273,7	535,1	2534,5	5205,4	2787,3	2130,5	1457,5	1404,9	1028,3	681,8
1979	608,0	183,3	335,7	895,3	5914,9	3963,6	3143,2	1810,6	1737,5	1561,5	1641,5	873,5
1980	793,8	470,4	544,2	681,0	3476,4	4819,1	2289,7	1381,5	947,8	1676,5	1130,1	881,6
1981	715,0	579,1	446,0	642,7	2794,8	6192,9	2763,4	1423,7	1193,2	955,0	887,1	752,4
1982	497,2	252,1	182,5	230,6	2388,1	5183,8	2411,8	1434,0	1702,5	937,2	807,0	739,1
1983	417,4	461,1	580,5	1067,1	5311,4	3328,9	2063,1	1382,0	1513,5	1932,7	1419,5	1218,0
1984	458,2	461,7	451,3	618,5	3092,1	3923,1	2440,0	1450,4	1194,8	1071,7	1211,3	656,4
1985	563,0	343,0	274,1	550,2	1097,3	3927,5	1772,0	1253,2	1024,9	1144,8	932,0	770,2
1986	239,9	203,7	115,6	274,7	4148,2	2608,8	2101,1	1045,7	1325,4	1241,3	771,9	463,0
1987	605,4	251,6	282,8	1537,1	2813,1	1681,5	1743,6	1770,1	1539,8	1422,0	1326,4	676,0
1988	765,2	138,4	424,2	432,5	2910,2	3311,6	1405,7	915,4	1297,4	1354,4	1073,1	415,9
1989	79,7	505,0	463,2	667,1	2550,2	2851,1	805,9	815,9	1036,3	1885,2	1519,0	979,8
1990	334,8	204,0	284,2	346,9	1700,1	3869,0	1709,0	1065,8	1319,0	2023,7	1238,1	888,7
1991	506,3	189,5	239,9	271,8	1165,0	3158,3	1868,1	963,7	1024,1	1312,9	1433,5	630,6
1992	576,2	212,0	413,8	372,9	1477,3	5088,9	2537,7	1829,8	1873,9	1469,5	724,7	559,0
1993	362,0	318,5	127,0	431,1	2136,1	2516,4	1331,7	932,2	1171,6	1424,0	843,1	633,3
1994	387,2	208,4	383,2	373,8	1585,0	3770,4	2258,1	1572,6	1381,1	1629,9	1132,4	734,5
1995	445,7	398,8	209,1	428,0	2838,0	2381,6	1332,8	622,1	824,2	1176,6	1266,6	794,4
1996	410,6	477,7	353,0	568,3	2646,6	3707,7	2260,3	1301,8	718,8	809,0	1479,2	1104,2
1997	582,7	255,3	314,3	367,7	1823,4	4559,9	2868,7	2052,5	1421,7	1436,7	1057,0	750,6
1998	498,8	401,3	392,2	521,0	3905,7	2979,2	1502,7	1247,6	1586,0	2033,6	1464,8	841,6
1999	659,2	480,6	495,6	476,7	4774,4	3503,6	1669,2	1381,2	1445,1	1561,9	1381,4	925,8
2000	700,7	459,6	433,8	424,3	1921,8	4059,9	2152,3	1037,0	930,9	1102,3	1050,1	825,7
2001	514,0	334,5	340,3	444,1	3228,8	2155,1	1831,4	1493,6	1486,1	1618,3	1545,3	1244,3
2002	726,4	386,9	372,0	408,8	1068,0	5207,5	2184,5	1612,4	1300,3	1821,8	1314,0	787,5
2003	620,6	414,9	261,5	392,9	2908,7	2628,6	2080,6	1080,2	873,6	1282,6	1306,9	912,0