REPORT

OF

COLUMBIA RIVER TREATY

CANADIAN AND UNITED STATES ENTITIES

for the period

1 October 1972

to

30 September 1973

October 1973

TABLE OF CONTENTS

	Page No.
Introduction	1
Organization and Meetings	1
Construction of the Treaty Storage Projects	2
Columbia Storage Operation - Operating Arrangements	3
Operating Committee Activities	5
Hydrometeorological Committee Activities	7
Cooperation with Permanent Engineering Board	7

- - - - - - -

Appendix A	Columbia River Treaty Entities
Appendix B	International Committees
Appendix C	Official Agreements of the Entities
Appendix D	Report of Operation of Columbia River Treaty Projects - 1 August 1972 through 31 July 1973 (attached)

INTRODUCTION

This report describes the joint actions of the Canadian and United States Entities during the period 1 October 1972 to 30 September 1973, in discharging their responsibility for formulating and carrying out operating arrangements necessary to implement the Columbia River Treaty.

Previous reports on this subject are:

Period Covered	Date of Report
16 September 1964 to 30 September 1967	22 April 1968
1 October 1967 to 30 September 1968	January 1969
1 October 1968 to 30 September 1969	April 1970
1 October 1969 to 30 September 1970	December 1970
1 October 1970 to 30 September 1971	October 1971
1 October 1971 to 30 September 1972	October 1972

ORGANIZATION AND MEETINGS

The names of the members of the two Entities and their representatives are shown in Appendix A.

During the period 1 October 1972 to 30 September 1973, the Canadian and United States Entities held two regular meetings and Canadian Entity representatives and the United States Coordinators met on two occasions.

The two international committees, listed in Appendix B, which were established effective 19 September 1968, continued their work. These two committees directed and coordinated studies with the support of the staffs

of B. C. Hydro and Power Authority, Bonneville Power Administration, and the U.S. Corps of Engineers, North Pacific Division.

The Entities received reports and recommendations on operating procedures, facilities, and other matters essential to Columbia River Treaty implementation from the International Committees. Where necessary, formal agreement on various items was reached by the Entities and Appendix C lists these official agreements reached and recorded during the period of this report.

CONSTRUCTION OF THE TREATY STORAGE PROJECTS

Construction work on Mica and Libby proceeded on schedule during the year. On 29 March 1973 impounding was commenced at Mica and the last and largest of the Treaty dams was operational. The scheduled date for completion was 1 April 1973. A Columbia Construction Progress Report, No. 25, covering the period October 1972 through March 1973, was issued by B. C. Hydro and Power Authority on the construction of Mica up to 31 March 1973. This is the last semi-annual report which will be issued on construction progress at Mica. The Division Engineer, North Pacific Division, Corps of Engineers, U.S. Army, issued Report No. 10 and the Final Report on the progress of construction of the Libby Dam project.

Because these reports give a detailed description of the construction achieved on the projects during this period, it is not considered necessary to repeat the information in this report.

COLUMBIA STORAGE OPERATION - OPERATING ARRANGEMENTS

During the period covered by this report, Duncan, Arrow, Mica, and Libby reservoirs were operated for power and flood control.

During this reporting year the Canadian entitlement to downstream power benefits from Duncan and Arrow had been purchased by the Columbia Storage Power Exchange and transferred and assigned to the Bonneville Power Administration. The United States Entity delivered capacity and energy to the C.S.P.E. participants in accordance with the Canadian Entitlement Exchange Agreement, dated 13 August 1964.

The operation of the storages was generally in accordance with:

(a) "Hydroelectric Operating Plans for Canadian Storage during the Operating Years 1969-70 through 1974-75," dated 15 February 1969, and the amendment thereto dated September 1969.

(b) "Detailed Operating Plan for Columbia River Treaty Storage - 1 July 1972 through 31 July 1973," dated 19 September 1972.

(c) "Detailed Operating Plan for Columbia River Treaty Storage - 1 July 1973 through 31 July 1974, dated 14 September 1973.

(d) "Interim Flood Control Operating Plan for Duncan and Arrow Reservoirs," dated November 12, 1968.

(e) "Columbia River Treaty Flood Control Operating Plan," dated October 1972.

Attached to this report as Appendix D is "Report on Operation of Columbia River Treaty Projects - 1 August 1972 through 31 July 1973," dated October 1973, which gives a detailed description of the operation of the Treaty storages for the first 10 months of the 12-month period of this report. This report also describes in detail the runoff conditions prevailing and the reservoir regulation during the year.

A brief description follows of the operation of the Duncan, Arrow, Libby and Mica reservoirs during the period 1 October 1972 to 30 September 1973.

Duncan

On 1 October 1972, the Duncan reservoir was at the full pool elevation of 1892 feet and continued at about this elevation until the end of November when the drafting of the reservoir commenced. The Duncan reservoir was drafted to its minimum flood control elevation at the beginning of March 1973. The filling of the reservoir commenced toward the end of March 1973, but the maximum elevation which was reached was only 1896 feet in the middle of August 1973. Storage draft was started shortly thereafter.

Arrow

On 1 October 1972, the Arrow reservoir was at approximately elevation 1442 feet and was drawn down to approximately elevation 1414 feet by the end of December 1972. Drafting of Arrow Lakes to its minimum elevation of approximately 1386 feet was completed by the end of February 1973.

The filling of the reservoir was commenced in the middle of March 1973 but the maximum elevation reached was approximately 1407 feet in the middle of July 1973.

By the end of September 1973, the Arrow Lakes had been drawn down to approximately 1381 feet.

Libby

Lake Koocanusa was at elevation 2402 feet on 1 August, the reservoir having been limited to a maximum elevation of 2405 feet during the previous summer because the spillway gates were not completed. The reservoir was held near the 2405 feet elevation until about 11 September, when a special draw down was initiated to facilitate construction of a rock buttress in a potential slide area on the left bank just upstream from the dam. The reservoir was lowered throughout September, October and November until the elevation required for construction of the lower portion of the buttress, 2230 feet, was reached on 2 December. This elevation was held throughout the balance of the winter.

Filling began on about 12 April, and throughout the latter part of April, all of May, and the first half of June the outflow was maintained at approximately the minimum discharge rate of 2,000 cfs. By the end of July, Lake Koocanusa had reached approximately elevation 2412 feet.

Mica

The Mica project was operational on 29 March 1973 and small releases were made during April, but thereafter until mid-June 1973 releases were held to the practical minimums. As a consequence, the elevation of the reservoir rose to approximately 2,200 feet on 19 June 1973.

Because of the critical conditions prevailing in the Columbia River Basin, the outlets at Mica were fully opened on 19 June 1973 and have remained so up to the end of September 1973. The maximum elevation reached by the reservoir was approximately 2,268 feet on 16 August and has since steadily declined.

OPERATING COMMITTEE ACTIVITIES

The work carried out in the year 1972/73 on the Assured Operating Plan for the year 1977/78 was finalized in October 1972 by the Entities signing an agreement in November 1972 on the Plan and corresponding Downstream Power Benefits, see Appendix C, Items 2 and 3.

In accordance with its terms of reference, the Operating Committee was responsible throughout the year for implementing the current hydroelectric and flood control operating plans for the storage provided in Canada under the Columbia River Treaty. This aspect of the Committee's work is described in Appendix D, "Report on Operation of Columbia River Treaty Projects," dated October 1973.

Work on the Detailed Operating Plan for the 1972-73 operating year was completed and the Entities signed an agreement on this on 20 November 1972. There was a delay in preparing the Plan because of a change in the construction schedule for the third powerhouse at Grand Coulee which resulted in the deep storage draft being delayed for one year. The Detailed Operating Plan had, therefore, to be modified to incorporate adjustments of the Grand Coulee and Arrow storage regulations.

For part of the present year the Flood Control Operating Plan in operation was the "Interim Flood Control Operating Plan for Duncan and Arrow Reservoirs," dated November 12, 1968. In October 1972, the Corps of Engineers prepared the "Columbia River Treaty Flood Control Operating Plan" which is now in operation, see Appendix C, Item 1.

The Committee continued with the studies of the filling of Mica reservoir. The last report on this subject was a report dated October 1972 "Initial Filling of Mica Reservoir." These studies are being updated each year to take account of the changing conditions with respect to loads and resources. An amendment, dated 19 June 1973, to the "Program for Initial Filling of Mica Reservoir," dated 26 July 1967, was agreed by the Entities, see Appendix C, Item 4.

The Detailed Operating Plan for Canadian Storage for the Period 1 July 1973 through 31 July 1974 was completed and agreed to by the Entities on September 28, 1973, see Appendix C, Item 5.

The Assured Operating Plan for 1978-79 for Canadian Treaty Storages was completed and agreed to by the Entities on September 28, 1973, see Appendix C, Item 6.

The Downstream Benefit Determinations for the year 1978-79 have been made in accordance with the Treaty and its associated documents. It was found that the operation of Mica with generation for this year has no adverse effect on the Canadian Entitlement to downstream power benefits in the United States. The Determinations were agreed to by the Entities on September 28, 1973, see Appendix C, Item 7.

HYDROMETEOROLOGICAL COMMITTEE ACTIVITIES

Revised discharge tables were prepared and distributed for Keenleyside Dam. New storage-elevation tables for Arrow Lakes and a storage-elevation table for the combined Arrow reservoir were distributed.

Repair work on the Nagle Creek station, the outflow gauge for the Mica project, has necessitated the use of calibrated outflow from the low-level outlet works at Mica Dam. Discharge tables, dated 31 July 1973, based on actual measurements of streamflow, were approved for use until such time as the Nagle Creek gauge again becomes operational and/or additional calibration measurements have been made. It is expected that this matter will be again reviewed early in 1974.

The Treaty Facility and Supporting Facilities lists will be reviewed in the near future.

The interim plan for the exchange of operational hydromet data remains in force until 31 December 1973. This plan will be reviewed prior to the December date and any necessary amendments and extension of the plan recommended.

COOPERATION WITH PERMANENT ENGINEERING BOARD

The Entities continued cooperating with the Permanent Engineering Board in the discharge of its functions and a joint meeting of the Permanent Engineering Board and the Entities was held on 20 November 1972 in Victoria, British Columbia.

Semi-annual reports were forwarded by the Entities to the Board covering the periods 1 October 1972 to 31 March 1973, and 1 April 1973 to 30 September 1973.

In addition, the construction progress reports - B. C. Hydro's Report No. 25 on Mica, and the Corps of Engineers' Reports No. 10 and Final on Libby, were supplied to the Permanent Engineering Board.

Copies of the "Runoff Volume Forecast Program for Treaty Reservoirs" were sent to the United States Section of the Permanent Engineering Board.

Copies of the agreements shown in Appendix C were sent to the Board.

APPENDIX A

COLUMBIA RIVER TREATY ENTITIES

CANADA

MR. W. D. KENNEDY*
CHAIRMAN

British Columbia Hydro and
Power Authority
Vancouver, B.C.

UNITED STATES

MR. DONALD PAUL HODEL**
CHAIRMAN

Administrator
Bonneville Power Administration
Department of the Interior
Portland, Oregon

MAJOR GENERAL R. E. McCONNELL***
Division Engineer
North Pacific Division
Corps of Engineers, U.S. Army
Portland, Oregon

Canadian Entity Representatives

MR. W. D. KENNEDY

Manager
Canadian Entity Services
British Columbia Hydro and
Power Authority
Vancouver, B.C.

United States Entity Coordinators

MR. BERNARD GOLDHAMMER
COORDINATOR

Assistant Administrator for
Power Management
Bonneville Power Administration
Portland, Oregon

MR. GORDON H. FERNALD, JR.****
COORDINATOR

Chief, Engineering Division
North Pacific Division
Corps of Engineers, U.S. Army
Portland, Oregon

MR. HAROLD KROPITZER
SECRETARY

Executive Assistant to the Administrator
Bonneville Power Administration
Portland, Oregon

* Succeeded Hon. R. G. Williston, October 1972
** Succeeded Mr. Henry R. Richmond, 1 December 1972
*** Succeeded Major General K. T. Sawyer, 15 December 1972
**** Retired June 1973.

APPENDIX B

COLUMBIA RIVER TREATY

INTERNATIONAL COMMITTEES

The official membership of the two International Committees for the year 1 October 1972 to 30 September 1973 was as follows:

	Canadian Section	United States Section
COLUMBIA RIVER TREATY OPERATING COMMITTEE	P.R. Purcell (Chairman	C.E. Hildebrand* (Co-Chairman) (1)
	D.R. Forrest	D.M.Rockwood (1)
	W.E. Kenny	H.M. McIntyre (Co-Chairman)(2)
		C.W. Blake (2)
COLUMBIA RIVER TREATY HYDROMETEOROLOGICAL COMMITTEE	P.R. Purcell (Chairman	F.A. Limpert (Chairman)(2)
	U. Sporns	B. J. Thomas (1)**

All Canadian Committee members represent B.C. Hydro and Power Authority. United States Committee members represent (1) United States Corps of Engineers, or (2) Bonneville Power Administration.

* Retired 30 August 1973.
** Succeeded D. M. Rockwood.

APPENDIX C

COLUMBIA RIVER TREATY

OFFICIAL AGREEMENTS OF THE ENTITIES

1 OCTOBER 1972 - 30 SEPTEMBER 1973

Item No.	Date Agreement Signed by Entities	Description
1	20 November 1972	Detailed Operating Plan for Columbia River Treaty Storage - 1 July 1972 through 31 July 1973, dated 19 September 1972
2	20 November 1972	Columbia River Treaty Hydroelectric Operating Plan - Assured Operating Plan for Operating Year 1977-78, dated October 16, 1972
3	20 November 1972	Determination of Downstream Power Benefits Resulting from Canadian Storage for Operating Year 1977-78, dated October 16, 1972, AND Downstream Power Benefit Computations for 1977-78 Operating Year, dated 6 November 1972
4	17 June 1973	Amendment to Program for Initial Filling of Mica Reservoir, dated 26 July 1967
5	28 September 1973	Detailed Operating Plan for Columbia River Treaty Storage - 1 July 1973 through 31 July 1974, dated 14 September 1973
6	28 September 1973	Columbia River Treaty Hydroelectric Operating Plan - Assured Operating Plan for Operating Year 1978-79, dated September 1973
7	28 September 1973	Determination of Downstream Power Benefits Resulting from Canadian Storage for Operating Year 1978-79, dated September 1973

REPORT ON OPERATION OF COLUMBIA RIVER TREATY PROJECTS

1 AUGUST 1972
THROUGH JULY 1973

COLUMBIA RIVER TREATY OPERATING COMMITTEE

October 1973

REPORT ON

OPERATION OF COLUMBIA RIVER

TREATY PROJECTS

1 AUGUST 1972 THROUGH 31 JULY 1973

COLUMBIA RIVER TREATY OPERATING COMMITTEE

H. M. McIntyre
Bonneville Power Administration
Co-Chairman, U.S. Section

Carver E. Hildebrand
Corps of Engineers
Co-Chairman, U.S. Section

C. W. Blake
Bonneville Power Administration
Member, U.S. Section

D. M. Rockwood
Corps of Engineers
Member, U.S. Section

D. D. Speers
Corps of Engineers
Secretary, U.S. Section

P. R. Purcell
B.C. Hydro & Power Authority
Chairman, Canadian Section

W. E. Kenny
B.C. Hydro & Power Authority
Member, Canadian Section

D. R. Forrest
B.C. Hydro & Power Authority
Member, Canadian Section

REPORT ON

OPERATION OF COLUMBIA TREATY PROJECTS

1 AUGUST 1972 THROUGH 31 JULY 1973

TABLE OF CONTENTS

		Page
	COLUMBIA RIVER BASIN MAP	
I.	INTRODUCTION	
	A. Authority - - - - - - - - - - - - - - - - -	1
	B. Operating Procedure - - - - - - - - - - - - -	1
II.	WEATHER AND STREAMFLOWS	
	A. Weather - - - - - - - - - - - - - - - - - -	1
	B. Streamflow - - - - - - - - - - - - - - - - -	2
	C. Seasonal Runoff Volumes - - - - - - - - - -	3
III.	RESERVOIR OPERATION	
	A. Arrow Reservoir - - - - - - - - - - - - - - -	4
	B. Duncan Reservoir - - - - - - - - - - - - - -	5
	C. Mica Reservoir - - - - - - - - - - - - - - -	5
	D. Libby Reservoir - - - - - - - - - - - - - -	6
IV.	DOWNSTREAM EFFECTS OF STORAGE OPERATION	
	A. Power - - - - - - - - - - - - - - - - - - -	6
	B. Flood Control - - - - - - - - - - - - - - -	9

Page

V. OPERATING CRITERIA

A. General - - - - - - - - - - - - - - - - - 9

B. Power Operation - - - - - - - - - - - - - - 10

C. Flood Control Operation - - - - - - - - - - 10

PHOTOGRAPHS

Keenleyside Dam - - - - - - - - - - - - - - - - 11

Dworshak Dam - - - - - - - - - - - - - - - - - 12

Kootenay Canal Project - - - - - - - - - - - - - 13

TABLES

Table 1 - Unregulated Runoff Volume Forecasts - - - - 14

Table 2 - Variable Refill Curve, Arrow Reservoir - - - 15

Table 3 - Variable Refill Curve, Duncan Reservoir - - - 16

Table 4 - Variable Refill Curve, Mica Reservoir - - - 17

Table 5 - Variable Refill Curve, Libby Reservoir - - - 18

CHARTS

Chart 1 - Seasonal Precipitation - - - - - - - - - 19

Chart 2 - Temperature & Precipitation Indices, Winter Season 1972-73, Columbia River Basin above The Dalles - - - - - - - - - - - - - - - 20

Chart 3 - Temperature & Precipitation Indices, Snowmelt Season 1972-73, Columbia River Basin above The Dalles - - - - - - - - - - - - - - - 21

Chart 4 - Temperature & Precipitation Indices, Snowmelt Season 1973, Columbia River Basin in Canada - 22

Chart 5 - Arrow Reservoir Regulation - - - - - - - - 23

Chart 6 - Duncan Reservoir Regulation - - - - - - - - 24

Chart 7 - Mica Reservoir Regulation - - - - - - - - 25

Chart 8 - Libby Reservoir Regulation - - - - - - - - 26

Chart 9 - Kootenay Lake Regulation - - - - - - - - - 27

Page

Chart 10 - Columbia River at Birchbank - - - - - - - - 28

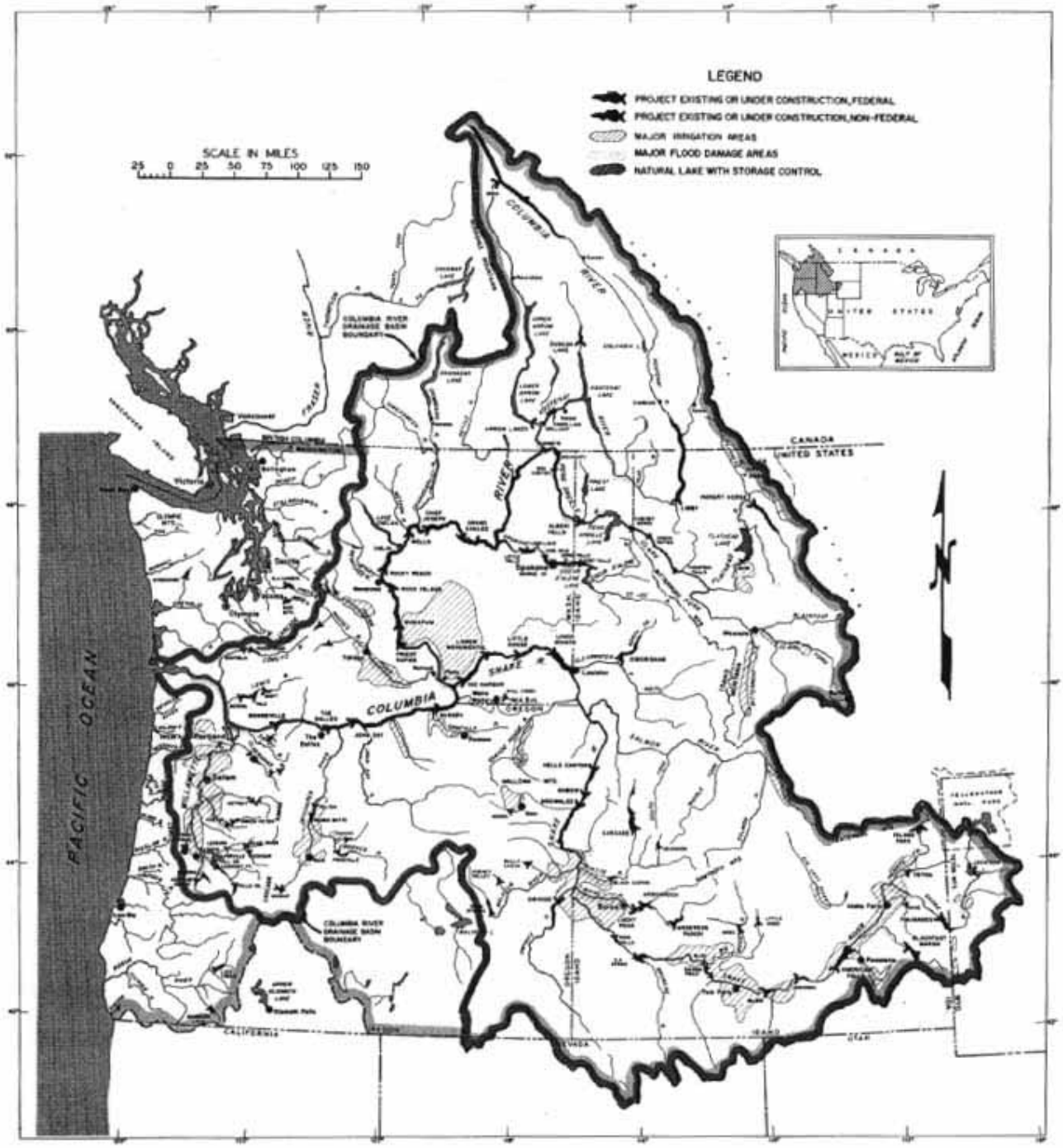
Chart 11 - Grand Coulee Reservoir Regulation - - - - - 29

Chart 12 - Columbia River at The Dalles, July 1972 Through July 1973 - - - - - - - - - - - 30

Chart 13 - Effective Flood Control at The Dalles, April 1973 Through July 1973 - - - - - - - 31

REFERENCES - 32

COLUMBIA RIVER BASIN



REPORT ON
OPERATION OF COLUMBIA RIVER TREATY PROJECTS
1 AUGUST 1972 THROUGH 31 JULY 1973

I. INTRODUCTION

A. AUTHORITY

Duncan, Arrow and Mica Reservoirs in Canada and Libby Reservoir in the United States of America were constructed under the provisions of the Columbia River Treaty of January 1961. The Treaty requires that the reservoirs be operated for increasing hydroelectric power generation and flood control in the United States of America and in Canada. In 1964, the Canadian and United States governments each designated an Entity to formulate and carry out the operating arrangements necessary to implement the Treaty. The Canadian Entity is British Columbia Hydro and Power Authority; the United States Entity is the Administrator, Bonneville Power Administration and the Division Engineer, North Pacific Division, Corps of Engineers.

The Columbia River Treaty Operating Committee, established in September 1968 by the Entities, is responsible for preparing and implementing operating plans as required by the Columbia River Treaty. This report records and reviews the operation of Duncan, Arrow, Mica and Libby reservoirs for power and flood control during the period 1 August 1972 through 31 July 1973, including the major effects downstream in Canada and in the United States of America.

B. OPERATING PROCEDURE

Throughout the period covered by this report, storage operations were implemented by the Operating Committee in accordance with the Detailed Operating Plan for Columbia River Treaty Storage, dated 19 September 1972. From the limited drawdown in September, 1972, the regulation of the Canadian storage content was determined by the Operating Committee on a weekly basis. Because of the extremely low runoff in the Columbia Basin during the spring of 1973 there was no requirement for daily flood control operation.

II. WEATHER AND STREAMFLOW

A. WEATHER

Markedly dry weather prevailed throughout the fall, winter and spring seasons in the Columbia River Basin. In every month but December well below normal precipitation was experienced, with the result that snow accumulation for the season was near record low levels on 1 April. Chart 1 shows geographical distribution of the accumulated seven-month (October 1972 - April 1973) precipitation over the entire Columbia River Basin

The effects of low runoff and reservoir regulation combined to produce the lowest maximum daily Columbia River flow ever recorded during the spring at The Dalles, 208,000 cfs on April 3. Without regulation by upstream reservoirs the peak flow at The Dalles would have been 402,000 cfs on 26 May.

The natural streamflow patterns for the year are shown on the inflow hydrographs for the Treaty Reservoirs, Charts 5, 6, 7 and 8. Observed and computed unregulated hydrographs for Kootenay Lake and Columbia River at Birchbank, Grand Coulee Dam and The Dalles are shown on Charts 9, 10, 11 and 12.

C. SEASONAL RUNOFF VOLUMES

Forecasts of volume of runoff during the snowmelt season, as well as the variation with time, are of great importance because the reservoir regulation plans are determined in part by the expected runoff volumes. Runoff volume forecasts, based on precipitation and snowpack data, were prepared for a large number of locations in the Columbia River Basin and updated each month as the season advanced. Table 1 lists the seasonal volume inflow forecasts for Mica, Dunca, Arrow and Libby projects and the unregulated runoff of the Columbia River at The Dalles. The forecasts of Mica, Duncan and Arrow inflow volumes were prepared by B. C. Hydro & Power Authority and those for Libby project and the lower Columbia River by the Columbia River Forecasting Service. Also shown on Table 1 are the actual volumes for these five locations for the 1973 April-August season. Runoff forecasts assume average precipitation subsequent to the date of forecast. Because of the deficient precipitation in the spring of 1973, this year's forecast generally overestimated the magnitude of the runoff.

Actual April-August runoff volumes, adjusted for upstream reservoir storage effects, are listed for seven locations in the following tabulation:

STREAM AND LOCATION	THOUSANDS OF ACRE-FEET	PERCENT OF 1953-67 AVERAGE
Duncan Reservoir Inflow	1,700	77
Mica Reservoir Inflow	9,460	78
Arrow Reservoir Inflow	19,500	83
Libby Reservoir Inflow	4,910	69
Columbia River at Birchbank	32,400	75
Grand Coulee (FDR) Reservoir Inflow	43,000	66
Snake River at Lower Granite	12,600	54
Columbia River at The Dalles	60,700	61

Comparison of the above tabulation with the seasonal precipitation map on Chart 1 reveals the general relationship between snow-accumulation season precipitation and snowmelt season runoff when expressed in percent of average.

The combination of these factors led to the storage draft from 1407 ft beginning in mid-July when Arrow inflows fell below outflow requirements. Storage releases continued and Arrow reservoir had reached elevation 1400.2 ft on 31 July. The 1973 volume inflow forecasts and the Variable Refill Curve computations for Arrow are shown in Table 2.

B. DUNCAN RESERVOIR

Reservoir Evacuation Period. As indicated on Chart 6, Duncan Reservoir was at normal full pool elevation 1892 ft on 1 August 1972 and was maintained near this elevation until the end of November when drafting of storage was initiated to augment flows downstream. The 1972-73 Detailed Operating Plan Flood Control Reservation Curve for Duncan was slightly modified to avoid loss of generation at the Kootenay River plants. Drafting of the reservoir to about elevation 1798 ft was completed early in March 1973.

Refill Period. On 12 March, outflow was restricted to 100 cfs nd the reservoir began to fill. On 31 March, outflow was increased to 700 cfs and this flow was maintained through 30 April to accommodate the request of the British Columbia Fish and Wildlife Branch. Duncan discharge was controlled at 100 cfs for the period 1 May through 30 June and at 5,000 cfs through July. Water surface elevation on 31 July was 1874 ft. The maximum elevation for the year of 1876.6 ft was reached on 11 August. Table 2 shows the 1973 volume inflow forecasts and the variable refill curve computations for Duncan.

C. MICA RESERVOIR

Initial Operation. As indicated on Chart 7, Mica storage reservoir became operational on 29 March 1973 and was operated for the balance of the report period in accordance with the 1972-73 Detailed Operating Plan and the Program for Initial Filling of Mica Reservoir dated 26 July 1967 as amended. The 1973 volume inflow forecasts and the variable refill curve computations are shown in Table 3.

From 29 March to 8 May, outflow was controlled to a weekly average of 1,000 cfs with the objective of storing as much water as possible. During this period, no large deficiency in later filling of Arrow reservoir was foreseen and as previously arranged, Mica low level outlets were closed from 8 May to 19 June to allow essential repairs to the concrete tunnel lining and inspection and testing of outlet gates.

During the closed period, the water elevation rose from 1993 ft on 8 May to 2201 ft on 19 June. From that date until the end of the report period, the low level outlets were kept fully open to pass as much Mica inflow as possible. This objective was made necessary by heavy demand for Columbia River flows at the boundary resulting from extremely low runoff in the United States portion of the Columbia River Basin.

The increase in water level from 1993 ft to 2201 ft had increased Mica discharge capacity from about 17,000 cfs on 8 May to about 26,000 cfs on 19 June, but inflows were over 30,000 cfs by that date and increasing. Involuntary storage continued for the remainder of the operating year and by 31 July the water surface reached elevation 2257 ft. The maximum elevation for the year of 2269 ft was reached on 16 August.

Duncan and Mica under the provisions of these agreements were made during the 1972-73 Operating Year. Generation at the projects in the United States for this purpose during the period 1 April 1972 through 31 March 1973 was 572 average megawatts at rates up to 995 megawatts. Subsequent to 31 March 1973, the energy amount was increased to 759 average megawatts and the maximum rate of generation was increased to 1377 megawatts when Mica became operational.

The estimated firm load-resource balance for the United States Pacific Northwest Coordinated System showed about 70 average megawatts firm energy in excess of firm loads during the storage draft period 1 September 1972 through 15 April 1974. The estimated potential secondary energy requirements of the Coordinated System for interruptible industrial loads and replacement of thermal and other higher cost generation was 1360 average megawatts. The interruptible industrial load increased during the year from 615 average megawatts to about 1000 average megawatts by 30 April 1973 and then dropped to about 500 average megawatts 11 April 1973.

Chronology. Streamflows on the Columbia River followed their normal recession during August 1972 but remained above median-month levels at the end of the month. BPA terminated surplus energy deliveries to California utilities on 21 August 1972. Deliveries were resumed 24 August but were again curtailed 29 August 1972. All reservoirs except Grand Coulee and the Willamette River reservoirs were full on 31 August 1972. Grand Coulee had been drafted in anticipation of additional storage releases to be made from Libby reservoir for construction purposes. Draft was required at the Willamette River reservoirs during August to maintain minimum non-power discharge requirements.

Hanford steamplant was returned to service 1 August 1972 after its summer maintenance outage. Centralia steamplant Unit No. 2 came on the line for the first time on 2 September 1972 at 300 megawatts. The rated capacity of each unit is 700 megawatts, but stack emission problems limited these units to only 300 megawatts each.

Direct service to interruptible industrial load and private utility secondary load was curtailed 1 October 1972, and the curtailment continued throughout the year in order to conserve water for firm power requirements in case critical water conditions developed later in the season and to protect against possible loss of the Hanford plant and reduced output from the Centralia Steamplant.

During the extended period of BPA curtailment of secondary energy deliveries to the interruptible industrial load beginning October 1, 1972, this load was served with energy available under prior purchase arrangements made by the industries in anticipation of such curtailments. The amounts of energy used by the industries from these sources were as follows:

B. FLOOD CONTROL

Flood control was not a controlling factor in the regulation of storage reservoirs during the spring runoff in 1973. Without any regulation by upstream reservoirs the peak flow of the Columbia River at The Dalles would have been only 402,000 cfs, lower than the bankfull capacity of 450,000 cfs. With reservoirs operating for power production and refill, the observed springtime maximum mean daily flow at The Dalles was only 208,000 cfs. In contrast, the regulated peak flow that occurred in 1972 was 618,000 cfs. Observed and unregulated hydrographs for the 1973 April through July period at The Dalles are shown on Chart 13. Similarly low spring peaks occurred on upstream tributaries. At Bonners Ferry, Idaho, an area subject to major flooding in previous years, the regulation at Libby project reduced the maximum unregulated springtime stage of 24.7 feet to 10.2 feet. Flood stage at Bonners Ferry is 31.0 feet.

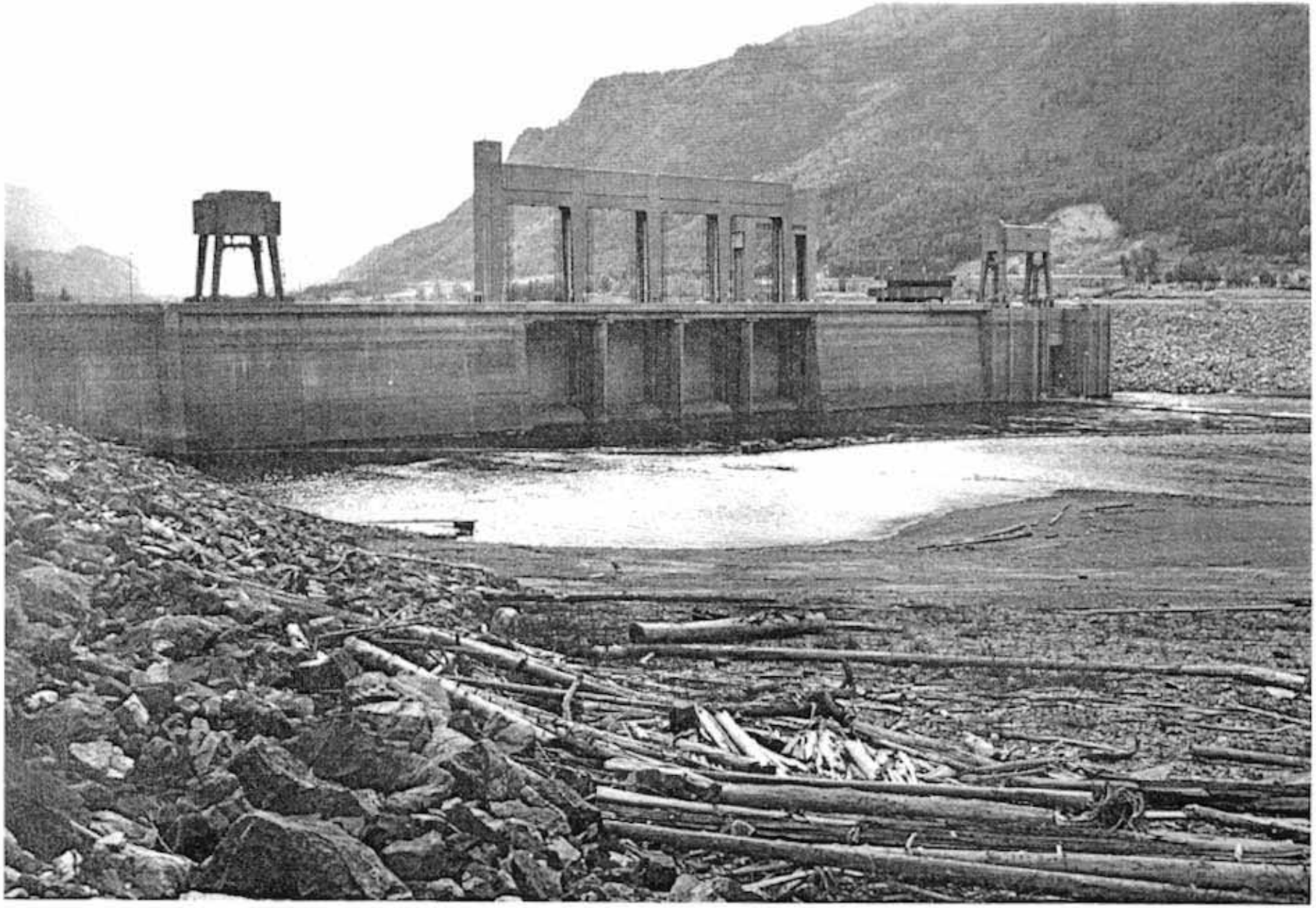
V. OPERATING CRITERIA

A. GENERAL

The Columbia River Treaty requires that the reservoirs constructed in Canada be operated pursuant to flood control and hydroelectric operating plans developed thereunder. Annex A of the Treaty stipulates that the United States Entity will submit flood control operating plans and that the Canadian Entity will operate in accordance with flood control storage diagrams or any variation which the Entities agree will not derogate from the desired aim of the flood control plan. Annex A also provides for the development of hydroelectric operating plans five years in advance to furnish the Entities with an Assured Operating Plan for Canadian Storage. In addition, Article XIV.2.k of the Treaty provides that a Detailed Operating Plan may be developed to produce more advantageous results through use of current estimates of loads and resources. The Protocol to the Treaty provides further detail and clarification of the principles and requirements of Annex A. The Principles and Procedures of 25 July 1967, together wihh the Columbia River Treaty Flood Control Operating Plan dated October 1972, both developed by special task forces, establish the general criteria of operations.

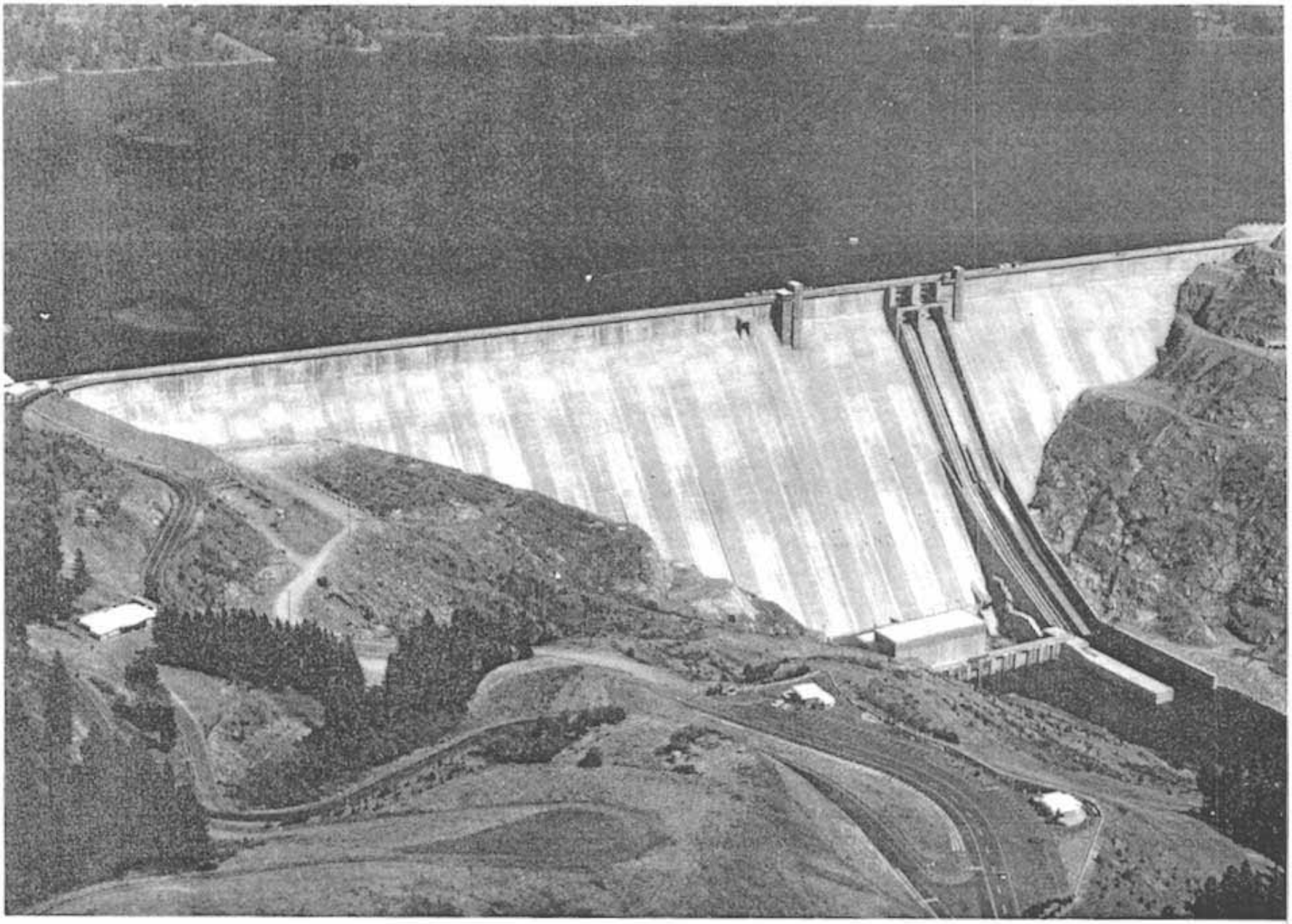
The Assured Operating Plan dated 15 February 1969 established Operating Rule Curves for Duncan, Arrow and Mica during the 1972-73 operating year. The Operating Rule Curves provided guidelines for refill levels as well as drawdown levels. They were derived from Critical Rule Curves, Assured Refill Curves, and simulated Variable Refill Curves, consistent with flood control requirements, as described in the Principles and Procedures. The Flood Control Storage Reservation Curves were established to conform to the Flood Control Operating Plan.

The Detailed Operating Plan dated 19 September 1972 established Operating Rule Curves based on power loads and resource data available just prior to the operating year for use in actual operations. The Variable Refill Curves and flood control requirements subsequent to 1 January 1973 were determined on the basis of seasonal volume runoff forecasts during actual operation.



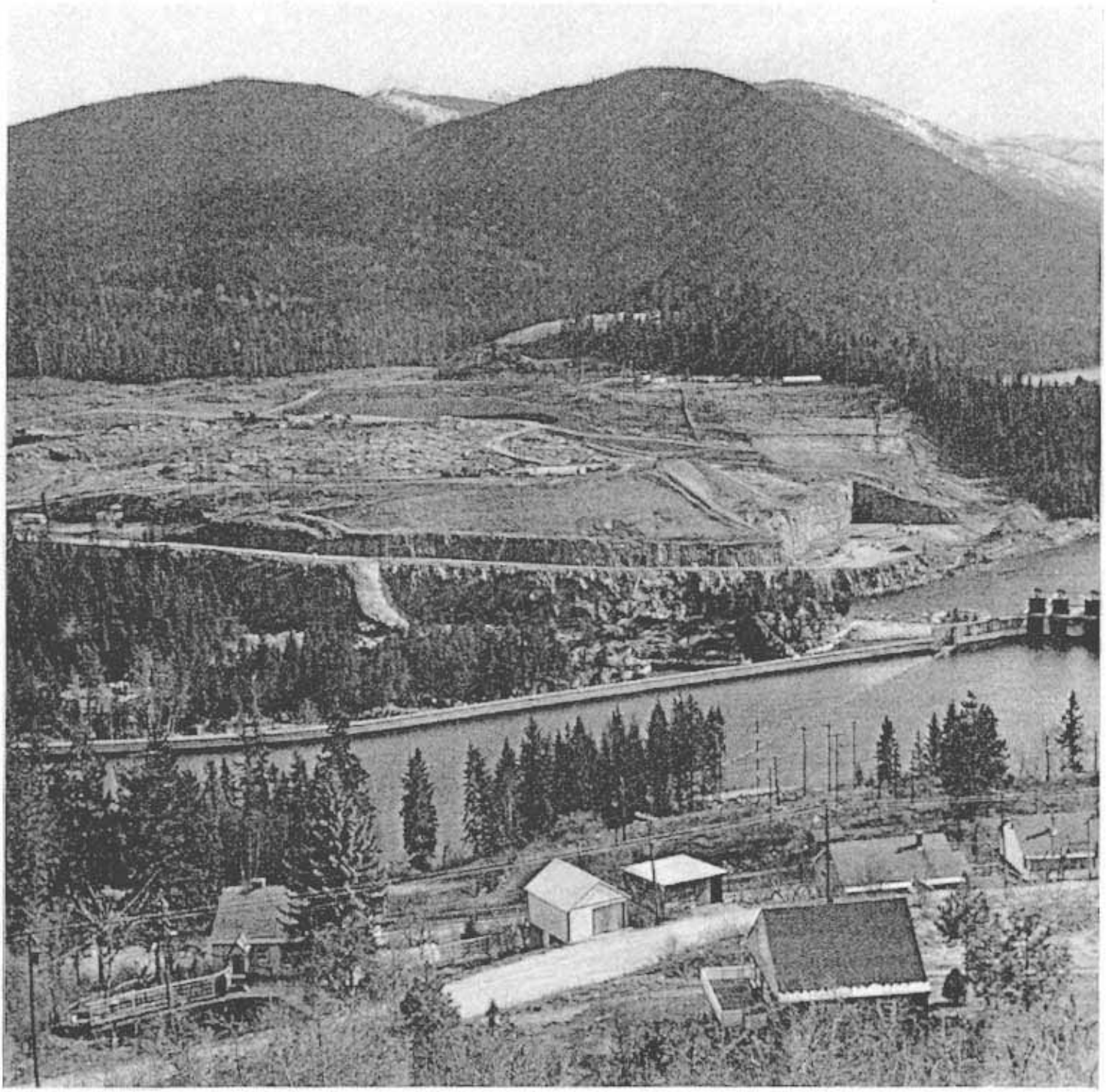
View of the Arrow Lakes Reservoir and the upstream face of Keenleyside Dam showing the extreme low level of Arrow Lakes on 23 August 1973. On that date Arrow Lakes Reservoir was 56.0 feet below the normal full pool level of 1444.0 feet.

Bonneville Power Administration Photograph



A recent view of Dworshak Dam, located on The North Fork Clearwater River in Idaho. Power was first put on line on 1 March 1973, and formal dedication ceremonies took place on 15 June 1973.

U.S. Corps of Engineers Photograph



View of Kootenay Canal Project construction, 4 April 1973, from right bank of Kootenay River. South Slocan pool is shown in foreground, Brilliant pool at right. Rock excavation for access road and powerhouse can be seen on opposite bank.

B.C. Hydro & Power Authority Photograph

TABLE 1

UNREGULATED RUNOFF VOLUME FORECASTS
MILLIONS OF ACRE-FEET
1973

Forecast Date - 1st of:	Duncan	Arrow	Mica	Libby	Unregulated Runoff Columbia River at The Dalles, Oregon
	Most Probable 1 Apr. - 31 Aug.	Most Probable 1 Apr. - 31 Aug.	Most Probable 1 Apr. - 31 Aug.	Most Probable 1 Apr. - 31 Aug.	Most Probable 1 Jan. - 31 Jul.
January	1.99	21.68	11.29	6.85	94.0
February	2.04	21.60	11.24	6.76	90.5
March	2.07	21.37	11.15	6.39	80.7
April	2.02	21.52	11.26	6.17	79.4
May	1.96	21.11	11.10	6.10	—
June	1.94	21.07	11.33	5.95	—
Actual	1.70	19.54	9.46	4.91	70.7

Note: These data are as used in actual operations. Subsequent revisions have been made in some cases.

TABLE 2

ARROW LAKES COMPUTATION FORM

95 PERCENT CONFIDENCE FORECAST AND VARIABLE REFILL CURVE

1973

		Initial	Jan. 1	Feb. 1	Mar. 1	Apr. 1	May 1	Jun. 1
1.	Probable Feb 1-Jul 31 inflow, KSFD 1/		9519.7	9496.0	9437.6	9555.2	9367.9	9287.1
2.	95% forecast error, KSFD		1755.5	1375.0	1285.1	1215.5	1127.8	1067.5
3.	95% confidence Feb 1-Jul 31 inflow, KSFD 2/		7764.2	8121.0	8152.5	8339.7	8240.1	8219.6
4.	Observed Feb 1-date inflow, KSFD			0	262.7	570.5	1072.4	2852.1
5.	95% confidence date-Jul 31 inflow, KSFD 3/		7764.2	8121.0	7889.8	7769.2	7167.7	5367.5
	Assumed Feb 1-Jul 31 inflow, % volume		100.0					
	Assumed Feb 1-Jul 31 inflow, KSFD 4/		7764.2					
	Min. Feb 1-Jul 31 outflow, KSFD		905.0					
	Mica refill requirements, KSFD 5/		3315.1					
	Min. Jan 31 contents, KSFD 6/		58.2					
	Min. Jan 31 elevation, ft. 7/		1378.4					
	Jan 31 Variable Refill Curve, ft 8/	1420.9	1378.4					
	Assumed Mar 1-Jul 31 inflow, % volume		97.6	97.6				
	Assumed Mar 1-Jul 31 inflow, KSFD 4/		7577.9	7926.1				
	Min. Mar 1-Jul 31 outflow, KSFD		765.0	765.0				
	Mica refill requirements, KSFD 5/		3315.1	3462.4				
	Min. Feb 28 contents, KSFD 6/		104.5	0				
	Min. Feb 28 elevation, ft. 7/		1379.5	1377.7				
	Feb 28 Variable Refill Curve, ft. 8/	1421.3	1379.5	1377.7				
	Assumed Apr 1-Jul 31 inflow, % volume		94.9	94.9	97.3			
	Assumed Apr 1-Jul 31 inflow, KSFD 4/		7368.2	7706.8	7676.8			
	Min. Apr 1-Jul 31 outflow, KSFD		610.0	610.0	3440.4			
	Mica refill requirements, KSFD 5/		3315.1	3462.4	1581.3			
	Min. Mar 31 contents, KSFD 6/		159.2	0	947.2			
	Min. Mar 31 elevation, ft. 7/		1380.8	1377.7	1397.8			
	Mar 31 Variable Refill Curve, ft. 8/	1419.1	1380.8	1377.7	1397.8			
	Assumed May 1-Jul 31 inflow, % volume		88.3	88.3	90.6	93.1		
	Assumed May 1-Jul 31 inflow, KSFD 4/		6855.8	7170.9	7148.2	7233.1		
	Min. May 1-Jul 31 outflow, KSFD		460.0	460.0	2594.4	2594.4		
	Mica refill requirements, KSFD, 5/		3247.4	3388.3	2506.5	2506.5		
	Min. Apr 30 contents, KSFD 6/		453.9	279.7	1555.0	1470.1		
	Min. Apr 30 elevation, ft 7/		1387.5	1383.6	1409.5	1407.9		
	Apr 30 Variable Refill Curve, ft. 8/	1407.1	1387.5	1383.6	1407.1	1407.1		
	Assumed Jun 1-Jul 31 inflow, % volume		66.3	66.3	68.1	70.0	75.1	
	Assumed Jun 1-Jul 31 inflow, KSFD 4/		5147.7	5384.2	5373.0	5433.4	5382.9	
	Min. Jun 1-Jul 31 outflow, KSFD		305.0	305.0	1730.2	1730.2	1730.2	
	Mica refill requirements, KSFD 5/		2655.7	2769.3	2232.6	2232.6	2232.6	
	Min. May 31 contents, KSFD 6/		1415.3	1292.4	2182.1	2126.1	2172.2	
	Min. May 31 elevation, ft 7/		1406.9	1404.6	1420.8	1419.8	1420.6	
	May 31 Variable Refill Curve, ft 8/	1415.4	1406.9	1404.6	1415.4	1415.4	1415.4	
	Assumed Jul 1-Jul 31 inflow, % volume		30.9	30.9	31.7	32.6	35.0	46.6
	Assumed Jul 1-Jul 31 inflow, KSFD 4/		2399.1	2509.4	2501.1	2532.8	2508.7	2501.3
	Min. Jul 1-Jul 31 outflow, KSFD		155.0	155.0	874.2	874.2	874.2	874.2
	Mica refill requirements, KSFD 5/		1357.1	1415.1	1103.4	1103.4	1103.4	1103.4
	Min. Jun 30 contents, KSFD 6/		2715.3	2663.0	3078.8	3047.1	3071.2	3078.6
	Min. Jun 30 elevation, ft. 7/		1429.8	1428.9	1435.7	1435.2	1435.6	1435.7
	Jun 30 Variable Refill Curve, ft. 8/	1432.2	1429.8	1428.9	1432.2	1432.2	1432.2	1432.2
	July 31 Variable Refill Curve, ft.	1444.0	1444.0	1444.0	1444.0	1444.0	1444.0	1444.0

1/ Mica forecast + local Arrow forecast developed by Canadian Entity
2/ Line 1 - Line 2
3/ Line 3 - Line 4
4/ Preceding Line x Line 5
5/ Mica full content-Energy Content Curve from Mica BCC Computation Form (except Jan, Feb, Mar)
6/ Full content (3602.3 KSFD) plus two preceding lines less line preceding that.
7/ Last reservoir elevation-storage content table dated November 30, 1966
8/ Lower of elevation on preceding line or elevation determined prior to year (Initial)

TABLE 3

95 PERCENT CONFIDENCE FORECAST AND VARIABLE REFILL CURVE

Forecast Date	Initial	1973 Jan. 1	Feb. 1	Mar. 1	Apr. 1	May 1	June 1
1. Probable Feb. 1-July 31 inflow, KSFD 1/		853.4	875.3	875.7	876.4	851.2	845.1
2. 95% forecast error, KSFD		191.5	150.7	129.8	116.8	106.9	95.5
3. 95% confidence Feb. 1-July 31 inflow, KSFD 2/		661.9	724.6	745.9	759.6	744.3	749.6
4. Observed Feb. 1-date inflow, KSFD		0.0	0.0	20.5	43.6	84.6	251.8
5. 95% confidence date-July 31 inflow, KSFD 3/		661.9	724.6	725.4	716.0	659.7	497.8
Assumed Feb. 1-Jul. 31 inflow, % volume		100.0					
Assumed Feb. 1-Jul. 31 inflow, KSFD 4/		661.9					
Min. Feb. 1-Jul. 31 outflow, KSFD		18.1					
Min. Jan. 31 reservoir content, KSFD 5/		72.4					
Min. Jan. 31 reservoir elev., ft. 6/		1806.8					
Jan. 31 Variable Refill Curve, ft. 7/	1843.6	1806.8					
Assumed Mar. 1-Jul. 31 inflow, % volume		98.1	98.1				
Assumed Mar. 1-Jul. 31 inflow, KSFD 4/		649.3	710.8				
Min. Mar. 1-Jul. 31 outflow, KSFD		15.3	15.3				
Min. Feb. 28 reservoir content, KSFD 5/		82.2	20.7				
Min. Feb. 28 reservoir elev., ft. 6/		1808.6	1796.4				
Feb. 28 Variable Refill Curve, ft. 7/	1844.8	1808.6	1796.4				
Assumed Apr. 1-Jul. 31 inflow, % volume		96.1	96.1	98.0			
Assumed Apr. 1-Jul. 31 inflow, KSFD 4/		636.1	696.3	710.9			
Min. Apr. 1-Jul. 31 outflow, KSFD		12.2	12.2	280.6			
Min. Mar. 31 reservoir content, KSFD 5/		92.3	32.1	286.0			
Min. Mar. 31 reservoir elev., ft. 6/		1810.3	1799.0	1839.2			
Mar. 31 Variable Refill Curve, ft. 7/	1846.6	1810.3	1799.0	1839.2			
Assumed Apr. 16-Jul. 31 inflow, % volume		94.6	94.6	96.5	98.5		
Assumed Apr. 16-Jul. 31 inflow, KSFD 4/							
Min. Apr. 16-Jul. 31 outflow, KSFD		10.7	10.7		10.7		
Min. Apr. 15 reservoir content, KSFD 5/							
Min. Apr. 15 reservoir elev., ft. 6/							
Apr. 15 Variable Refill Curve, ft. 7/							
Assumed May 1-Jul. 31 inflow, % volume		91.1	91.1	92.9	94.8		
Assumed May 1-Jul. 31 inflow, KSFD 4/		603.0	660.1	673.9	678.7		
Min. May 1-Jul. 31 outflow, KSFD		9.2	9.2	211.6	211.6		
Min. Apr. 30 reservoir content, KSFD 5/		122.4	65.3	254.0	249.1		
Min. Apr. 30 reservoir elev., ft. 6/		1815.3	1805.5	1834.9	1834.2		
Apr. 30 Variable Refill Curve, ft. 7/	1841.4	1815.3	1805.5	1834.9	1834.2		
Assumed June 1-Jul. 31 inflow, % volume		71.7	71.7	73.1	74.6	78.7	
Assumed June 1-Jul. 31 inflow, KSFD 4/		474.6	519.5	530.3	534.1	519.2	
Min. June 1-Jul. 31 outflow, KSFD		6.1	6.1	140.3	140.3	140.3	
Min. May 31 reservoir content, KSFD 5/		247.7	202.8	326.3	322.4	337.3	
Min. May 31 reservoir elev., ft. 6/		1834.0	1827.6	1844.6	1844.1	1846.0	
May 31 Variable Refill Curve, ft. 7/	1853.0	1834.0	1827.6	1844.6	1844.1	1846.0	
Assumed Jul. 1-Jul. 31 inflow, % volume		33.9	33.9	34.6	35.3	37.2	47.3
Assumed Jul. 1-Jul. 31 inflow, KSFD 4/		224.4	245.6	251.0	252.7	245.4	235.5
Min. Jul. 1- Jul. 31 outflow, KSFD		3.1	3.1	71.3	71.3	71.3	71.3
Min. June 30 reservoir content, KSFD 5/		494.4	473.7	536.6	534.8	542.1	552.0
Min. June 30 reservoir, elev., ft. 6/		1866.0	1863.4	1871.1	1870.9	1871.8	1872.9
June 30 Variable Refill Curve, ft. 7/	1874.1	1866.0	1863.4	1871.1	1870.9	1871.8	1872.9
July 31 Variable Refill Curve, ft.	1892.0	1892.0	1892.0	1892.0	1892.0	1892.0	1892.0

1/ Developed by Canadian Entity
2/ Line 1 - Line 2
3/ Line 3 - Line 4
4/ Preceding Line x Line 5
5/ Full content (716.2 KSFD) plus preceding line less line preceding that with a minimum content of 4.8
6/ From reservoir elevation - storage content table dated April 24, 1968
7/ Lower of elevation on preceding line or elevation determined prior to year (Initial)

TABLE 4

MICA RESERVOIR COMPUTATION POINT

95 PERCENT CONFIDENCE FORECAST AND VARIABLE REFILL CURVE

		1973					
	Initial	Jan. 1	Feb. 1	Mar. 1	Apr. 1	May 1	June 1
1. Probable Fed. 1-July 31 inflow, KSFD 1/		4687.9	4675.1	4632.2	4674.4	4610.0	4692.8
2. 95% forecast error, KSFD		841.4	674.7	644.5	602.2	596.7	569.4
3. 95% confidence Feb. 1-July 31 inflow, KSFD 2/		3846.5	4000.4	3987.7	4072.2	4013.3	4123.4
4. Observed Feb. 1-date inflow, KSFD			0	84.0	194.9	372.9	1183.0
5. 95% confidence date-July 31 inflow, KSFD 3/		3846.5	4000.4	3903.7	3879.3	3640.4	2940.0
Assumed Feb. 1-Jul. 31 inflow, % volume		100.0					
Assumed Feb. 1-Jul. 31 inflow, KSFD 4/		3846.5					
Min. Feb 1.-Jul 31 outflow, KSFD		366.0					
Min. Jan. 31 reservoir content, KSFD 5/		0					
Min. Jan. 31 reservoir elev., ft. 6/							
Jan. 31 Variable Refill Curve, ft. 7/	1860.0	1860.0					
Assumed Mar. 1-Jul 31 inflow, % volume		98.0	98.0				
Assumed Mar. 1-Jul. 31 inflow, KSFD 4/		3769.6	3920.4				
Min. Mar. 1-Jul. 31 outflow, KSFD		366.0	366.0				
Min. Feb. 28 reservoir content, KSFD 5/		0					
Min. Feb. 28 reservoir elev., ft. 6/							
Feb. 28 Variable Refill Curve, ft. 7/	1860.0	1860.0	1860.0				
Assumed Apr. 1-Jul. 31 inflow, % volume		95.7	95.7	97.7			
Assumed Apr. 1-Jul. 31 inflow, KSFD 4/		3681.1	3828.4	3813.9			
Min. Apr. 1-Jul. 31 outflow, KSFD		366.0	366.0	2232.6			
Min. Mar. 31 reservoir content, KSFD 5/		0		0			
Min. Mar. 31 reservoir elev., ft. 6/							
Mar. 31 Variable Refill Curve, ft. 7/	1860.0	1860.0	1860.0	1860.0			
Assumed May 1-Jul. 31 inflow, % volume		91.6	91.6	93.6	95.8		
Assumed May 1-Jul. 31 inflow, KSFD 4/		3523.4	3644.3	3653.9	3716.4		
Min. May 1-Jul. 31 outflow, KSFD		276.0	276.0	1683.6	1683.6		
Min. Apr. 30 reservoir content, KSFD 5/		285.8	141.5	1559.5	1497.0		
Min. Apr. 30 reservoir elev., ft. 6/		2003.9	1967.8	2190.2	2183.1		
Apr. 30 Variable Refill Curve, ft. 7/	2128.2	2003.9	1967.8	2128.2	2128.2		
Assumed Jun. 1-Jul. 31 inflow, % volume		73.8	73.8	75.4	77.2	80.6	
Assumed Jun. 1-Jul. 31 inflow, KSFD 4/		2838.7	2952.3	2943.4	2994.8	2934.2	
Min. Jun. 1-Jul. 31 outflow, KSFD		183.0	183.0	1116.3	1116.3	1116.3	
Min. May 31 reservoir content, KSFD 5/		877.5	760.5	1702.7	1651.3	1711.9	
Min. May 31 reservoir elev., ft. 6/		2108.1	2090.9	2204.4	2199.4	2205.3	
May 31 Variable Refill Curve, ft. 7/	2161.7	2108.1	2090.9	2161.7	2161.7	2161.7	
Assumed Jul. 1-Jul. 31 inflow, % volume		37.7	37.7	38.5	39.4	41.2	51.1
Assumed Jul. 1-Jul. 31 inflow, KSFD 4/		1450.1	1508.1	1502.9	1528.4	1499.8	1502.5
Min. Jul. 1-Jul. 31 outflow, KSFD		93.0	93.0	567.3	567.3	567.3	567.3
Min. June 30 reservoir content, KSFD 5/		2716.1	2114.7	2594.2	2568.7	2597.3	2594.6
Min. June 30 reservoir, elev., ft. 6/		2239.8	2236.2	2261.3	2260.1	2261.5	2261.4
June 30 Variable Refill Curve, ft. 7/	2253.1	2239.8	2236.2	2253.1	2253.1	2253.1	2253.1*
July 31 Variable Refill Curve, ft.	2302.8	2302.8	2302.8	2302.8	2302.8	2302.8	2302.8*

1/ Developed by Canadian Entity
2/ Line 1 - Line 2
3/ Line 3 - Line 4
4/ Preceding Line x Line 5
5/ Full content plus preceding line less line preceding that.
6/ From reservoir elevation - storage content table dated February 20, 1967.
7/ Lower of elevation on preceding line or elevation determined prior to year (Initial)

* These elevations are based on a usable storage content of 3529.8 ksfd and do not reflect any dead storage accumulation.

TABLE 5

LIBBY
COMPUTATION FORM
95 PERCENT CONFIDENCE FORECAST AND VARIABLE ENERGY CONTENT CURVE

1973

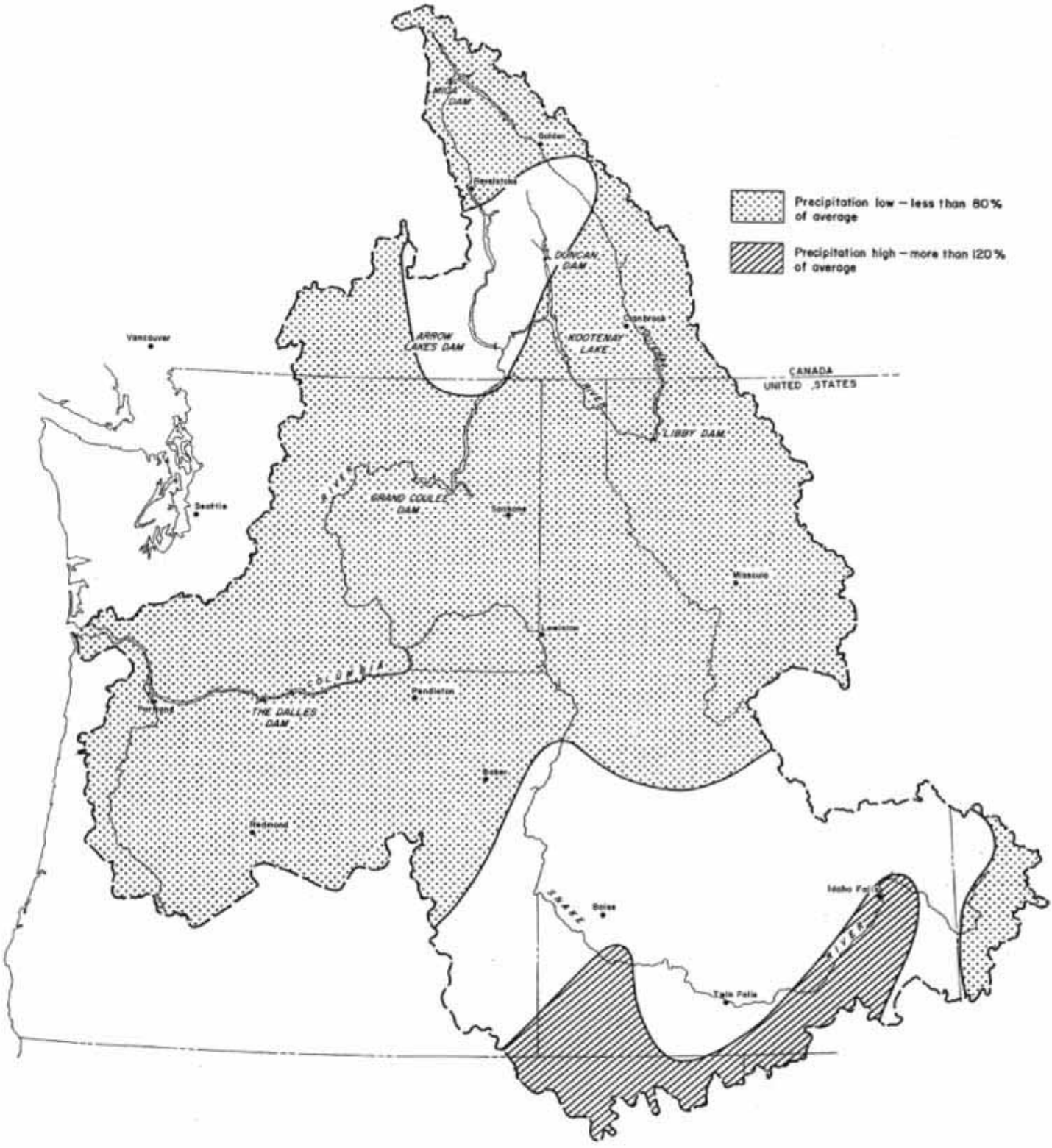
	Jan 1	Feb 1	Mar 1	Apr 1	May 1	Jun 1
Residual 95% date-Jul 31 inflow, kafd 1/	2452.8	2393.6	2281.3	2155.4	2117.5	1426.0
Assumed Feb 1-Jul 31 inflow, % of volume	96.94					
Assumed Feb 1-Jul 31 inflow, kafd 2/	2377.7					
Min. Feb 1-Jul 31 outflow, kafd	362.0					
Min. Jan 31 reservoir content, kafd 3/	487.3					
Min. Jan 31 reservoir elev., ft 4/	2339.0					
Jan 31 ECC, ft. 5/	2230.0 6/					
Base E.C.C. 2300.0						
Assumed Mar 1-Jul 31 inflow, % of volume	94.17	97.14				
Assumed Mar 1-Jul 31 inflow, kafd 2/	2309.8	2325.1				
Min. Mar 1-Jul 31 outflow, kafd	306.0	306.0				
Min. Feb 28 reservoir content, kafd 3/	499.2	483.9				
Min. Feb 28 reservoir elev. ft. 4/	2340.1	2340.1				
Feb 28 ECC, ft 5/	2230.0	2230.0 6/				
Base E.C.C. 2300.0						
Assumed Apr 1-Jul 31 inflow, % of volume	90.79	93.66	96.42			
Assumed Apr 1-Jul 31 inflow, kafd 2/	2226.9	2241.8	2199.6			
Min. Apr 1-Jul 31 outflow, kafd	244.0	244.0	390.4			
Min. Mar 31 reservoir content, kafd 3/	520.1	505.2	693.8			
Min. Mar 31 reservoir elev. ft 4/	2342.0	2342.0	2358.0			
Mar 31 ECC, ft 5/	2230.0	2230.0	2230.0 6/			
Base E.C.C. 2300.0						
Assumed May 1-Jul 31 inflow, % of volume	81.71	84.29	86.77	90.00		
Assumed May 1-Jul 31 inflow, kafd 2/	2004.2	2017.6	1979.5	1943.0		
Min. May 1-Jul 31 outflow, kafd	184.0	184.0	294.4	294.4		
Min. Apr 30 reservoir content, kafd 3/	682.8	669.4	817.9	854.4		
Min. Apr 30 reservoir elev. ft 4/	2357.1	2356.1	2367.6	2370.5		
Apr 30 ECC, ft 5/	2357.1	2356.1	2367.6	2370.5		
Base E.C.C. 2395.3						
Assumed Jun 1-Jul 31 inflow, % of volume	52.75	54.42	56.02	58.10	64.56	
Assumed Jun 1-Jul 31 inflow, kafd 2/	1293.9	1302.6	1278.0	1252.4	1367.1	
Min. Jun 1-Jul 31 outflow, kafd	122.0	122.0	195.2	195.2	195.2	
Min. May 31 reservoir content, kafd 3/	1331.2	1322.4	1420.2	1445.8	1331.1	
Min. May 31 reservoir elev. ft 4/	2401.4	2400.9	2406.6	2408.1	2401.4	
May 31 ECC, ft. 5/	2401.4	2400.9	2406.6	2408.1	2401.4	
Base E.C.C. 2421.1						
Assumed Jul 1-31 inflow, % of volume	18.97	19.57	20.15	20.90	23.22	35.97
Assumed Jul 1-31 inflow, kafd 2/	465.3	468.4	459.7	450.5	491.7	512.9
Min. Jul 1-31 outflow, kafd	62.0	62.0	99.2	99.2	99.2	992.
Min. Jun 30 reservoir content, kafd 3/	2099.7	2096.6	2142.5	2151.7	2110.5	2089.3
Min. Jun 30 reservoir elev, ft	2441.7	2441.6	2443.7	2444.1	2442.2	2441.2
Jun 30 ECC, ft. 5/	2441.7	2441.6	2443.7	2444.1	2442.2	2441.2
Base E.C.C. 2449.8						
Jul 31 ECC, Ft.	2459.0	2459.0	2459.0	2459.0	2459.0	2459.0

1/ The residual 95% forecast is obtained directly from the forecasting procedure.
2/ Preceding line x line 3.
3/ Full content (2503 kafd) plus preceding line less line preceding that.
4/ From reservoir elevation - storage content table dated March 17, 1972.
5/ Lower of elevation on preceding line or elevation determined prior to year.
6/ Elevation 2230 ft. as required by construction through April 15, 1973.

COLUMBIA RIVER BASIN

OCTOBER 1972 – APRIL 1973 PRECIPITATION
PERCENT OF 1953–67 AVERAGE

CHART 1
SEASONAL
PRECIPITATION



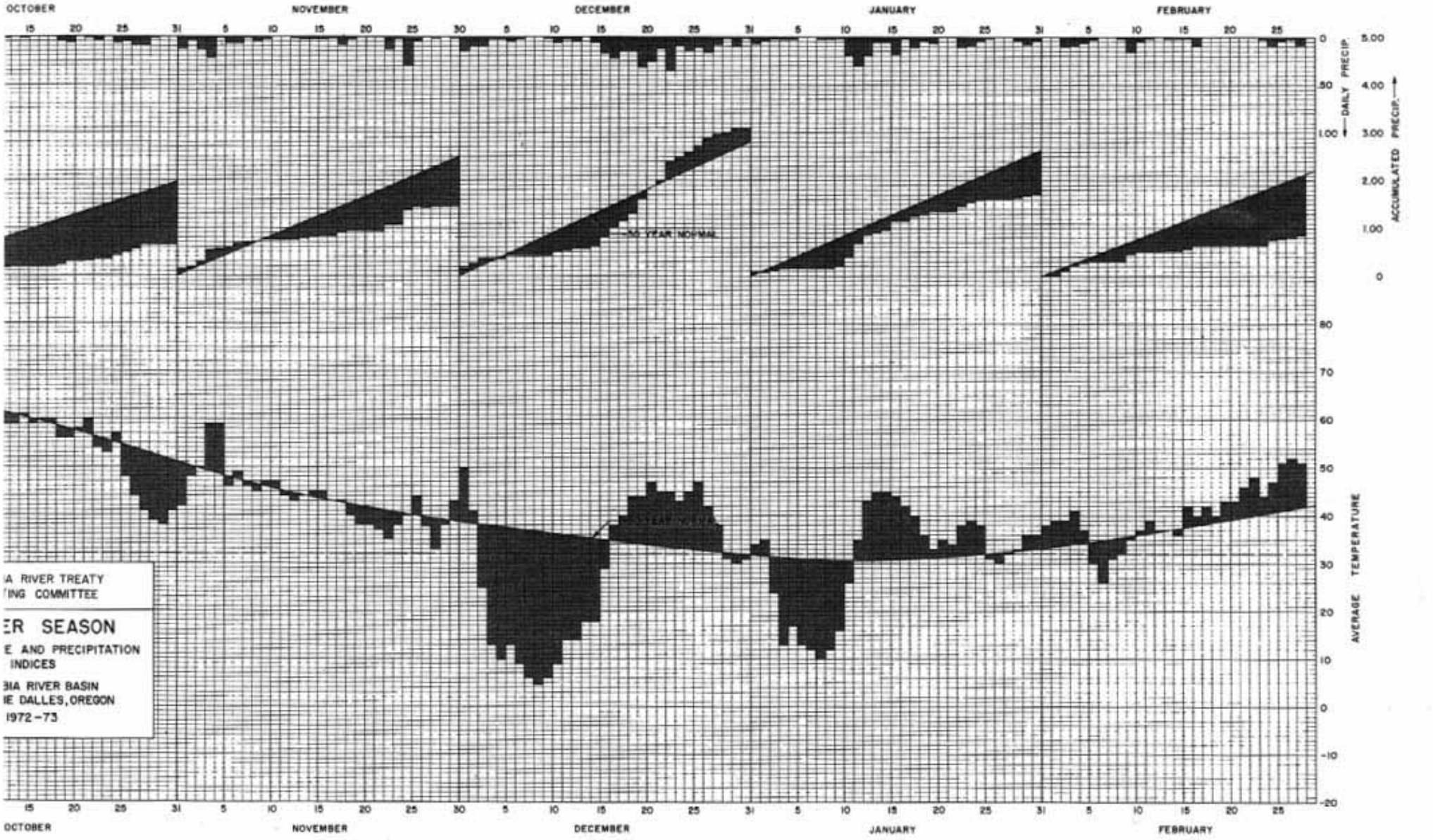
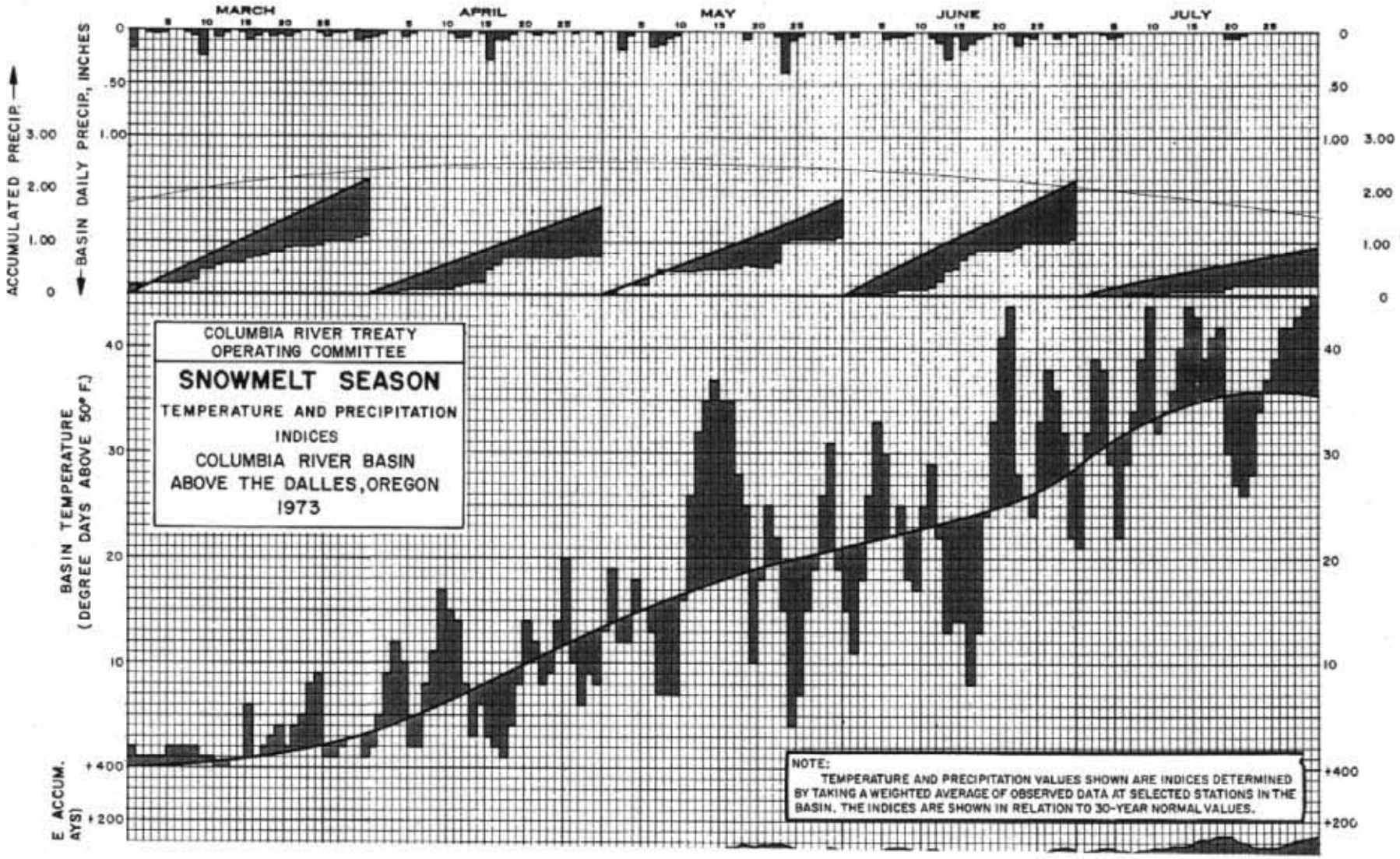
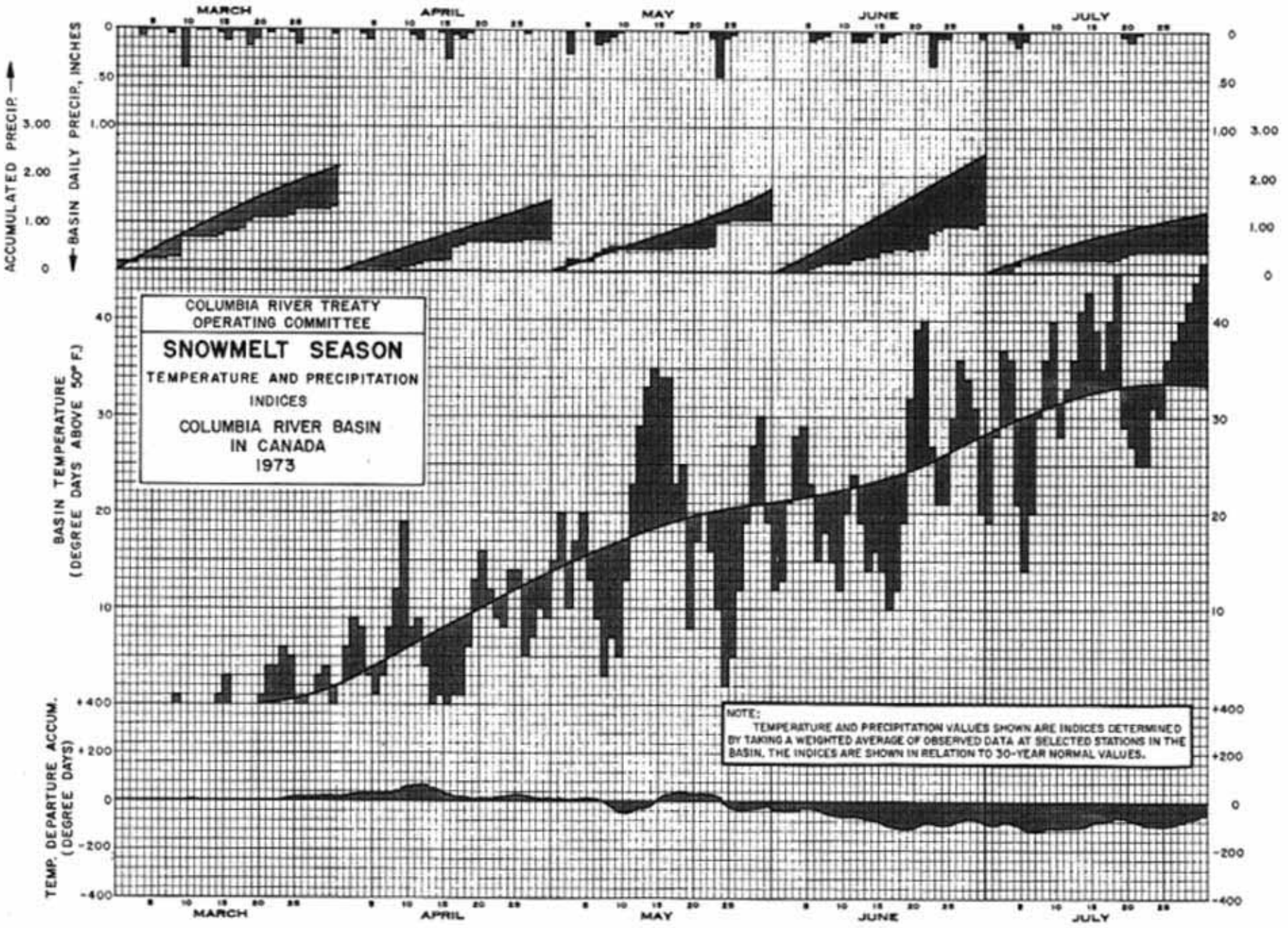

OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
15 20 25 31 5 10 15 20 25 30 5 10 15 20 25 31 5 10 15 20 25 31 5 10 15 20 25
0
.50
1.00
— DAILY PRECIP.
5.00
4.00
3.00
2.00
1.00
0
ACCUMULATED PRECIP. —
80
70
60
50
40
30
20
10
0
-10
-20
AVERAGE TEMPERATURE
A RIVER TREATY
ING COMMITTEE
ER SEASON
E AND PRECIPITATION
INDICES
BIA RIVER BASIN
E DALLES, OREGON
1972-73

CHART 3


MARCH
APRIL
MAY
JUNE
JULY
ACCUMULATED PRECIP.
BASIN DAILY PRECIP., INCHES
BASIN TEMPERATURE
(DEGREE DAYS ABOVE 50° F.)
E ACCUM.
AYS)
COLUMBIA RIVER TREATY
OPERATING COMMITTEE
SNOWMELT SEASON
TEMPERATURE AND PRECIPITATION
INDICES
COLUMBIA RIVER BASIN
ABOVE THE DALLES, OREGON
1973
NOTE:
TEMPERATURE AND PRECIPITATION VALUES SHOWN ARE INDICES DETERMINED BY TAKING A WEIGHTED AVERAGE OF OBSERVED DATA AT SELECTED STATIONS IN THE BASIN. THE INDICES ARE SHOWN IN RELATION TO 30-YEAR NORMAL VALUES.


MARCH
APRIL
MAY
JUNE
JULY
ACCUMULATED PRECIP.
BASIN DAILY PRECIP., INCHES
0
.50
1.00
2.00
3.00
COLUMBIA RIVER TREATY
OPERATING COMMITTEE
SNOWMELT SEASON
TEMPERATURE AND PRECIPITATION
INDICES
COLUMBIA RIVER BASIN
IN CANADA
1973
BASIN TEMPERATURE
(DEGREE DAYS ABOVE 50° F.)
10
20
30
40
TEMP. DEPARTURE ACCUM.
(DEGREE DAYS)
+400
+200
0
-200
-400
NOTE:
TEMPERATURE AND PRECIPITATION VALUES SHOWN ARE INDICES DETERMINED BY TAKING A WEIGHTED AVERAGE OF OBSERVED DATA AT SELECTED STATIONS IN THE BASIN. THE INDICES ARE SHOWN IN RELATION TO 30-YEAR NORMAL VALUES.

REGULATION OF ARROW
1 JULY 1972 – 31 JULY 1973

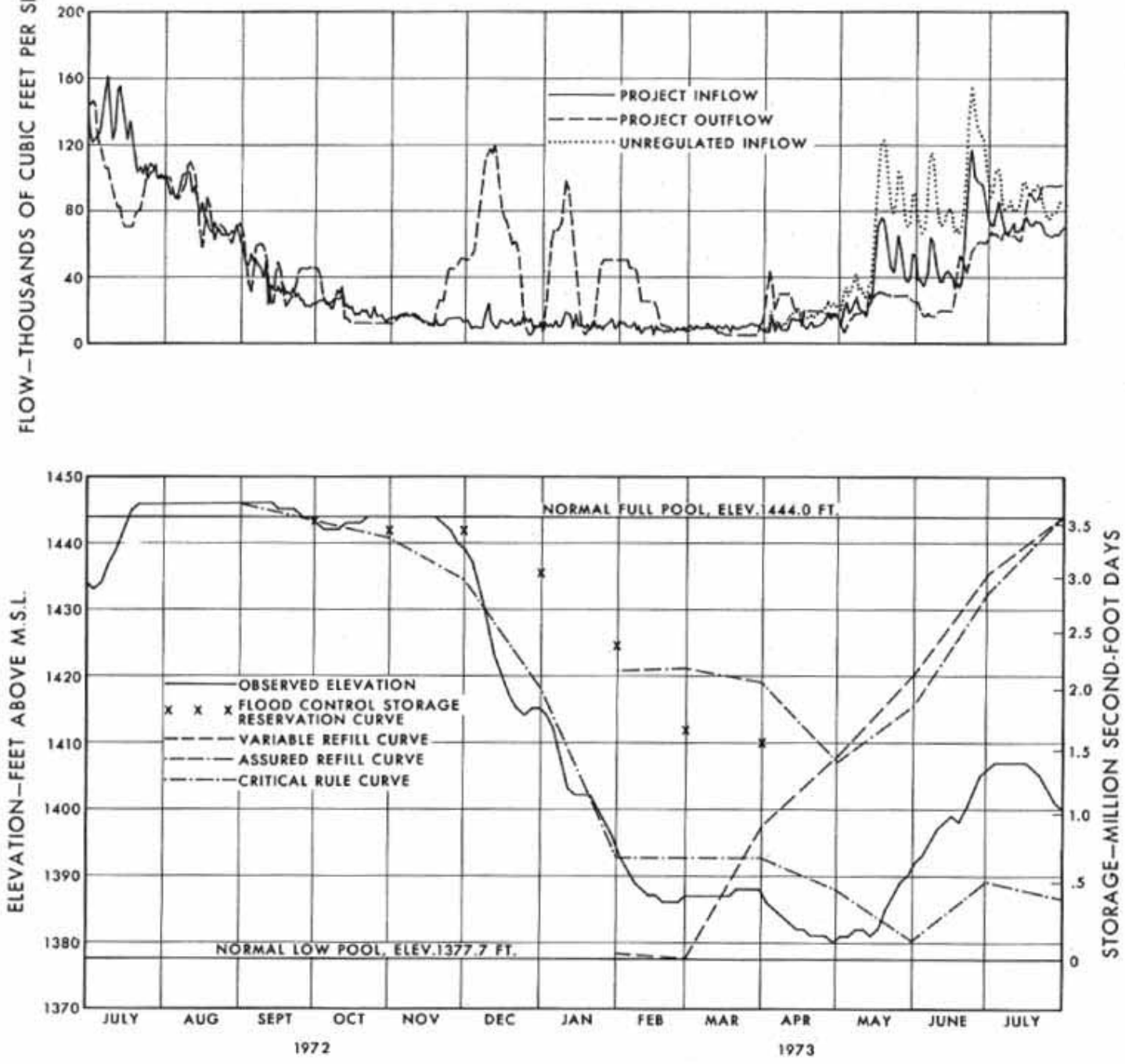
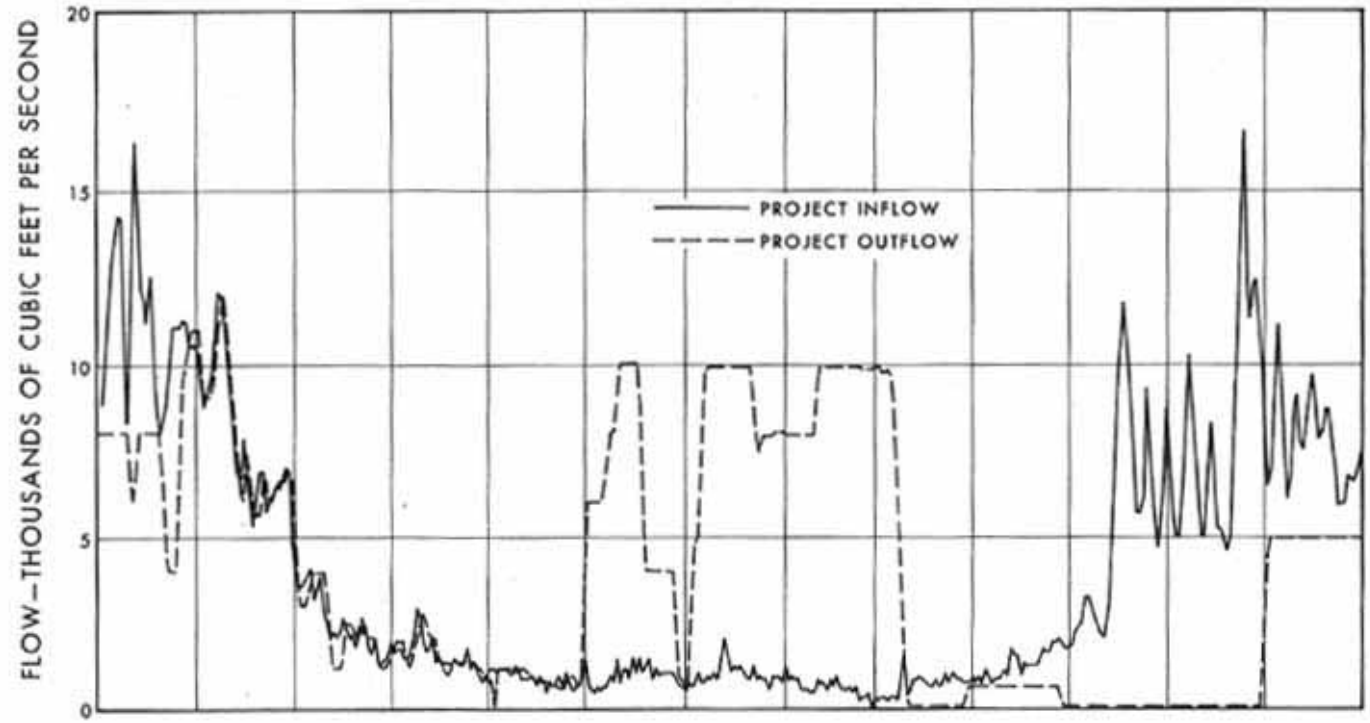
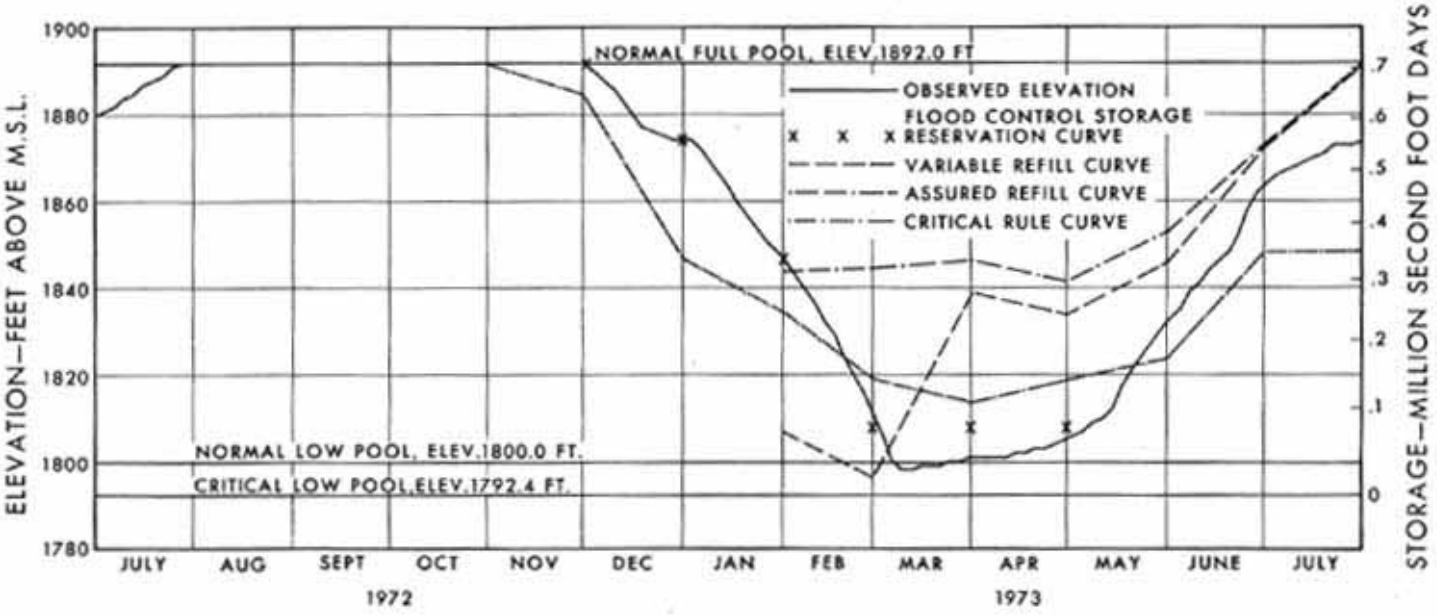


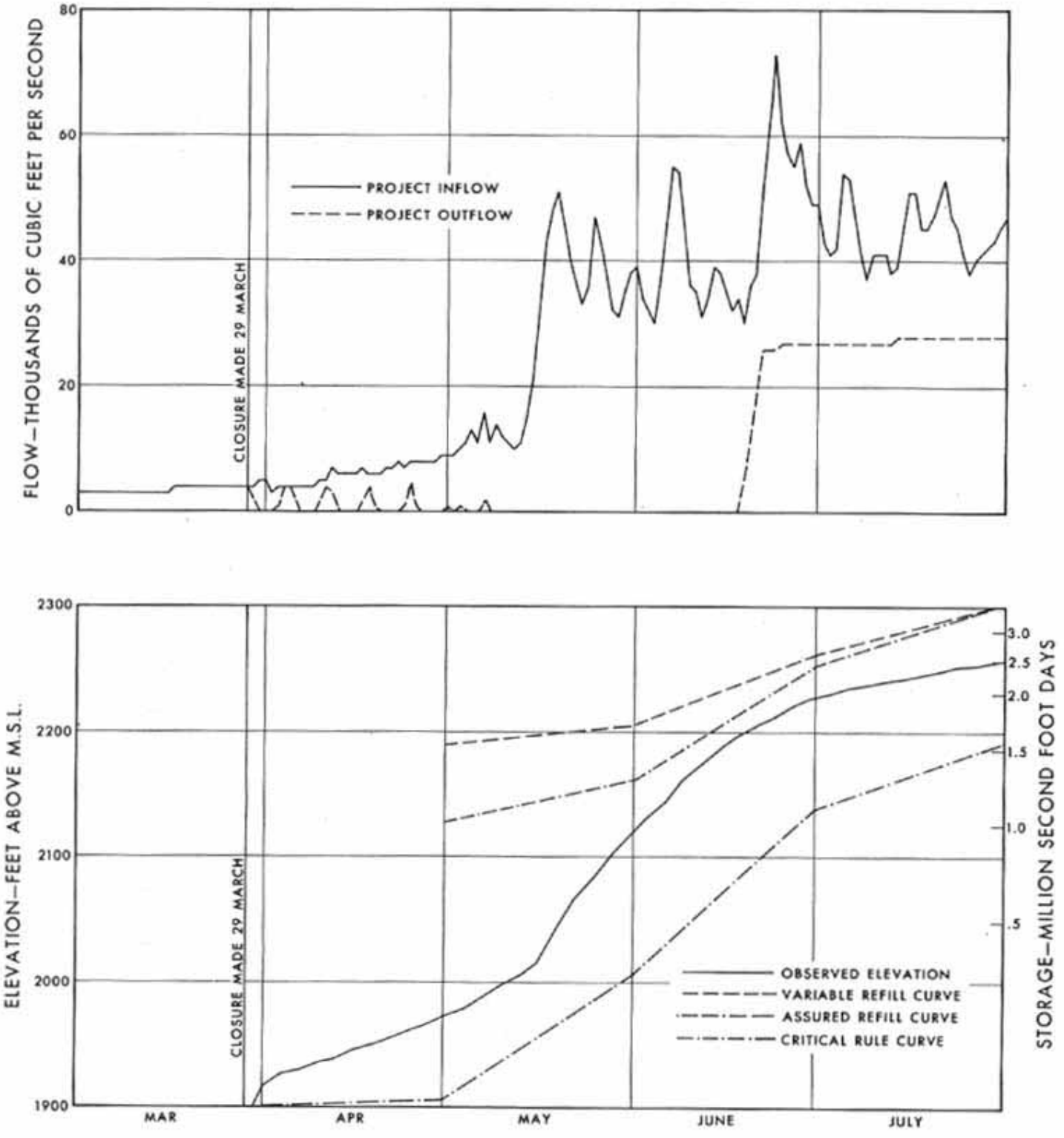
CHART 6
DUNCAN

REGULATION OF DUNCAN
1 JULY 1972 – 31 JULY 1973

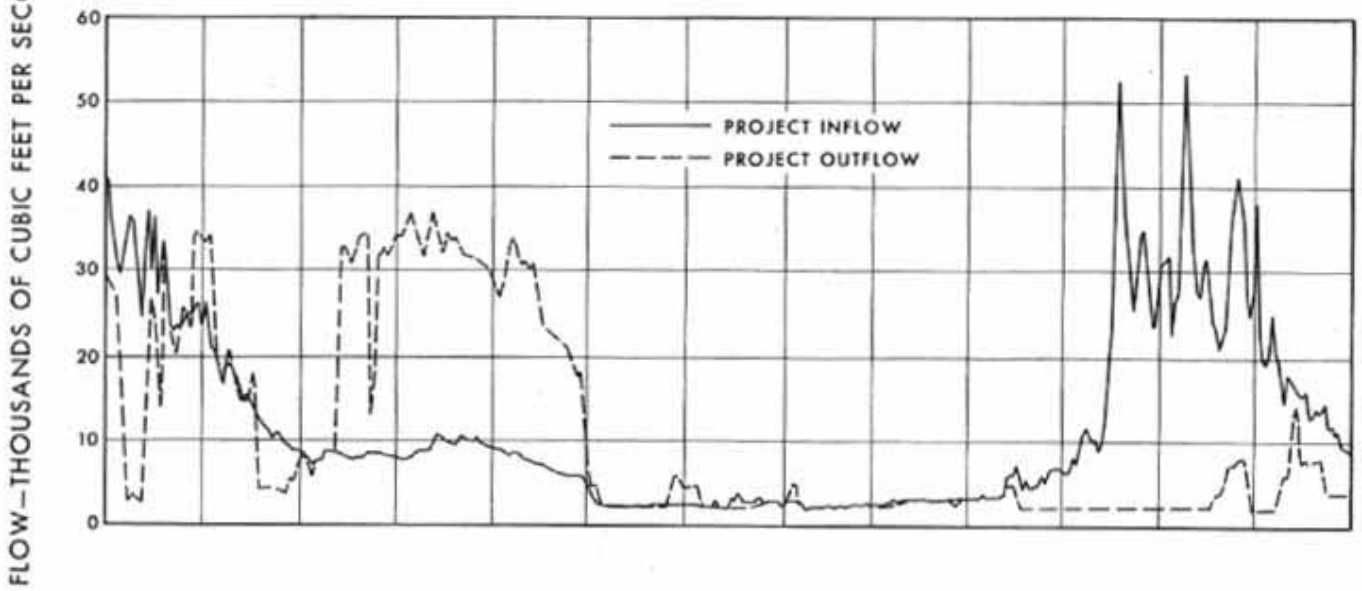




REGULATION OF MICA
1 MARCH 1973 – 31 JULY 1973



REGULATION OF LIBBY
1 JULY 1972 – 31 JULY 1973



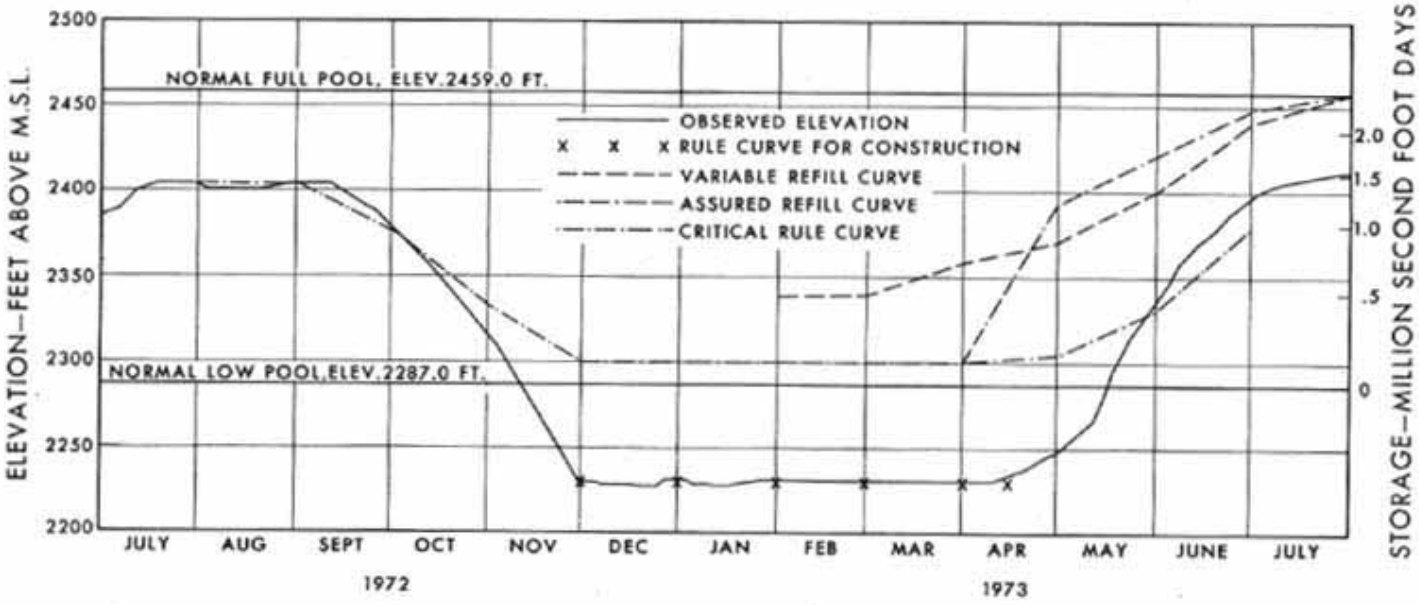


CHART 9
KOOTENAY LAKE

REGULATION OF KOOTENAY LAKE
1 JULY 1972 – 31 JULY 1973

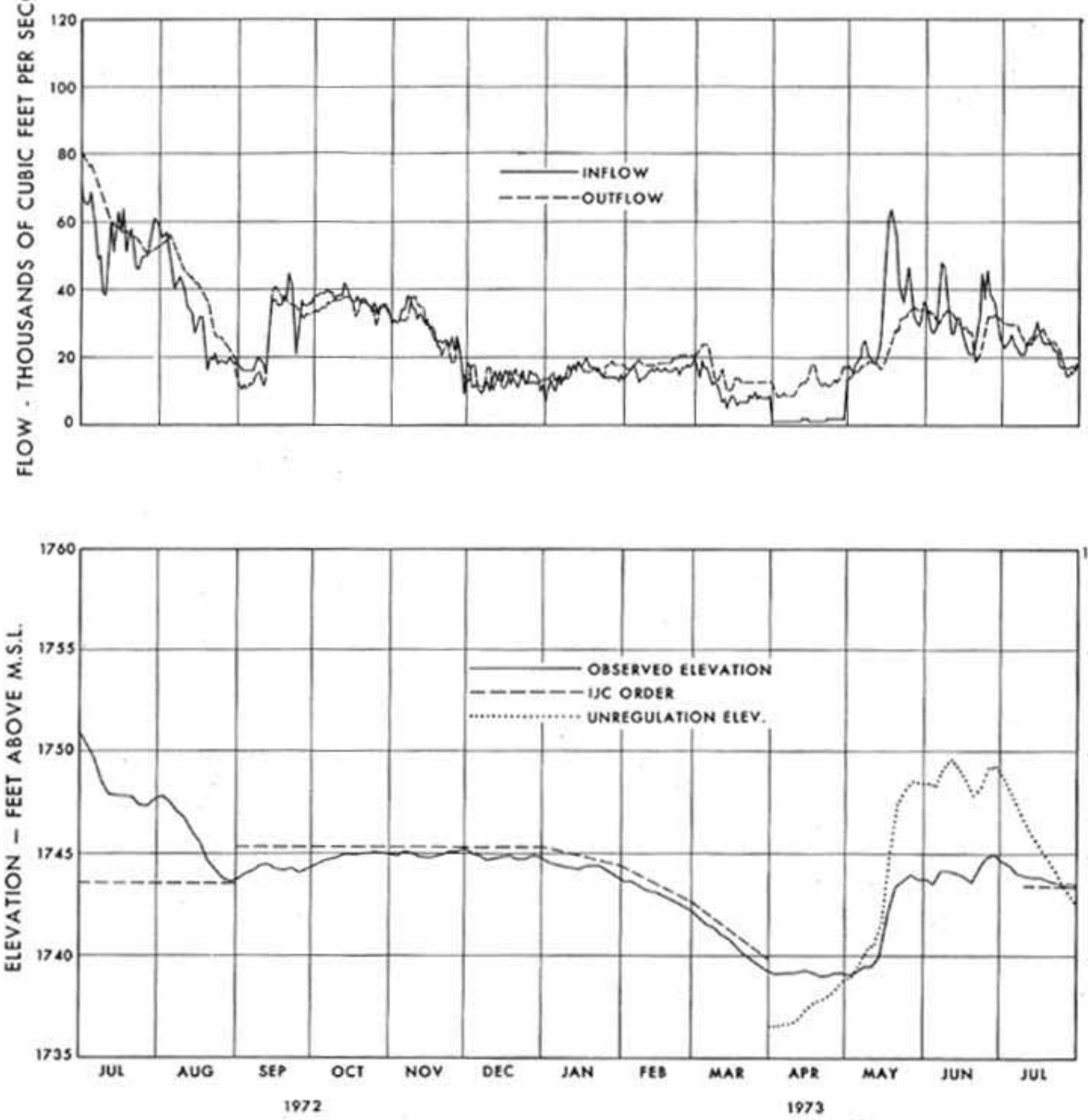


CHART 10
BIRCHBANK

COLUMBIA RIVER AT BIRCHBANK
1 JULY 1972 – 31 JULY 1973

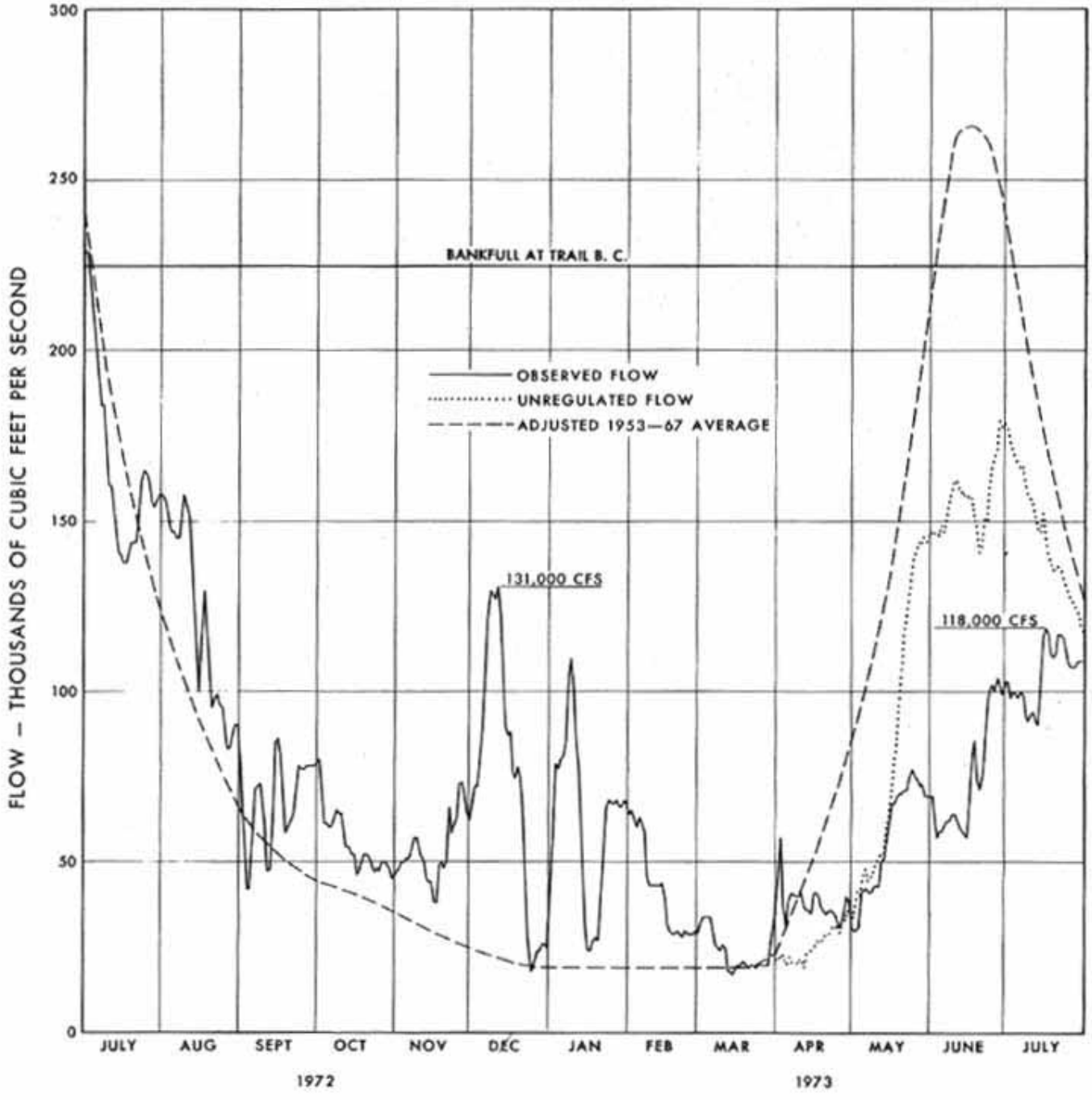
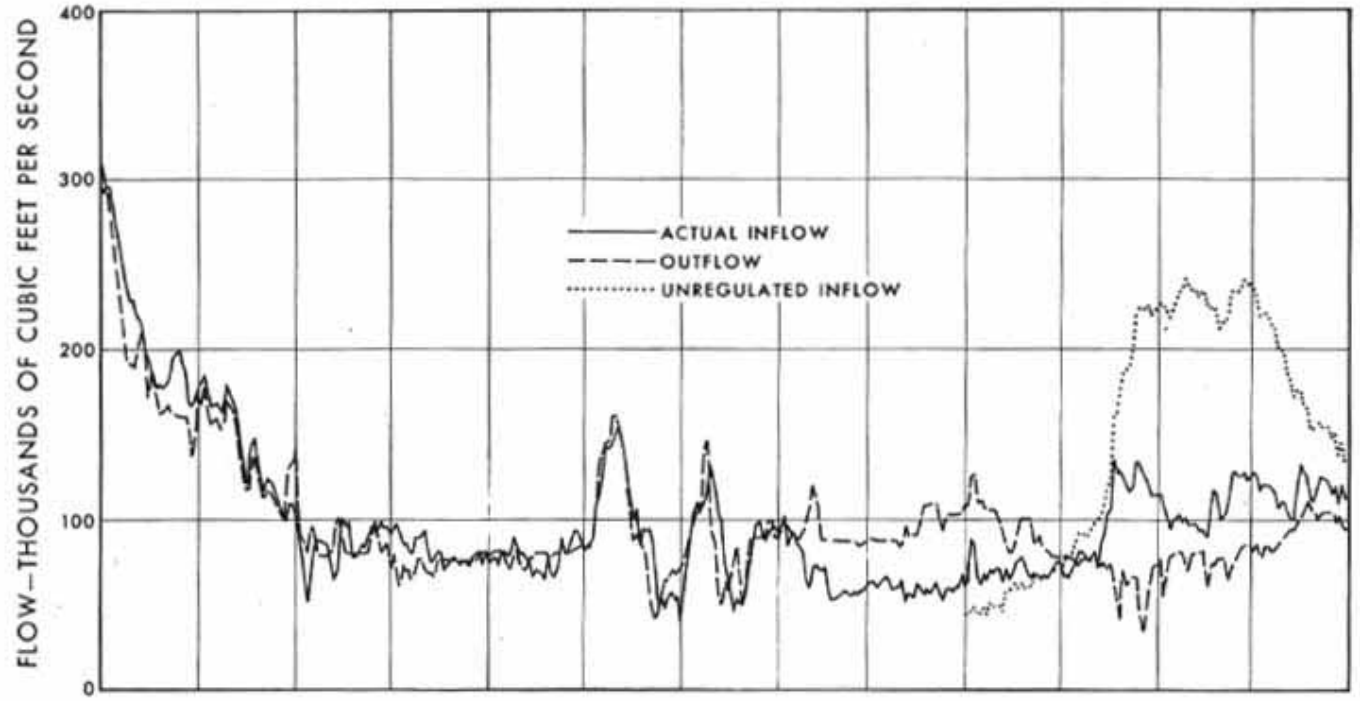


CHART 11
GRAND COULEE

REGULATION OF GRAND COULEE
1 JULY 1972 – 31 JULY 1973



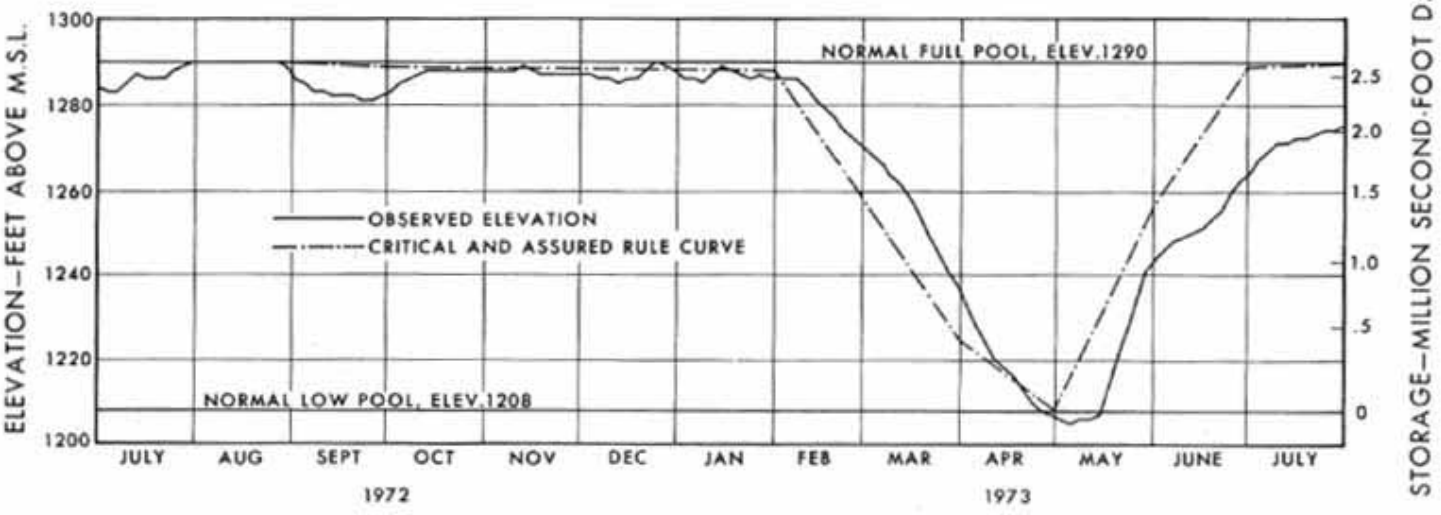
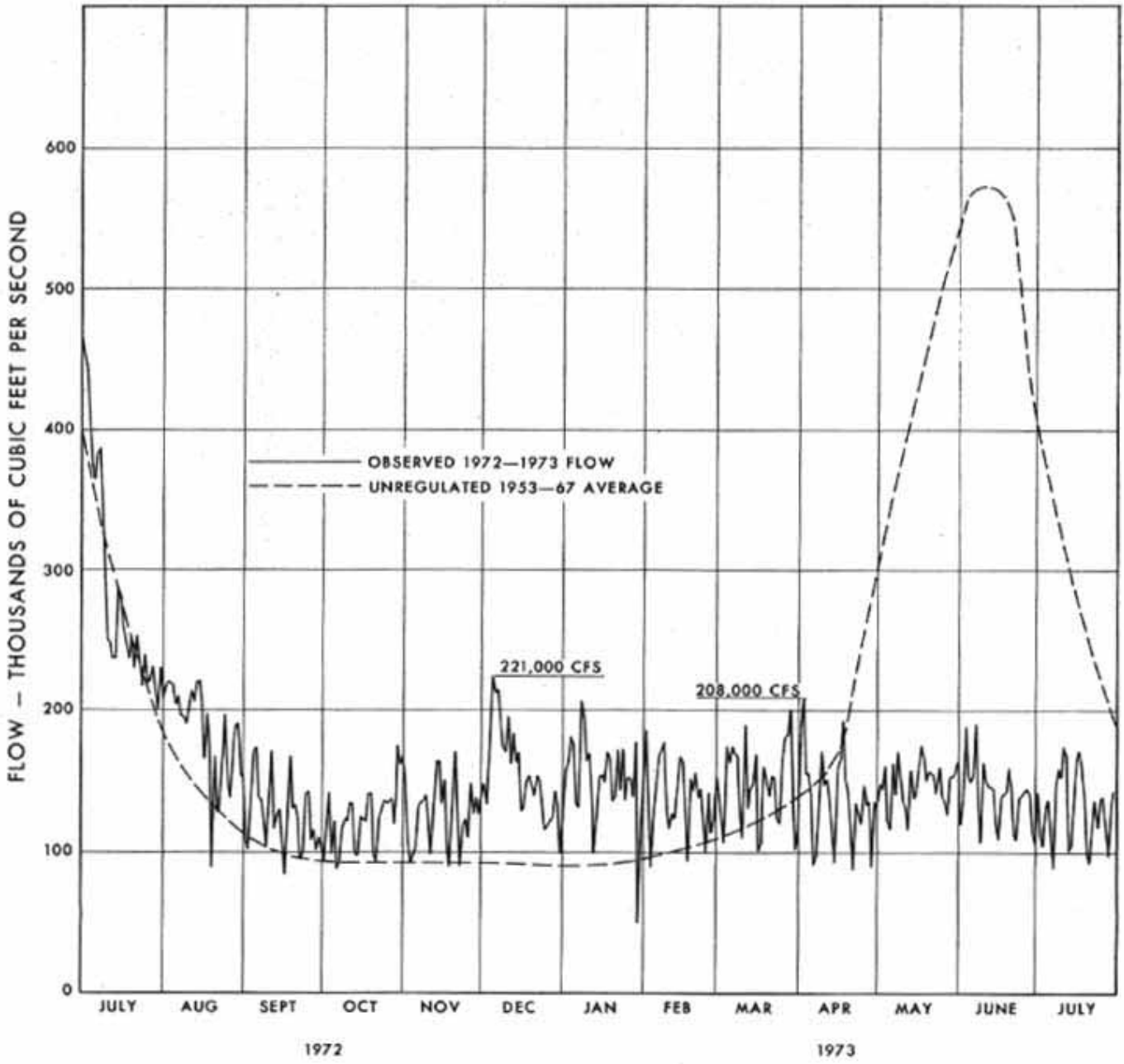
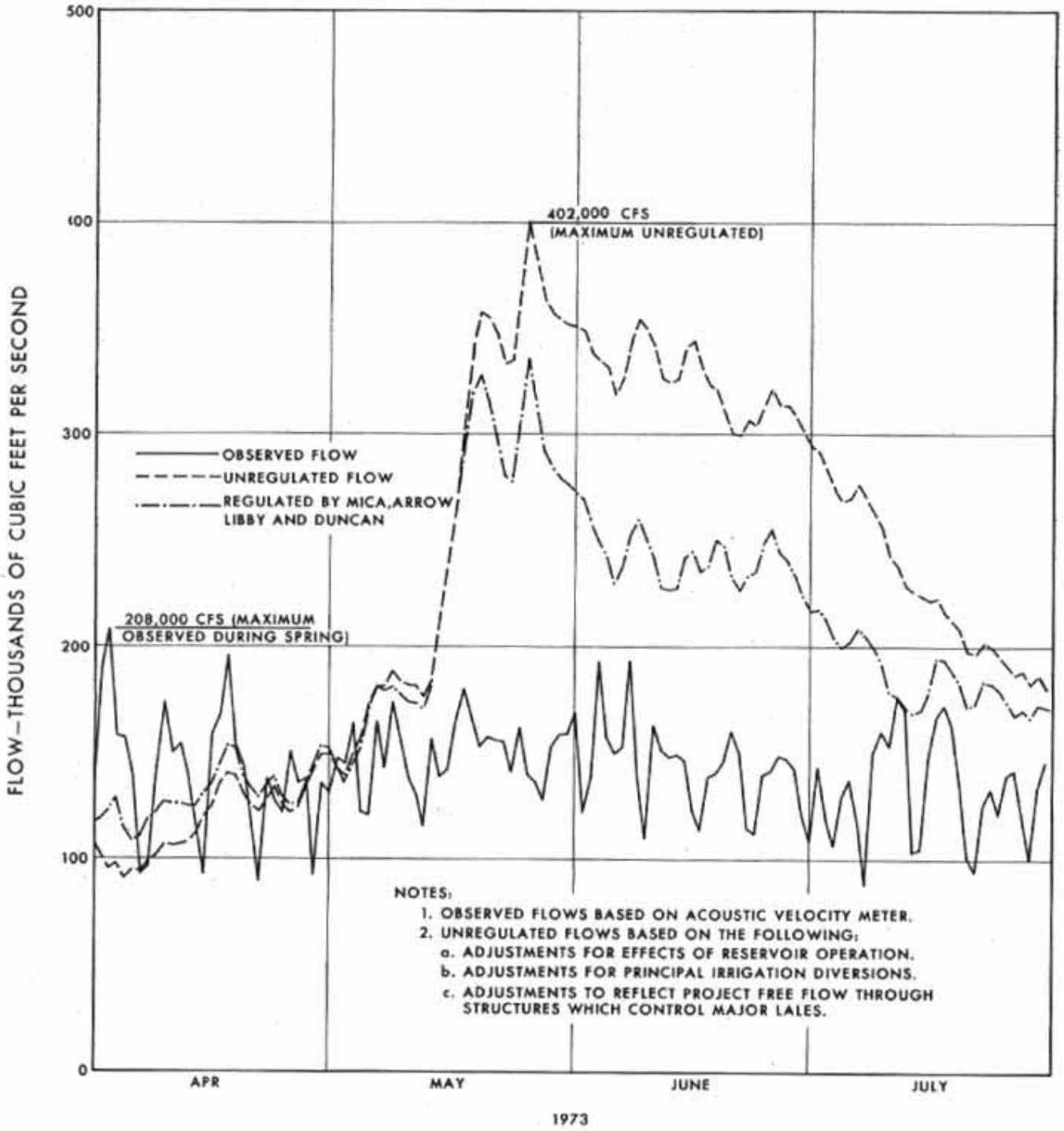


CHART 12
THE DALLES

COLUMBIA RIVER AT THE DALLES
1 JULY 1972 – 31 JULY 1973



COLUMBIA RIVER AT THE DALLES
1 APRIL 1973 – 31 JULY 1973



REFERENCES

The following documents governed the operation of the Columbia Treaty Projects during the period 1 August 1972 through 31 July 1973:

1. "Principles and Procedures for the Preparation and Use of Hydroelectric Operating Plans for Canadian Treaty Storage", dated 25 July 1967.

2. "Columbia River Treaty Hydroelectric Operating Plans for Canadian Storage, Operating Years 1969-70 through 1974-75", dated 15 February 1969.

3. "Columbia River Treaty Detailed Operating Plan for Canadian Storage, 1 July 1972 through 31 July 1973", dated 19 September 1972.

4. "Columbia River Treaty Flood Control Operating Plan" draft, dated September 1972.

5. "Program for Initial Filling of Mica Reservoir" dated 26 July 1967.