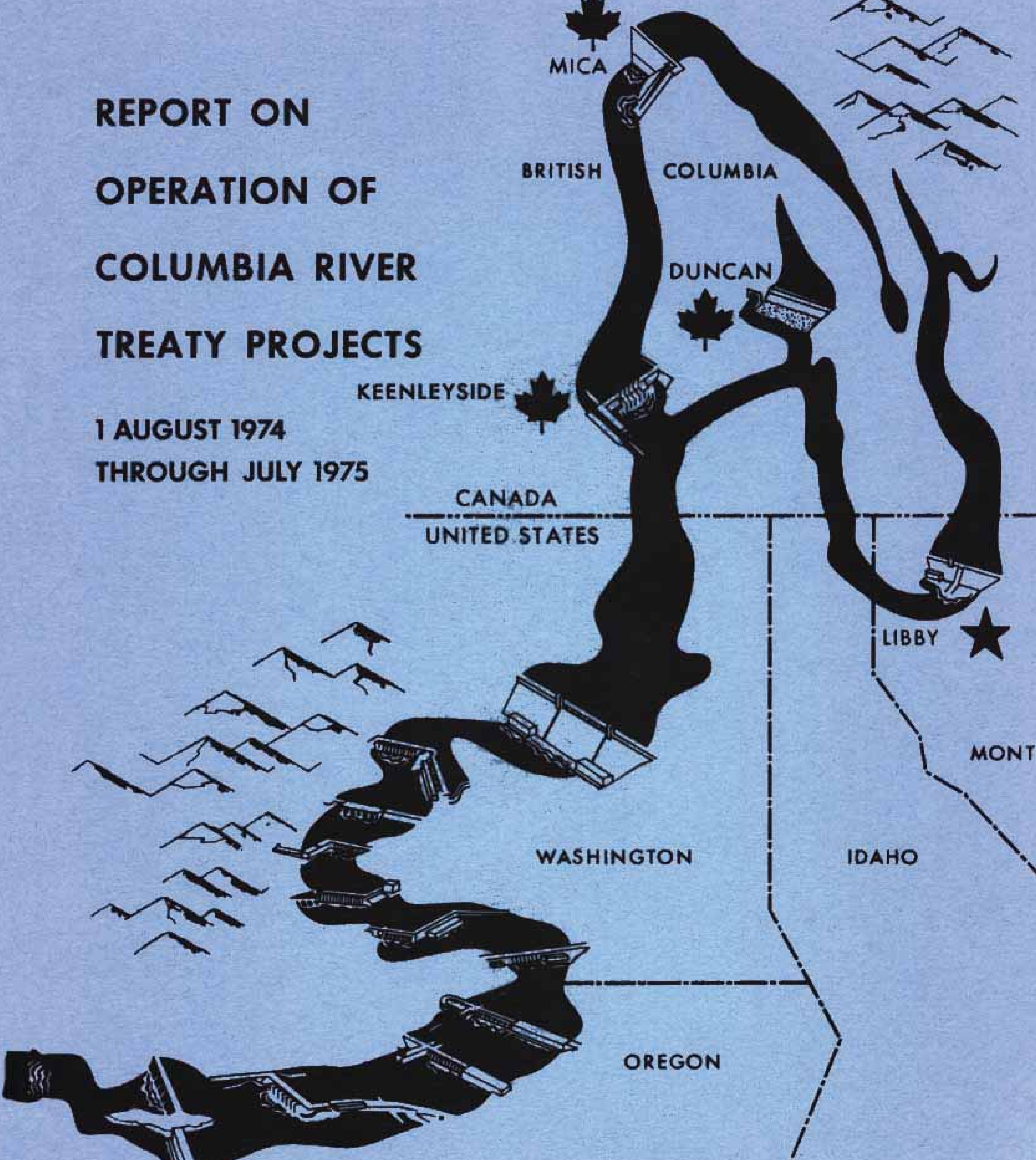
REPORT ON OPERATION OF COLUMBIA RIVER TREATY PROJECTS

1 AUGUST 1974
THROUGH JULY 1975



COLUMBIA RIVER TREATY OPERATING COMMITTEE

September 1975

REPORT ON
OPERATION OF COLUMBIA RIVER
TREATY PROJECTS

1 AUGUST 1974 THROUGH 31 JULY 1975

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REPORT ON

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COLUMBIA RIVER AND COASTAL BASINS

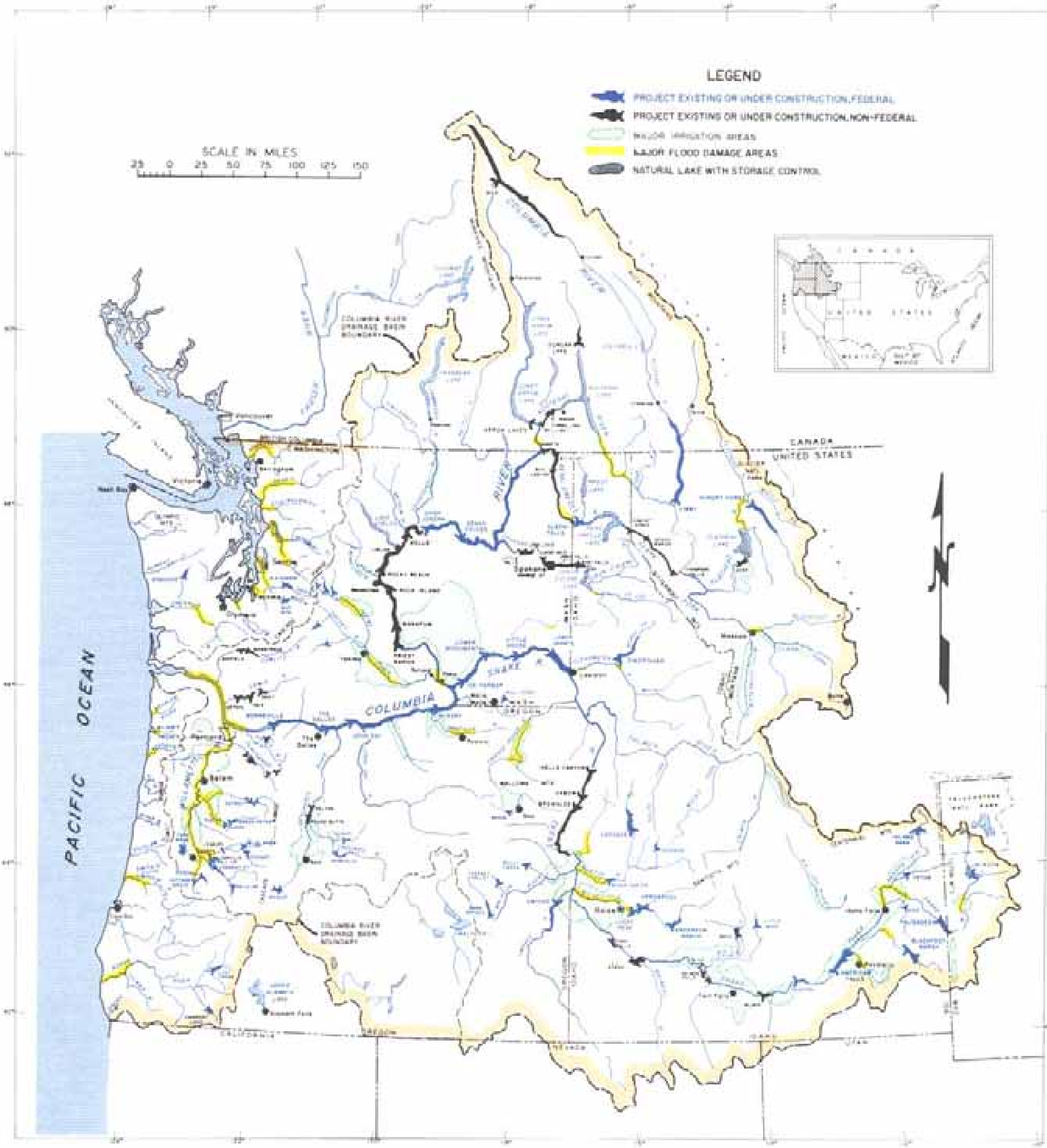


CHART 1

REPORT ON

OPERATION OF COLUMBIA RIVER TREATY PROJECTS

1 AUGUST 1974 THROUGH 31 JULY 1975

I. INTRODUCTION

A. AUTHORITY

Duncan, Arrow, and Mica (McNaughton) 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. Treaty Storage is required to be operated for the purpose of 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 McNaughton, Arrow, Duncan and Libby reservoirs for power and flood control during the period 1 August 1974 through 31 July 1975, 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 September 1974. During the drawdown season from mid August 1974 to late April 1975 the regulation of the Canadian Treaty storage content was normally determined by the Operating Committee on a weekly basis. From 10 May 1975 through 22 June 1975 during the 1975 Flood Control Refill Period, project outflows were determined on a daily basis. During the remainder of the refill period storage operations were determined on a weekly basis.

II. WEATHER AND STREAMFLOW

A. WEATHER

The wet weather that characterized the 1974 runoff year ended in August over the Columbia Basin. The August through October precipitation index for the Columbia above The Dalles was only 37 percent of average. Two storm periods in November deposited above normal precipitation in the high runoff producing areas of the basin, but the basin index for The Dalles was still below average. The normally heavy precipitation period, December through February, was 120 percent of average with some areas exceeding 200 percent during February. March was below average and April only slightly above. Chart 1 shows the geographical distribution of the accumulated October through April precipitation over the Columbia River Basin expressed as percentage of the 1958-1972 average. As shown, the basin as a whole was about 92 percent of the 15 year average with isolated areas near Flathead Lake and McNaughton Lake showing less than 80 percent. Several areas were more than 20 percent above average, notably in Southeastern Idaho. Chart 2 depicts the sequence of precipitation and temperatures that occurred throughout the winter, as measured by index stations in the basin.

Snow accumulation for the Columbia Basin as of 1 April 1975, was 10 percent above average. Because of the cool temperatures and a slightly above average precipitation, the snowpack increased to about 120 percent of average by May 1, thus increasing the threat of high flows. Active snowmelt began about May 10. Thereafter, below normal to moderate temperatures with only short hot spells kept most streams within banks. Substantial amounts of precipitation in Western Montana on June 19 and 20 caused flooding on the Flathead and Clark Fork River Basins. The pattern of temperature and precipitation throughout the March-July season is shown on Charts 3 and 4. Chart 3 applies to the Columbia River Basin above The Dalles, Oregon and Chart 4 applies to the Upper Columbia and Kootenay River Basins in Canada. Since the major portion of the runoff which occurs during this season is produced by snowmelt, the temperatures shown are of special significance to system reservoir regulation in that they largely influence the pattern of streamflow.

B. STREAMFLOW

The much-above normal streamflows that were experienced during the 1973-1974 operating year continued into August then dropped below normal in September. The October adjusted monthly flow of the Columbia River at The Dalles was only 74 percent of the 1958-1972

October average. The adjusted monthly flows for The Dalles continued well below normal through April, approached normal in May and exceeded normal in June and July then returned to normal in August. The adjusted flow at The Dalles for the October-March period was 82 percent of the 15-year average.

Heavy rains in the Flathead and Clark Fork River Basins on June 19 and 20 caused local flooding, and record flows for the month were recorded for the Clark Fork above Missoula and Middle Fork Flathead near West Glacier.

Streamflow during the spring-summer snowmelt period was near normal but due to the cool spring varied from 72 percent of average in April to 126 percent of average in July. The adjusted flow at The Dalles, Oregon, for the period April-August was 104 percent of average. The flows for the combined period October-August were near normal, 98 percent. Maximum daily local inflows for the season were 89,700 cfs on June 3 at Arrow, 84,300 cfs on July 6 at Mica, 15,300 cfs on July 7 at Duncan and 51,000 cfs on June 7 at Libby.

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, Columbia River at Birchbank, Grand Coulee Dam, and The Dalles are shown on Charts 9, 10, 11 and 12.

C. SEASONAL RUNOFF VOLUMES

Volume of runoff during the snowmelt season, as well as the variation with time, is of great importance because the reservoir regulation plans are determined in part by the expected runoff volume. 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, Arrow, Duncan, and Libby projects and the unregulated runoff of the Columbia River at The Dalles. The forecasts for Mica, Arrow, and Duncan inflow were prepared by B.C. Hydro and Power Authority and those for the Lower Columbia River and Libby inflow were prepared by the Columbia River Forecasting Service. Also shown on Table 1 are the actual volumes for these five locations.

Observed April-August runoff volumes, adjusted for upstream storage effects, are listed for eight locations in the following tabulation:

Streamflow & Location	Thousands of Acre-Feet	Percent of 1958-72 Average
Libby Reservoir Inflow	5,925	84
Duncan Reservoir Inflow	1,795	82
Mica Reservoir Inflow	10,265	84
Arrow Reservoir Inflow	20,886	87
Columbia River at Birchbank	38,035	88
Grand Coulee (FDR) Reservoir Inflow	62,329	96
Snake River at Lower Granite Dam	27,978	122
Columbia River at The Dalles	102,905	104

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.

III. RESERVOIR OPERATION

A. McNAUGHTON RESERVOIR

Reservoir Evacuation Period. As indicated on Chart 5, McNaughton Lake was at elevation 2397.8 ft. on 31 July 1974 and continued to fill until it reached a maximum elevation of 2409.1 ft. on 27 August 1974. To meet downstream power requirements and in anticipation of later cutbacks for construction purposes discharges were increased at the beginning of August from minimum discharge to the maximum that could be tolerated by the personnel working on the construction of the Mica powerhouse.

By the end of October McNaughton Lake storage content had dropped below its individual Critical Rule Curve, although total Canadian Treaty storage was still above the Composite Rule Curve. Simulation studies showed that under a few water conditions the outlet limitations for construction purposes could still cause usable water to be retained in Mica beyond the end of the storage drawdown period. In view of these results maximum releases were maintained until the end of February. At this point simulation studies showed that releases could be reduced to minimum amounts without jeopardizing power requirement under any historical flow condition. During the first week in March releases were reduced to minimum values to conserve water for possible transfer to dead storage.

In the second half of March large releases from Canadian Treaty storage were required to meet loads in the Pacific Northwest and

Pacific Southwest United States. It became apparent that these loads were substantially higher than those used in the simulation studies, and also that the actual streamflows were less than those anticipated in light of the volume forecasts. By the end of March outflows had again been increased to maximum tolerable levels. In an effort to compensate for involuntary storage in Arrow Lake Mica was drawn down below the Variable Refill Curve to a low of elevation 2281.6 ft. on 30 April 1975.

Refill Period. Because of the below normal runoff and the releases required for power purposes Mica was drawn down well below flood control requirements. Outflows were reduced to 1,000 cfs in an effort to conserve water for dead storage, however downstream power requirements through the end of July used all water in excess of that required to refill Canadian Treaty storage. There was therefore no additional dead storage credited after 7 August 1974 and at 31 July 1975 there was a 13.19 maf (6,650 KSFD) total storage of which 6.17 maf (3,112 KSFD) was credited to dead storage and 7.02 maf (3,538 KSFD) credited to live storage.

The 1975 volume inflow forecasts and the Variable Refill Curve computations for McNaughton reservoir are shown in Table 2.

B. ARROW RESERVOIR

Reservoir Evacuation Period. As indicated on Chart 6 Arrow reservoir was at elevation 1445.9 ft. on 31 July 1974, 1.9 ft. above the normal full pool elevation of 1444 ft. By 7 August this water in excess of Canadian Treaty storage had been released in lieu of equivalent releases from Mica and credited to Mica dead storage.

Releases from Arrow were made in accordance with the Detailed Operating Plan to meet downstream power requirements. This resulted in the elevation dropping an average of 8 ft. per month from August to the end of February. Chart 6 indicates this pattern as well as short periods of filling in August, October and January when less water was required from Canadian Treaty storage.

During the second half of March the total Columbia basin inflow was less than expected, Grand Coulee was being drawn down as quickly as possible, and most projects, other than Arrow and Mica, were close to minimum refill levels. This changed Arrow's release pattern radically and in one week the elevation dropped from 1385.3 ft. to 1380.3 ft. On March 29 with Arrow on free flow the actual release was less than that requested. Arrow remained on free flow until the first week of May at which point all Canadian Treaty storage in excess of that required for refill had been evacuated.

Refill Period. The power requirements resulted in Arrow being drawn well below flood control elevations so that releases were maintained at minimum levels until mid-July. Although releases were increased for power purposes towards the end of July the reservoir filled above elevation 1444.0 ft. to a maximum of 1446.1 ft. on 28 July 1975. The elevation was then lowered, reaching normal full pool elevation at the end of July. This temporary surcharge was to compensate for anticipated involuntary storage at Mica due to discharge limitations.

The 1975 volume inflow forecasts and the Variable Refill Curve computations for Arrow are shown in Table 3.

C. DUNCAN RESERVOIR

Reservoir Evacuation Period. As indicated on Chart 7, Duncan reservoir was at normal full pool elevation of 1892 ft. on 1 August 1974 and was maintained at this elevation till the end of November. From 1 December 1974 to 30 March 1975 the storage in Duncan was evacuated for flood control purposes, and by the end of March all storage had been evacuated. During this period releases were closely coordinated with releases from Libby to ensure compliance with the International Joint Commission's order on Kootenay Lake while evacuating the required storage space. During April releases from Duncan were kept below 700 cfs to assist in studies on the fish population below the reservoir.

Refill Period. The Duncan reservoir was maintained below elevation 1798 until 6 May 1975 when outflows were restricted to 100 cfs. Outflows were kept at approximately minimum values for flood control and reservoir refill purposes until the end of July when they were increased to pass inflows. The reservoir filled to elevation 1892 on 1 August 1975. Table 4 shows the 1975 volume inflow forecast and the Variable Refill Curve computations for Duncan.

D. LIBBY RESERVOIR

Reservoir Evacuation Period. Lake Koocanusa reached its normal full pool elevation 2,459 feet for the first time on 25 July 1974. As shown on Chart 8, the lake was maintained near full until September 22 so that the Board of Consultants could observe potential problem areas (slides, sloughing, etc.); the Montana Fish and Game Department could conduct fish population studies under low flow conditions in the Kootenai River downstream of Libby, which restricted Libby Dam releases to less than 6,000 cfs; and the project could conduct tests of the sluice and spillway concrete, which also restricted project releases. The draft of the reservoir to provide downstream generation and at-site flood control space began September 22 and project releases were increased to near 20,000 cfs by September 25.

Discharges were held as high as possible (22,000-25,000 cfs) during October except for reduced flows on October 1 and 2 for stilling basin inspection. Construction work at the project, outlet restrictions, and threatened inundation of Deep Creek Bridge restricted the project releases to an average release of 17,100 cfs during November. However, by the end of November, Libby outflows were regulated to less than maximum capacity while still satisfying downstream water needs and providing uniform draft of Lake Koocanusa. Libby and Duncan outflows were adjusted 7 January 1975, through March to maintain Kootenay Lake on or slightly below its IJC Rule Curve, with a balanced evacuation of both reservoirs.

Despite all of the restrictions imposed on this year's evacuation, Lake Koocanusa was successfully drafted to its minimum flood control pool elevation 2,287 feet, by April 1. A special fish study on the Kootenai River downstream of Libby Dam by the Montana Fish and Game Department required Libby Dam to control outflows between 5,000 and 10,000 cfs from 24 March 1975, through 12 April 1975. However, low inflows during this period caused Lake Koocanusa to draft below normal minimum pool elevation 2,287 feet by April 2 and although a draft below minimum pool was approved to complete the study, Montana Fish and Game Department decided not to jeopardize the reservoir fish and on April 4 requested Libby Dam hold the pool near elevation 2,287 feet. Lake Koocanusa reached a minimum elevation of 2,286.5 feet on April 4.

Refill Period. Lake Koocanusa was maintained near elevation 2,287 feet until May 8 when the flow forecasts indicated the unregulated flow of the Columbia River at The Dalles would exceed the Initial Controlled Flow of 410,000 cfs on about May 23. Libby outflows were then held near 10,000 cfs until the revised volume forecasts for May 1 were completed and the flood control release was reduced to 5,000 cfs on May 12. Libby held this 5,000 cfs discharge until June 14 when outflow was reduced to 3,000 cfs to increase the rate of filling of Lake Koocanusa. Libby outflow was reduced to minimum, 2,000 cfs, on July 24 when it became apparent from streamflow simulations that the volume inflow forecasts that had been in use were too high, and that the reservoir would not fill by the dedication date of 24 August 1975. Lake Koocanusa reached an elevation of 2,442.6 feet at the end of July, 16.4 feet below normal full pool elevation of 2,459 feet. Subsequently Lake Koocanusa reached a maximum elevation of 2,455.5 on September 9, before outflows were increased to begin a uniform seasonal draft of the lake.

IV. DOWNSTREAM EFFECTS OF STORAGE OPERATION

A. POWER

General. During the period covered by this report, the Treaty storage was operated in accordance with the 1974-75 Detailed Operating Plan designed to achieve optimum power generation downstream in the United States of America. The Canadian Entitlement to downstream power benefits for the 1974-75 operating year having been sold in 1964 to Columbia Storage Power Exchange (CSPE), deliveries of power and energy specified under the Canadian

Entitlement Exchange Agreements and attributable to Arrow, Duncan and Mica under the provisions of these agreements were made during the 1974-75 Operating Year.

The generation at downstream projects in the United States attributable to Canadian Treaty storage and delivered under the Canadian Entitlement Exchange Agreement was 759 average megawatts at rates up to 1,385 megawatts, 1 August 1974 through 31 March 1975, and 739 average megawatts at rates up to 1,479 megawatts, 1 April 1975 through 31 July 1975. Prior to 1 April 1975 the CSPE participants had assigned 695 average megawatts at rates up to 1,086 megawatts to Pacific Southwest utilities. Beginning 1 April 1975 this assignment was reduced to 163 average megawatts at rates up to 300 megawatts. CSPE power not assigned to Pacific Southwest utilities was used in Pacific Northwest loads.

Review of 1974-75 Power Operations. Power operations during 1974-75 were far less eventful than power operations the previous year, largely because all Pacific Northwest reservoirs were full on August 1, and favourable weather and streamflow conditions occurred thereafter.

The Centralia Steamplant operated at lower levels than expected during 1974-75 and unit 2 at Hanford was out of service from mid-October to late-December because of turbine blade failures. On 14 October 1974, Bonneville Power Administration (BPA) curtailed direct service to interruptible industrial loads and secondary energy deliveries to investor-owned utilities. To the extent that BPA was unable to supply all industrial nonfirm loads during the period from mid-October 1974 through January 1975, industrial customers were able to supply their nonfirm loads with firm energy purchased from non-Federal sources, interruptible replacement energy purchased from Pacific Northwest utilities, provisional energy from BPA and advance energy made available from Dworshak reservoir under a special arrangement with the Corps of Engineers. No industrial loads were physically curtailed because of lack of electrical power supply. Investor-owned utilities obtained their requirements from their own thermal generation, supplemented with purchases of higher cost generation from other utilities. During this period of curtailment, the industries purchased more than 664 million kilowatt-hours from non-Federal sources.

BPA and most other Pacific Northwest utility loads significantly underran estimates during 1974-75. BPA'S total energy load averaged about 8.5 percent below estimate during the year. Coordinated System energy and peak loads underran estimates by about 9 and 12 percent respectively. These underruns were mainly attributable to voluntary energy conservation efforts and slower than anticipated economic conditions. BPA's industrial nonfirm loads dropped from an average of 743 megawatts in early fall of 1974 to an average of 430 megawatts by May 1975. Lower loads significantly assisted BPA in its ability to meet the power demands on its system.

BPA's power supply assessment based on January 1975 snow surveys and runoff forecasts for the period January through July permitted delivery of limited amounts of secondary energy to investor-owned Pacific Northwest utilities and to BPA industrial nonfirm loads beginning Tuesday, 14 January 1975. Warm weather and an increase in streamflows resulted in BPA supplying almost all industrial nonfirm loads and investor-owned utilities' secondary energy requirements after January 18.

February 1975 snow surveys and runoff forecasts indicated a further improvement in the expected spring runoff and power supply. The forecasted February through July volume runoff at The Dalles, Oregon, of 100.6 million acre-feet was about 96 percent of average runoff. On February 13 BPA began making surplus hydroelectric energy available to markets outside the Pacific Northwest. During the period 13 February 1975 through 31 July 1975, BPA sold over 7.4 billion kilowatt-hours of surplus hydroelectric energy to Pacific Southwest utilities.

B. FLOOD CONTROL

Lower Columbia River Regulation. Without regulation by upstream reservoirs, the 1975 high water season would have produced an April through August runoff volume of 103 maf compared to the 1958-72 average of 99 maf. The computed unregulated peak discharge at The Dalles was 670,000 cfs on June 17; the actual peak was 423,000 cfs on May 17. At Vancouver, Washington, a key gauging station for evaluating flooding on the Lower Columbia River, the maximum stage during the spring freshet was 13.8 feet observed on May 18 as compared to a computed unregulated stage of 23.0 feet. Bankfull stage at Vancouver is 16 feet and major flood stage is 26 feet at this gauge.

Chart 12 shows the 1974-75 flows at The Dalles, both as observed and as they would have been under unregulated conditions. These hydrographs are shown compared with the summary hydrograph of previously observed flows at The Dalles. Chart 13 shows the flow at The Dalles for the spring flood period in 1975. On this chart the effects of regulation by Mica, Arrow, Duncan, and Libby projects are separated from those of all other major storage projects in the Columbia River Basin. The Treaty projects contributed about 40 percent of the total storage volume for flood control regulation for the Lower Columbia River during the peak runoff month of June 1975.

The flood control regulation of the Lower Columbia River is significantly affected by the operation of Grand Coulee project. Chart 11 shows the regulation by Grand Coulee reservoir during the period July 1974-July 1975. The observed peak inflow to Roosevelt Lake at Grand Coulee Dam was 211,000 cfs on June 12, 1975, when the outflow was 131,000 cfs. The computed unregulated peak inflow was 360,000 cfs on June 27, at which time the actual outflow was 118,000 cfs. The basis for the computation of the Initial Controlled Flow of 410,000 cfs for the Columbia River at The Dalles, Oregon, is shown on Table 6.

Chart 14 documents the relative filling of Arrow and Grand Coulee during the principal filling period, and compares the coordinated regulation of the two reservoirs to guidelines in the Flood Control Operating Plan. The guideline shown on Chart 14 is based on relative space available on May 31. Since Arrow was drawn down well below the level required for flood control the reservoir did not reach the elevations indicated by the guideline until the end of the refill period.

Local Regulation. No significant local flood control problems were encountered in 1975. Unregulated discharges at Bonners Ferry, Idaho would have caused stages approximately 1 foot over bankfull stage, 27 feet, but well below the top of the levees, 36 feet. The operation at Libby Reservoir reduced the Kootenay River flow to a non-damaging stage of 14 feet and permitted use of roads and lands that are normally inundated. The combined operation of Libby and Duncan reservoirs in controlling inflows to Kootenay Lake improved the seasonal operation of the lake and reduced the peak stage of Kootenay Lake by about 5 feet as indicated on Chart 9.

The operation of Mica and Arrow projects not only contributed to the reduction of flows in the lower Columbia River to non-damaging flows but regulated the flow of the Columbia River in Canada to well below bankfull levels. As shown on Chart 10 the peak discharge of the Columbia River at Birchbank was 166,000 cfs which is well below the bankfull level as measured at Trail, B.C. The computed unregulated flow at Birchbank would have been 216,000 cfs on June 27 which is approaching bankfull.

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 be adverse to 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 with 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 1974-75 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 September 1974 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 1975 were determined on the basis of seasonal volume runoff forecasts during actual operation.

B. POWER OPERATION

The Detailed Operating Plan dated September 1974 was designed to achieve optimum power generation downstream in the United States, consistent with project operating limits and flood control requirments.

The power facilities in the United States which are downstream from the Treaty storage projects are all operated under the Pacific Northwest Coordination Agreement dated September 1964. Optimum generation in the United States was assured by the adoption, in the Assured and Detailed Operating Plans, of criteria and operating guides designed to coordinate the operation of Treaty projects with the projects operating under the Agreement, Optimum operation of Treaty reservoirs was accomplished, for the actual water condition experienced, by operating with reference to the Critical Rule Curves, Assured Refill Curves, Variable Refill Curves, Flood Control Storage Reservation Curves and related criteria determined in accordance with the Detailed Operating Plan.

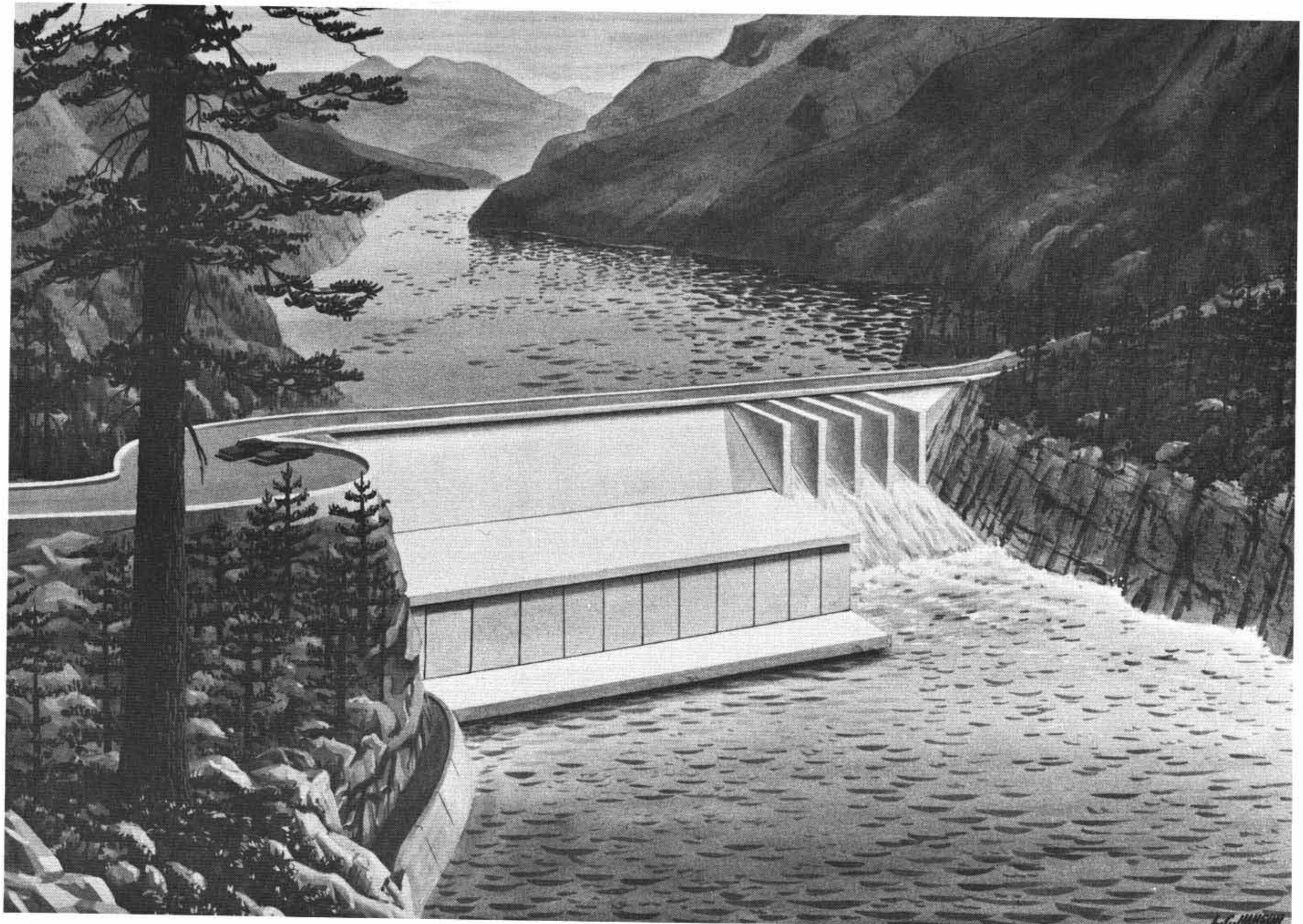
C. FLOOD CONTROL OPERATION

The Flood Control Operating Plan was designed to minimize flood damage both in Canada and in the United States. The flood control operation during the drawdown period consisted of evacuating and holding available, consistent with refill criteria, storage space sufficient to control the maximum flood that may occur under forecast conditions. Runoff volume forecasts determined the volume of storage space required.

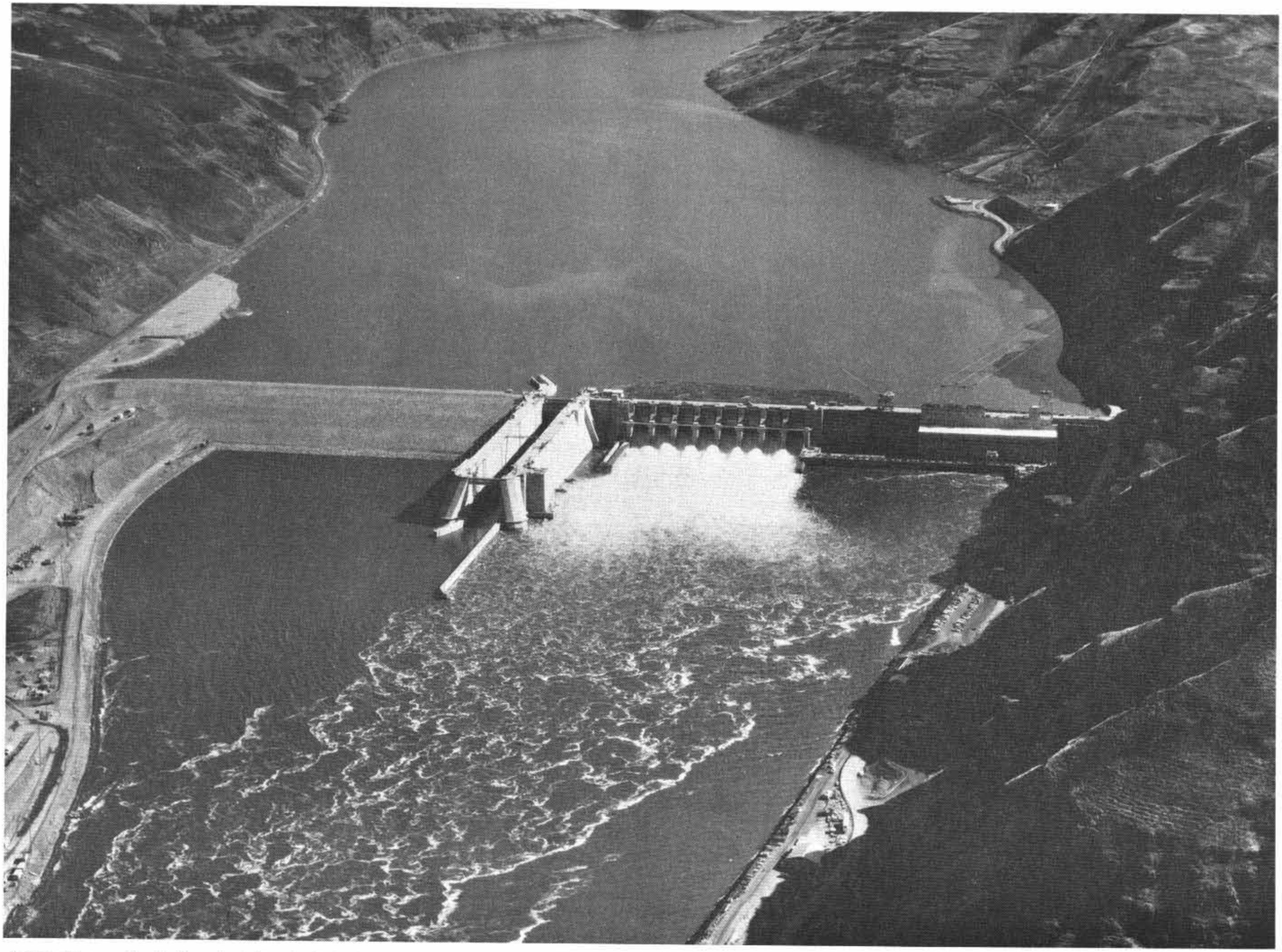
Flood control operation of the Columbia River Treaty projects during the refill period was controlled in part by the computed Initial Controlled Flow of Columbia River at The Dalles. Other operating rules and local criteria were utilized to prepare day-to-day streamflow forecasts for key points in Canada and the United States and to establish the operations of the flood control storage. These forecasts were prepared daily during the snowmelt season by the Columbia River Forecasting Service for periods of 30 to 45 days using both moderate and severe snowmelt sequences.

View from downstream of Mica Dam, showing the fog and spray from an outlet's discharge of 24000 cfs on 6 Feb. 1975. During the winter of 1974-1975 this was the maximum discharge that could be tolerated by personnel working on construction of the Mica Powerhouse.

B.C. Hydro and Power Authority Photograph



Artist's impression of the Seven Mile Project on the Pend d'Oreille River in Canada. The project is now under construction by B.C. Hydro for service in early 1980. It will have an ultimate installed capacity of 700 megawatts.



A view of Lower Granite Dam, just after the initial filling of the pool in February, 1975. This project extends navigation on the Columbia and Lower Snake Rivers to the city of Lewiston, Idaho, and adds 405 mw of nameplate capacity to the U.S. federal power system.

U.S. Army Corps of Engineers Photograph

TABLE 1

UNREGULATED RUNOFF VOLUME FORECASTS
MILLIONS OF ACRE-FEET
1975

	DUNCAN	ARROW	MICA	LIBBY	UNREGULATED RUNOFF COLUMBIA RIVER AT THE DALLES, OREGON
Forecast Date - 1st of:	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	2.03	21.41	11.06	7.28	96.2
February	2.09	21.96	11.25	7.60	106.0
March	2.12	22.30	11.47	8.09	114.0
April	2.13	22.36	11.46	8.04	116.0
May	2.08	22.00	11.30	7.92	116.0
June	2.04	21.60	11.20	7.75	113.0
Actual	1.79	20.85	10.23	5.93	111.7

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

MICA RESERVOIR COMPUTATION FORM

TABLE 2

95 PERCENT CONFIDENCE AND VARIABLE REFILL CURVE

1975

	INITIAL	JAN. 1	FEB. 1	MAR. 1	APR. 1	MAY 1	JUNE 1
1. PROBABLE FEB. 1-JULY 31 INFLOW, KSFD 1/		4698.7	4670.8	4815.4	4806.0	4720.4	4545.8
2. 95% FORECAST ERROR, KSFD		841.4	674.6	644.5	602.2	596.6	569.3
3. 95% CONFIDENCE FEB. 1-JULY 31 INFLOW, KSFD 2/		3857.3	3996.2	4170.9	4203.8	4123.8	3976.5
4. OBSERVED FEB. 1-DATE INFLOW, KSFD		0.0	0.0	143.2	242.2	432.3	1039.7
5. 95% CONFIDENCE DATE-JULY 31, INFLOW, KSFD 3/		3857.3	3996.2	4027.7	3961.6	3691.5	2936.8
ASSUMED FEB. 1-JULY 31 INFLOW, % VOLUME		100.0					
ASSUMED FEB. 1-JULY 31 INFLOW, KSFD 4/		3857.3					
MIN. FEB. 1-JULY 31 OUTFLOW, KSFD		543.0					
MIN. JAN. 31 RESERVOIR CONTENT, KSFD 5/		374.1*					
MIN. JAN. 31 RESERVOIR ELEV., FT. 6/	2340.5	2297.4					
JAN. 31 VARIABLE REFILL CURVE, FT. 7/		2297.4					
ASSUMED MAR. 1-JULY 31 INFLOW, % VOLUME		98.0	98.0				
ASSUMED MAR. 1-JULY 31 INFLOW, KSFD 4/		3780.2	3916.3				
MIN. MAR. 1-JULY 31 OUTFLOW, KSFD		459.0	459.0				
MIN. FEB. 28 RESERVOIR CONTENT, KSFD 5/		208.0	160.3*				
MIN. FEB. 28 RESERVOIR ELEV., FT. 6/	2333.2	2290.4	2288.3				
FEB. 28 VARIABLE REFILL CURVE, FT. 7/		2290.4	2288.3				
ASSUMED APR. 1-JULY 31 INFLOW, % VOLUME		95.7	95.7	95.7			
ASSUMED APR. 1-JULY 31 INFLOW, KSFD 4/		3691.4	3824.4	3854.5			
MIN. APR. 1-JULY 31 OUTFLOW, KSFD		366.0	366.0	366.0			
MIN. MAR. 31 RESERVOIR CONTENT, KSFD 5/		203.8	160.3*	160.3*			
MIN. MAR. 31 RESERVOIR ELEV., FT. 6/	2329.8	2290.2	2288.3	2288.3			
MAR. 31 VARIABLE REFILL CURVE, FT. 7/		2290.2	2288.3	2288.3			
ASSUMED MAY 1-JULY 31 INFLOW, % VOLUME		91.6	91.6	93.6	95.8		
ASSUMED MAY 1-JULY 31 INFLOW, KSFD 4/		3533.3	3660.5	3769.9	3795.2		
MIN. MAY 1-JULY 31 OUTFLOW, KSFD		276.0	276.0	276.0	276.0		
MIN. APR. 30 RESERVOIR CONTENT, KSFD 5/		271.9	144.7	35.3	10.0		
MIN. APR. 30 RESERVOIR ELEV., FT. 6/	2300.4	2293.1	2287.6	2282.8	2281.7		
APR. 30 VARIABLE REFILL CURVE, FT. 7/		2293.1	2287.6	2282.8	2281.7		
ASSUMED JUN. 1-JULY 31 INFLOW, % VOLUME		73.8	73.8	75.4	77.2	80.6	
ASSUMED JUN. 1-JULY 31 INFLOW, KSFD 4/		2846.7	2949.2	3036.9	3058.4	2975.3	
MIN. JUN. 1-JULY 31 OUTFLOW, KSFD		183.0	183.0	183.0	183.0	183.0	
MIN. MAY 31 RESERVOIR CONTENT, KSFD 5/		865.5	763.0	675.3	653.8	736.9	
MIN. MAY 31 RESERVOIR ELEV., FT. 6/	2322.1	2317.3	2313.2	2309.7	2308.9	2312.2	
MAY 31 VARIABLE REFILL CURVE, FT. 7/		2317.3	2313.2	2309.7	2308.9	2312.2	
ASSUMED JUL. 1-JULY 31 INFLOW, % VOLUME		37.7	37.7	38.5	39.4	41.2	51.1
ASSUMED JUL. 1-JULY 31 INFLOW, KSFD 4/		1454.2	1506.6	1550.7	1560.9	1520.9	1500.7
MIN. JUL.1-JULY 31 OUTFLOW, KSFD		93.0	93.0	93.0	93.0	93.0	93.0
MIN. JUNE 30 RESERVOIR CONTENT, KSFD 5/		2168.0	2115.6	2071.5	2061.3	2101.3	2121.5
MIN. JUNE 30 RESERVOIR ELEV., FT. 6/	2370.0	2364.0	2362.3	2360.9	2360.6	2361.9	2362.5
JUNE 30 VARIABLE REFILL CURVE, FT. 7/		2364.0	2362.3	2360.9	2360.6	2361.9	2362.5
JULY 31 VARIABLE REFILL CURVE, FT. 7/	2401.8	2401.8	2401.8	2401.8	2401.8	2401.8	2401.8
NOTE - ACCUMULATED DEAD STORAGE, KSFD		3112.0	3112.0	3112.0	3112.0	3112.0	3112.0

1/ DEVELOPED BY CANADIAN ENTITY
2/ LINE 1 - LINE 2
3/ LINE 3 - LINE 4
4/ PRECEDING LINE X LINE 5
5/ FULL CONTENT (3529.2) PLUS PRECEDING LINE LESS LINE PRECEDING THAT (USABLE STORAGE).
6/ FROM RESERVOIR ELEVATION - STORAGE CONTENT TABLE DATED MARCH 25, 1974 (FOOTNOTE 5 PLUS ACCUMULATED DEAD STORAGE).
7/ LOWER OF ELEVATION ON PRECEDING LINE OR ELEVATION DETERMINED BY ADDING DEAD STORAGE TO INITIAL CONTENTS.
* LIMITED TO SECOND YEAR CRITICAL RULE CURVE

TABLE 3

ARROW LAKES RESERVOIR COMPUTATION FORM

95 PERCENT CONFIDENCE AND VARIABLE REFILL CURVE

1975

	INITIAL	JAN. 1	FEB. 1	MAR. 1	APR. 1	MAY 1	JUNE 1
1. PROBABLE FEB. 1-JULY 31 INFLOW, KSFD 1/		9671.8	9652.6	9694.8	9598.4	9107.0	8240.6
2. 95% FORECAST ERROR, KSFD		1755.5	1375.1	1285.1	1215.5	1127.8	1067.6
3. 95% CONFIDENCE FEB. 1-JULY 31 INFLOW, KSFD 2/		7916.3	8277.5	8409.7	8382.9	7979.2	7173.0
4. OBSERVED FEB. 1-DATE INFLOW, KSFD		0.0	0.0	120.2	253.4	498.9	1541.2
5. 95% CONFIDENCE DATE-JULY 31 INFLOW, KSFD 3/		7916.3	8277.5	8289.5	8129.5	7480.3	5631.8
ASSUMED FEB. 1-JULY 31 INFLOW, % VOLUME		100.0					
ASSUMED FEB.1-JULY 31 INFLOW, KSFD 4/		7916.3					
MIN. FEB. 1-JULY 31 OUTFLOW, KSFD		905.0					
MICA REFILL REQUIREMENTS, KSFD 5/		3155.1					
MIN. JAN. 31 CONTENTS, KSFD 6/		0.0					
MIN. JAN. 31 ELEVATION, FT. 7/	1383.4	1377.9					
JAN. 31 VARIABLE REFILL CURVE, FT. 8/		1377.9					
ASSUMED MAR. 1-JULY 31 INFLOW, % VOLUME		97.6	97.6				
ASSUMED MAR. 1-JULY 31 INFLOW, KSFD 4/		7726.3	8078.9				
MIN. MAR. 1-JULY 31 OUTFLOW, KSFD		765.0	765.0				
MICA REFILL REQUIREMENTS, KSFD 5/		3321.2	3368.9				
MIN. FEB. 28 CONTENTS, KSFD 6/		0.0	0.0				
MIN. FEB. 28 ELEVATION, FT. 7/	1381.7	1377.9	1377.9				
FEB. 28 VARIABLE REFILL CURVE, FT. 8/		1377.9	1377.9				
ASSUMED APR.1-JULY 31 INFLOW, % VOLUME		94.9	94.9	97.3			
ASSUMED APR. 1-JULY 31 INFLOW, KSFD 4/		1512.6	7855.3	8065.7			
MIN. APR.1-JULY 31 OUTFLOW, KSFD		610.0	610.0	610.0			
MICA REFILL REQUIREMENTS, KSFD 5/		3325.4	3368.9	3368.9			
MIN. MAR. 31 CONTENTS, KSFD 6/		2.4	0.0	0.0			
MIN. MAR. 31 ELEVATION, FT. 7/	1383.5	1378.0	1377.9	1377.9			
MAR. 31 VARIABLE REFILL CURVE, FT. 8/		1378.0	1377.9	1377.9			
ASSUMED MAY 1-JULY 31 INFLOW, % VOLUME		88.3	88.3	90.6	93.1		
ASSUMED MAY 1-JULY 31 INFLOW, KSFD 4/		6990.1	7309.0	7510.3	7568.6		
MIN. MAY 1-JULY 31 OUTFLOW, KSFD		460.0	460.0	460.0	460.0		
MICA REFILL REQUIREMENTS, KSFD 5/		3257.3	3384.5	3493.9	3519.2		
MIN. APR. 30 CONTENTS, KSFD 6/		306.8	115.1	23.2	0.0		
MIN. APR. 30 ELEVATION, FT. 7/	1388.9	1385.2	1380.7	1378.5	1377.9		
APR. 30 VARIABLE REFILL CURVE, FT. 8/		1385.2	1380.7	1378.5	1377.9		
ASSUMED JUN. 1-JULY 31 INFLOW, % VOLUME		66.3	66.3	68.1	70.0	75.1	
ASSUMED JUN. 1-JULY 31 INFLOW, KSFD 4/		5248.5	5488.0	5645.1	5690.7	5617.7	
MIN. JUN.1-JULY 31 OUTFLOW, KSFD		305.0	305.0	305.0	305.0	305.0	
MICA REFILL REQUIREMENTS, KSFD 5/		2663.7	2766.2	2853.9	2875.4	2792.3	
MIN. MAY 31 CONTENTS, KSFD 6/		1299.8	1162.8	1093.4	1069.3	1059.2	
MIN. MAY 31 ELEVATION, FT. 7/	1410.5	1405.5	1402.9	1401.6	1401.1	1400.9	
MAY 31 VARIABLE REFILL CURVE, FT. 8/		1405.5	1402.9	1401.6	1401.1	1400.9	
ASSUMED JUL. 1-JULY 31 INFLOW, % VOLUME		30.9	30.9	31.7	32.6	35.0	46.6
ASSUMED JUL. 1-JULY 31 INFLOW, KSFD 4/		2446.1	2557.7	2627.8	2650.2	2618.1	2624.4
MIN. JUL. 1-JULY 31 OUTFLOW, KSFD		155.0	155.0	155.0	155.0	155.0	155.0
MICA REFILL REQUIREMENTS, KSFD 5/		1361.2	1413.6	1457.7	1467.9	1427.9	1407.7
MIN. JUN. 30 CONTENTS, KSFD 6/		2649.7	2590.5	2564.5	2552.3	2544.4	2517.9
MIN. JUN. 30 ELEVATION, FT. 7/	1436.4	1429.3	1428.3	1427.9	1427.7	1427.6	1427.1
JUN. 30 VARIABLE REFILL CURVE, FT. 8/		1429.3	1428.3	1427.9	1427.7	1427.6	1427.1
JULY 31 VARIABLE REFILL CURVE, FT. 8/	1444.0	1444.0	1444.0	1444.0	1444.0	1444.0	1444.0

1/ DEVELOPED BY CANADIAN ENTITY
2/ LINE 1 - LINE 2
3/ LINE 3 - LINE 4
4/ PRECEDING LINE X LINE 5
5/ MICA FULL CONTENT - VARIABLE REFILL CURVE FROM MICA VRC COMPUTATION FORM
6/ FULL CONTENT (3579.6 KSFD) PLUS TWO PRECEDING LINES LESS LINE PRECEDING THAT
7/ FROM RESERVOIR ELEVATION-STORAGE CONTENT TABLE DATED FEBRUARY 28, 1974
8/ LOWER OF THE ELEVATION ON PRECEDING LINE OR ELEVATION DETERMINED PRIOR TO YEAR (INITIAL)

TABLE 4

DUNCAN RESERVOIR COMPUTATION FORM

95 PERCENT CONFIDENCE AND VARIABLE ENERGY CONTENT CURVE

1975

	INITIAL	JAN. 1	FEB. 1	MAR. 1	APR. 1	MAY 1	JUNE 1
1. PROBABLE FEB. 1-JULY 31 INFLOW, KSFD 1/		891.5	894.7	904.6	905.2	880.0	854.0
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/		700.0	744.0	774.8	788.4	773.1	758.5
4. OBSERVED FEB. 1-DATE INFLOW, KSFD		0.0	0.0	16.5	27.0	53.0	184.7
5. 95% CONFIDENCE DATE-JULY 31 INFLOW, KSFD 3/		700.0	744.0	758.3	761.4	720.1	573.8
ASSUMED FEB. 1-JULY 31 INFLOW, % VOLUME		100.0					
ASSUMED FEB. 1-JULY 31 INFLOW, KSFD 4/		700.0					
MIN. FEB. 1-JULY 31 OUTFLOW, KSFD		18.1					
MIN. JAN. 31 RESERVOIR CONTENT, KSFD 5/		23.9					
MIN. JAN. 31 RESERVOIR ELEVATION, FT. 6/	1834.0	1799.8					
JAN. 31 VARIABLE REFILL CURVE, FT. 7/		1799.8					
ASSUMED MAR. 1-JULY 31 INFLOW, % VOLUME		98.1	98.1				
ASSUMED MAR. 1-JULY 31 INFLOW, KSFD 4/		686.7	729.9				
MIN. MAR. 1-JULY 31 OUTFLOW, KSFD		15.3	15.3				
MIN. FEB. 28 RESERVOIR CONTENT, KSFD 5/		34.4	0.0				
MIN. FEB. 28 RESERVOIR ELEVATION, FT. 6/	1835.3	1801.9	1794.2				
FEB. 28 VARIABLE REFILL CURVE, FT. 7/		1801.9	1794.2				
ASSUMED APR. 1-JULY 31 INFLOW, % VOLUME		96.1	96.1	98.0			
ASSUMED APR.1-JULY 31 INFLOW, KSFD 4/		672.7	715.0	743.1			
MIN. APR. 1-JULY 31 OUTFLOW, KSFD		12.2	12.2	12.2			
MIN. APR. 30 RESERVOIR CONTENT, KSFD 5/		45.3	3.0	0.0			
MIN. MAR. 31 RESERVOIR CONTENT, FT. 6/	1837.2	1804.0	1795.0	1794.2			
MAR. 31 VARIABLE REFILL CURVE, FT. 7/		1804.0	1795.0	1794.2			
ASSUMED MAY 1-JULY 31 INFLOW, % VOLUME		91.1	91.1	92.9	94.8		
ASSUMED MAY 1-JULY 31 INFLOW, KSFD 4/		637.7	677.8	704.5	721.8		
MIN. MAY 1-JULY 31 OUTFLOW, KSFD		9.2	9.2	9.2	9.2		
MIN. APR. 30 RESERVOIR CONTENT, KSFD 5/		77.3	37.2	10.5	0.0		
MIN. APR. 30 RESERVOIR CONTENT, FT. 6/	1834.2	1809.8	1802.5	1796.8	1794.2		
APR. 30 VARIABLE REFILL CURVE, FT. 7/		1809.8	1802.5	1796.8	1794.2		
ASSUMED JUNE 1-JULY 31 INFLOW, % VOLUME		71.7	71.7	73.1	74.6	78.7	
ASSUMED JUNE 1-JULY 31 INFLOW, KSFD 4/		501.9	533.5	554.3	568.0	566.7	
MIN. JUNE 1-JULY 31 OUTFLOW, KSFD		6.1	6.1	6.1	6.1	6.1	
MIN. MAY 31 RESERVOIR CONTENT, KSFD 5/		210.0	178.4	157.6	143.9	145.2	
MIN. MAY 31 RESERVOIR CONTENT, FT. 6/	1848.6	1830.5	1825.9	1822.8	1820.7	1820.9	
MAY 31 VARIABLE REFILL CURVE, FT. 7/		1830.5	1825.9	1822.8	1820.7	1820.9	
ASSUMED JULY 1-JULY 31 INFLOW, % VOLUME		33.9	33.9	34.6	35.3	37.2	47.3
ASSUMED JULY 1-JULY 31 INFLOW, KSFD 4/		237.3	252.2	262.4	268.8	267.9	271.4
MIN. JULY 1-JULY 31 OUTFLOW, KSFD		3.1	3.1	3.1	3.1	3.1	3.1
MIN. JUNE 30 RESERVOIR CONTENT, KSFD 5/		471.6	456.7	446.5	440.1	441.0	437.5
MIN. JUNE 30 RESERVOIR CONTENT, FT. 6/	1872.0	1864.7	1862.9	1861.6	1860.8	1860.9	1860.5
JUNE 30 VARIABLE REFILL CURVE, FT. 7/		1864.7	1862.9	1861.6	1860.8	1860.9	1860.5
JULY 31 VARIABLE REFILL CURVE, FT.		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 (705.8) PLUS PRECEDING LINE LESS LINE PRECEDING THAT
6/ FROM RESERVOIR ELEVATION-STORAGE CONTENT TABLE DATED JUNE 20, 1974
7/ LOWER OF ELEVATION ON PRECEDING LINE OR ELEVATION DETERMINED PRIOR TO YEAR (INITIAL)

TABLE 5

LIBBY

COMPUTATION FORM

95 PERCENT CONFIDENCE FORECAST AND VARIABLE REFILL CURVE

1975

	INITIAL	JAN. 1	FEB. 1	MAR. 1	APR. 1	MAY 1	JUNE 1
RESIDUAL 95% DATE-JULY 31 INFLOW, KSFD 1/		2727.3	3036.6	3258.1	3133.1	2997.3	2298.0
ASSUMED FEB. 1-JULY 31 INFLOW, % OF VOLUME		96.9					
ASSUMED FEB. 1-JULY 31 INFLOW, KSFD 2/		2643.8					
MIN. FEB. 1-JULY 31 OUTFLOW, KSFD		362.0					
MIN. JAN. 31 RESERVOIR CONTENT, KSFD 3/		221.2					
MIN. JAN. 31 RESERVOIR ELEV., FT. 4/	2403.0	2313.8					
JAN. 31 VARIABLE REFILL CURVE, FT. 5/		2313.8					
ASSUMED MAR. 1-JULY 31 INFLOW, % OF VOLUME		94.2	97.1				
ASSUMED MAR. 1-JULY 31 INFLOW, KSFD 2/		2568.3	2949.8				
MIN. MAR. 1-JULY 31 OUTFLOW, KSFD		306.0	306.0				
MIN. FEB. 28 RESERVOIR CONTENT, KSFD 3/		240.7	0.0				
MIN. FEB. 28 RESERVOIR ELEV., FT. 4/	2403.0	2315.9	2287.0				
FEB. 28 VARIABLE REFILL CURVE, FT. 5/		2315.9	2287.0				
ASSUMED APR. 1-JULY 31 INFLOW, % OF VOLUME		90.8	93.7	96.4			
ASSUMED APR. 1-JULY 31 INFLOW, KSFD 2/		2476.1	2844.1	3141.5			
MIN. APR. 1-JULY 31 OUTFLOW, KSFD		244.0	244.0	244.0			
MIN. MAR. 31 RESERVOIR CONTENT, KSFD 3/		270.9	0.0	0.0			
MIN. MAR. 31 RESERVOIR ELEV., FT. 4/	2403.0	2319.7	2287.0	2287.0			
MAR. 31 VARIABLE REFILL CURVE, FT. 5/		2319.7	2287.0	2287.0			
ASSUMED MAY 1-JULY 31 INFLOW, % OF VOLUME		81.7	84.3	86.8	90.0		
ASSUMED MAY 1-JULY 31 INFLOW, KSFD 2/		2228.4	2559.6	2827.1	2819.8		
MIN. MAY 1-JULY 31 OUTFLOW, KSFD		184.0	184.0	184.0	184.0		
MIN. APR. 30 RESERVOIR CONTENT, KSFD 3/		458.6	127.4	0.0	0.0		
MIN. APR. 30 RESERVOIR ELEV., FT. 4/	2403.0	2337.8	2303.1	2287.0	2287.0		
APR. 30 VARIABLE REFILL CURVE, FT. 5/		2337.8	2303.1	2287.0	2287.0		
ASSUMED JUN. 1-JULY 31 INFLOW, % OF VOLUME		52.8	54.4	56.0	58.1	64.6	
ASSUMED JUN. 1-JULY 31 INFLOW, KSFD 2/		1438.6	1652.5	1825.2	1820.4	1935.1	
MIN. JUN. 1-JULY 31 OUTFLOW, KSFD		122.0	122.0	122.0	122.0	122.0	
MIN. MAY 31 RESERVOIR CONTENT, KSFD 3/		1186.4	972.5	799.8	804.6	689.9	
MIN. MAY 31 RESERVOIR ELEV., FT. 4/	2427.0	2392.7	2378.6	2366.4	2366.5	2357.8	
MAY 31 VARIABLE REFILL CURVE, FT. 5/		2392.7	2378.6	2366.4	2366.5	2357.8	
ASSUMED JUL. 1-JULY 31 INFLOW, % OF VOLUME		19.0	29.6	20.2	20.9	23.2	34.0
ASSUMED JUL. 1-JULY 31 INFLOW, KSFD 2/		517.4	594.3	656.5	654.8	696.0	826.6
MIN. JUL. 1-JULY 31 OUTFLOW, KSFD		62.0	62.0	62.0	62.0	62.0	62.0
MIN. JUNE 30 RESERVOIR CONTENT, KSFD 3/		2047.6	1970.7	1908.5	1910.2	1869.0	1738.4
MIN. JUNE 30 RESERVOIR ELEV., FT. 4/	2457.0	2439.3	2435.5	2432.5	2432.6	2430.5	2423.4
JUNE 30 VARIABLE REFILL CURVE, FT. 5/		2439.3	2435.5	2432.5	2432.6	2430.5	2423.4
JULY 31 VARIABLE REFILL CURVE, FT.		2459.0	2459.0	2459.0	2459.0	2459.0	2459.0

1/ FROM LIBBY FORECAST COMPUTATION FORMS
2/ PRECEDING LINE X LINE 3
3/ FULL CONTENT (2487.3 KSFD) PLUS PRECEDING LINE LESS LINE PRECEDING THAT
4/ FROM RESERVOIR ELEVATION - STORAGE CONTENT TABLE DATED MARCH 17, 1972
5/ LOWER OF ELEV. ON PRECEDING LINE OR ELEV. DETERMINED PRIOR TO YEAR

TABLE 6

COMPUTATION OF INITIAL CONTROLLED FLOW
COLUMBIA RIVER AT THE DALLES, OREGON
1 MAY 1975

1 May Forecast of May - August Unregulated Runoff Volume, MAF		97.4
Less Estimated Depletions, MAF		1.5
Less Upstream Storage Corrections, MAF		
Mica	8.3	
Arrow	5.0	
Libby	4.9	
Duncan	1.2	
Hungry Horse	1.8	
Flathead Lake	.5	
Noxon	.2	
Pend Oreille Lake	.5	
Grand Coulee	4.9	
Brownlee	.7	
Dworshak	1.8	
John Day	.5	
TOTAL	30.3	30.3
Forecast of Adjusted Residual Runoff Volume, MAF		65.6
Computed Initial Controlled Flow (From Chart 1, of Interim Flood Control Plan), KCFS		425.0

COLUMBIA RIVER BASIN

OCTOBER 1974 - APRIL 1975 PRECIPITATION
PERCENT OF 1958-72 AVERAGE

CHART 1
SEASONAL PRECIPITATION

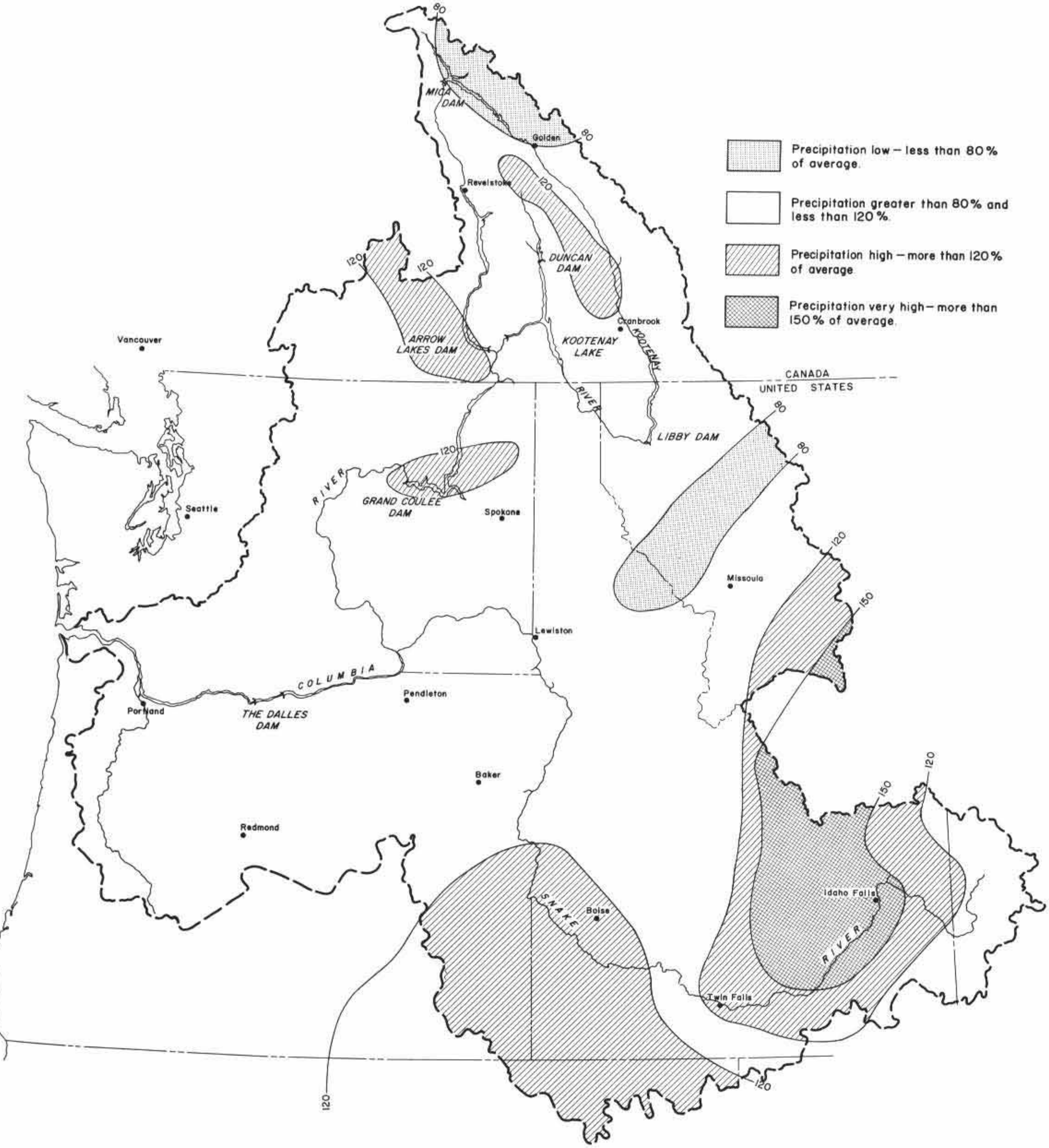
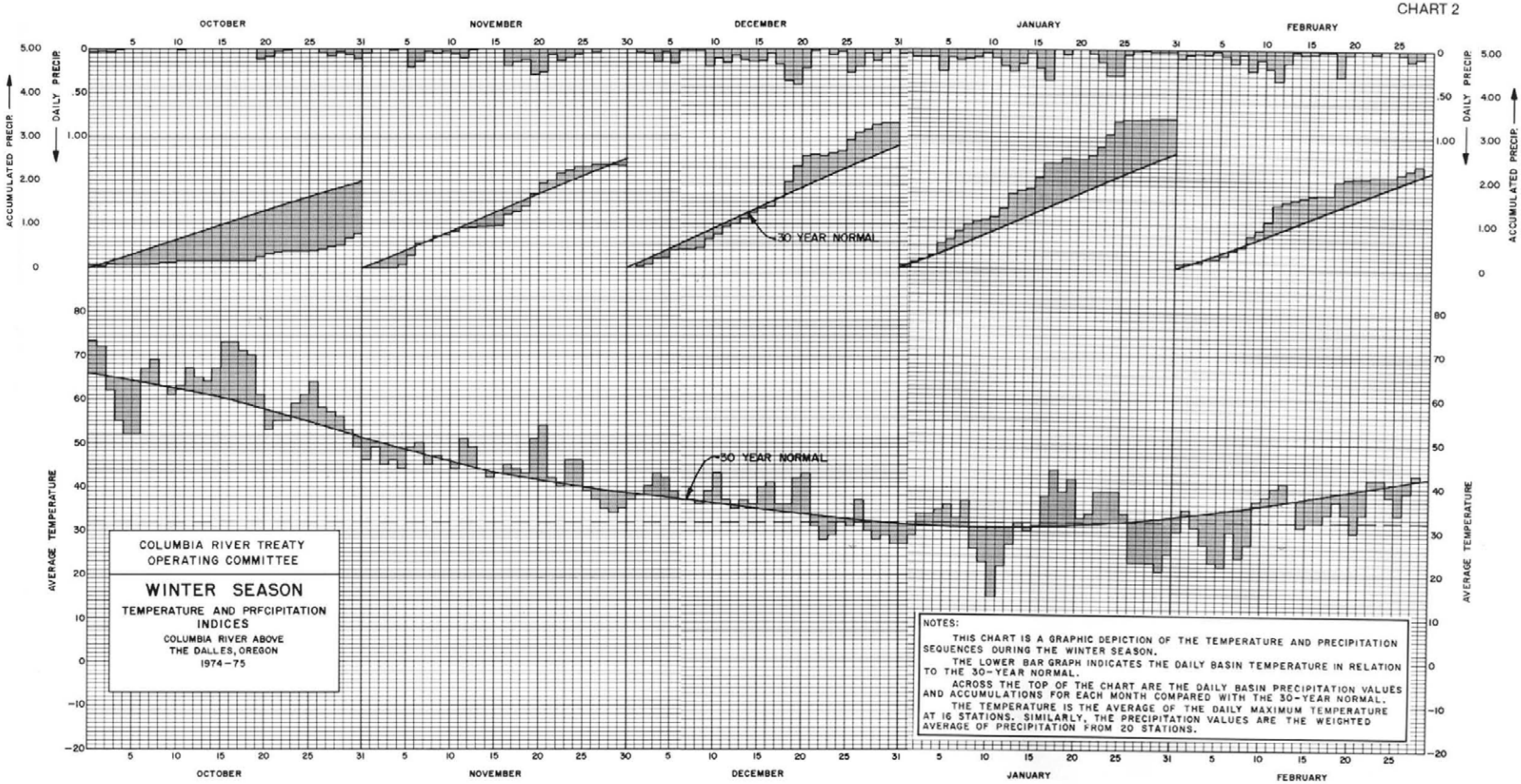
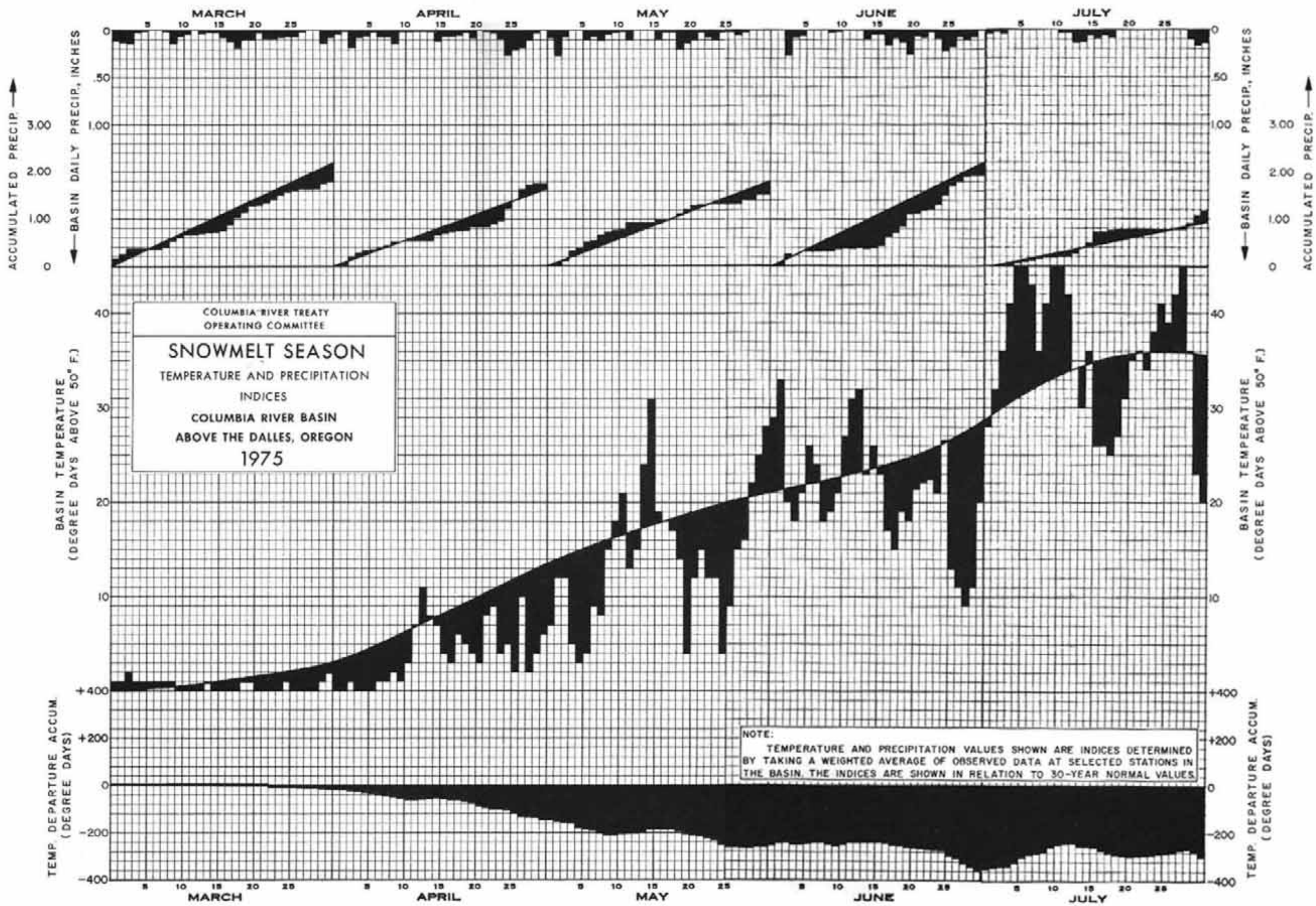


CHART 2



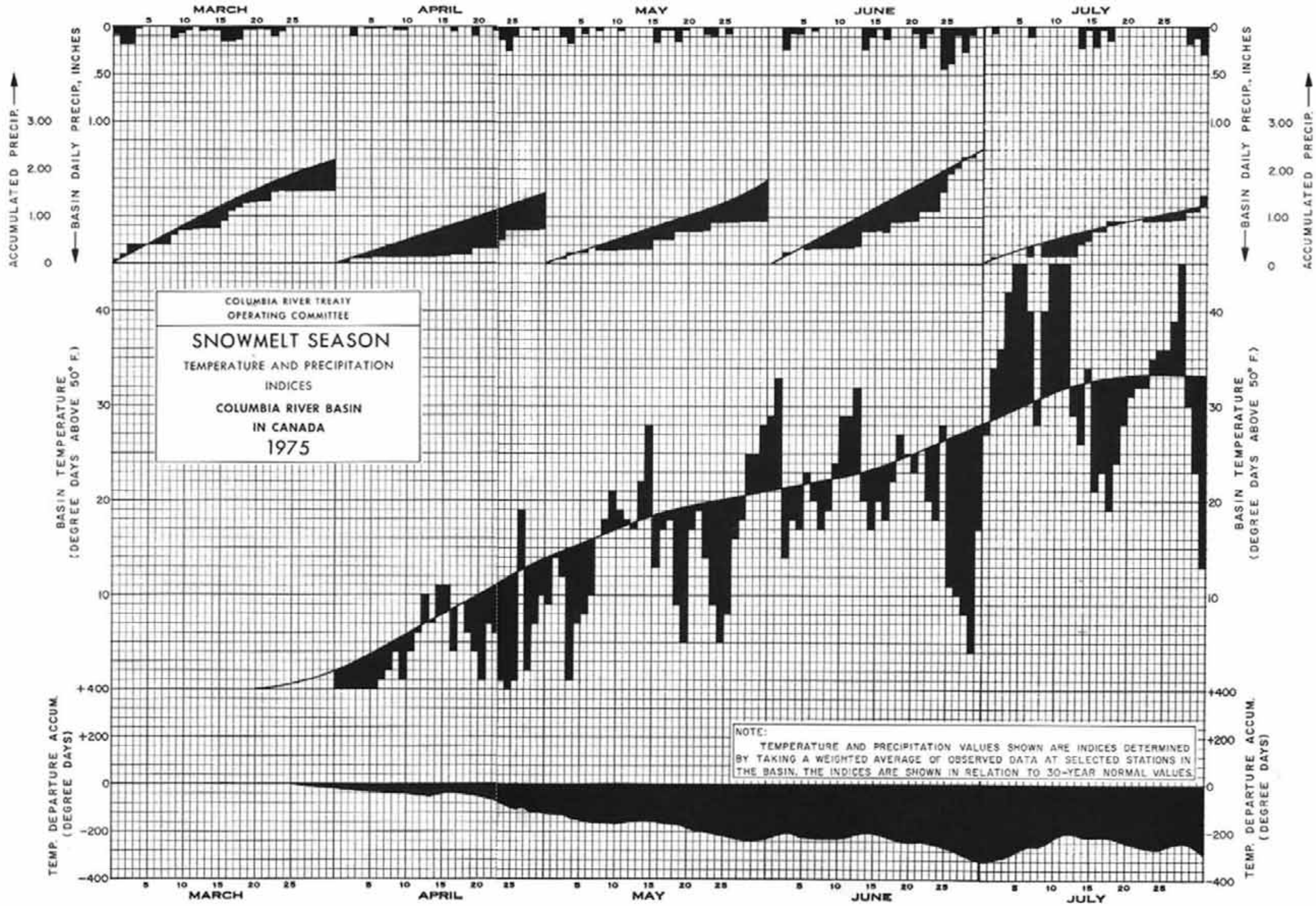
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
ACCUMULATED PRECIP.
DAILY PRECIP.
AVERAGE TEMPERATURE
30 YEAR NORMAL
30 YEAR NORMAL
COLUMBIA RIVER TREATY
OPERATING COMMITTEE
WINTER SEASON
TEMPERATURE AND PRECIPITATION
INDICES
COLUMBIA RIVER ABOVE
THE DALLES, OREGON
1974–75
NOTES:
THIS CHART IS A GRAPHIC DEPICTION OF THE TEMPERATURE AND PRECIPITATION SEQUENCES DURING THE WINTER SEASON.
THE LOWER BAR GRAPH INDICATES THE DAILY BASIN TEMPERATURE IN RELATION TO THE 30-YEAR NORMAL.
ACROSS THE TOP OF THE CHART ARE THE DAILY BASIN PRECIPITATION VALUES AND ACCUMULATIONS FOR EACH MONTH COMPARED WITH THE 30-YEAR NORMAL.
THE TEMPERATURE IS THE AVERAGE OF THE DAILY MAXIMUM TEMPERATURE AT 16 STATIONS. SIMILARLY, THE PRECIPITATION VALUES ARE THE WEIGHTED AVERAGE OF PRECIPITATION FROM 20 STATIONS.

CHART 3

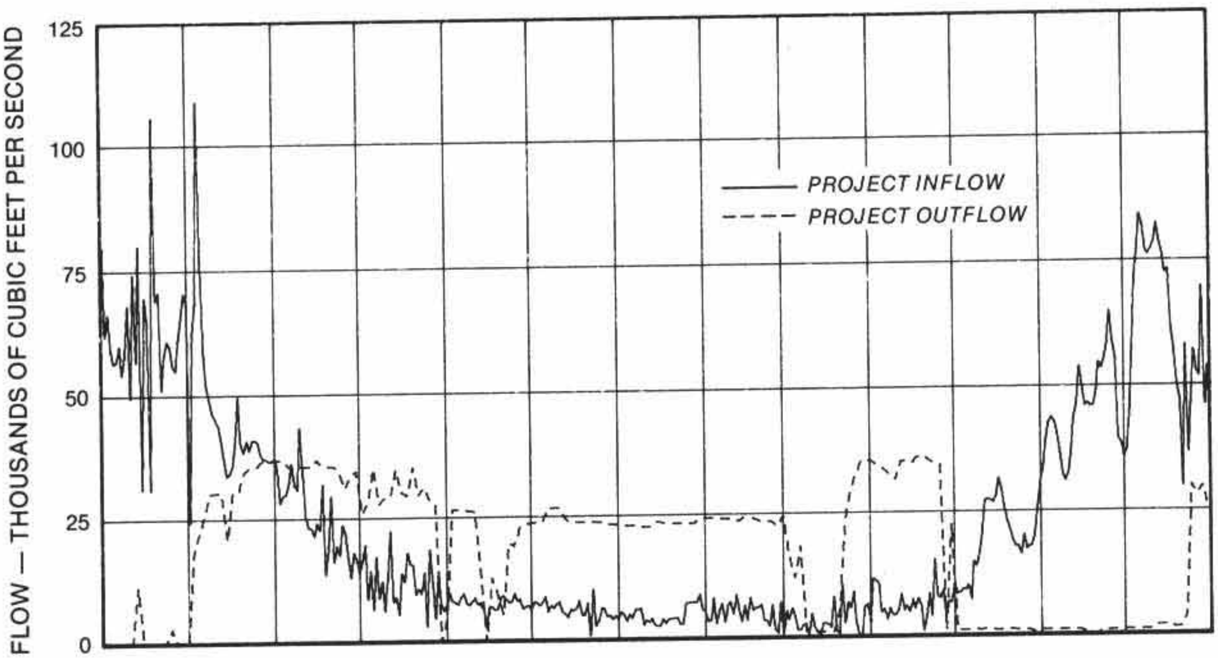


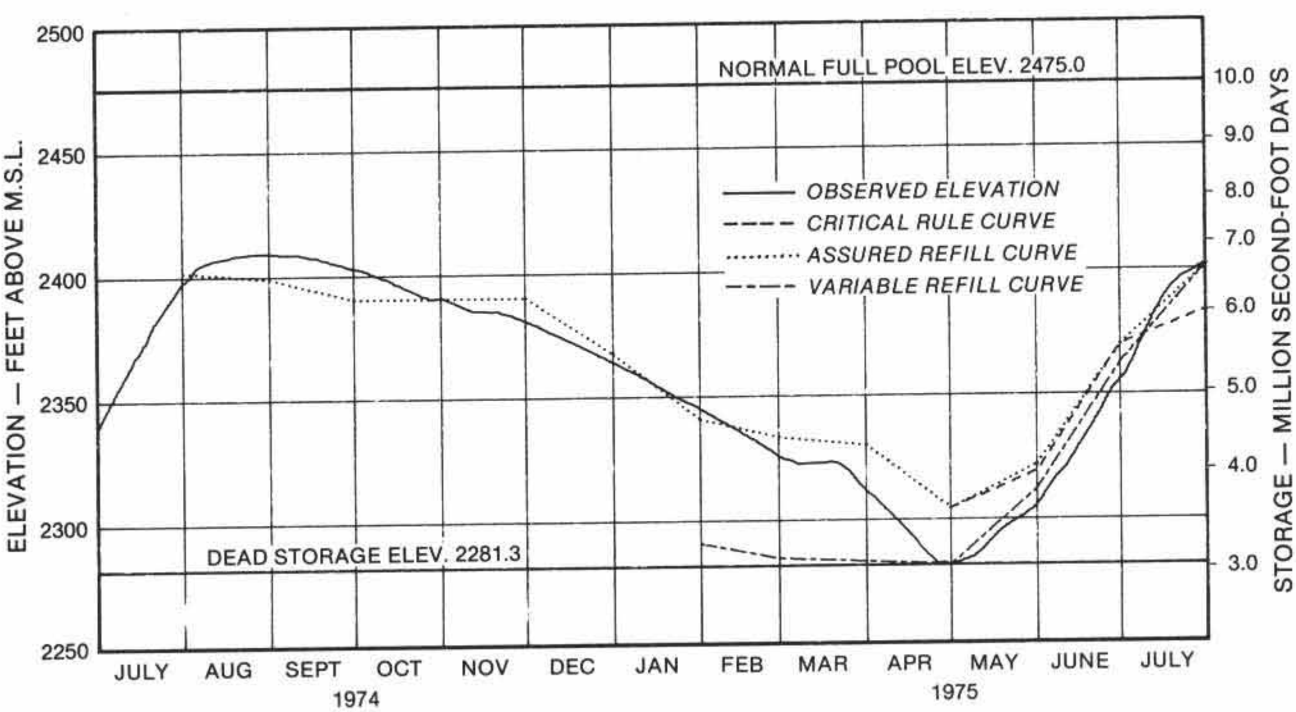
COLUMBIA RIVER TREATY OPERATING COMMITTEE
SNOWMELT SEASON
TEMPERATURE AND PRECIPITATION
INDICES
COLUMBIA RIVER BASIN
ABOVE THE DALLES, OREGON
1975
MARCH
APRIL
MAY
JUNE
JULY
BASIN DAILY PRECIP., INCHES
ACCUMULATED PRECIP.
BASIN TEMPERATURE (DEGREE DAYS ABOVE 50° F.)
TEMP. DEPARTURE ACCUM. (DEGREE DAYS)
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.

CHART 4

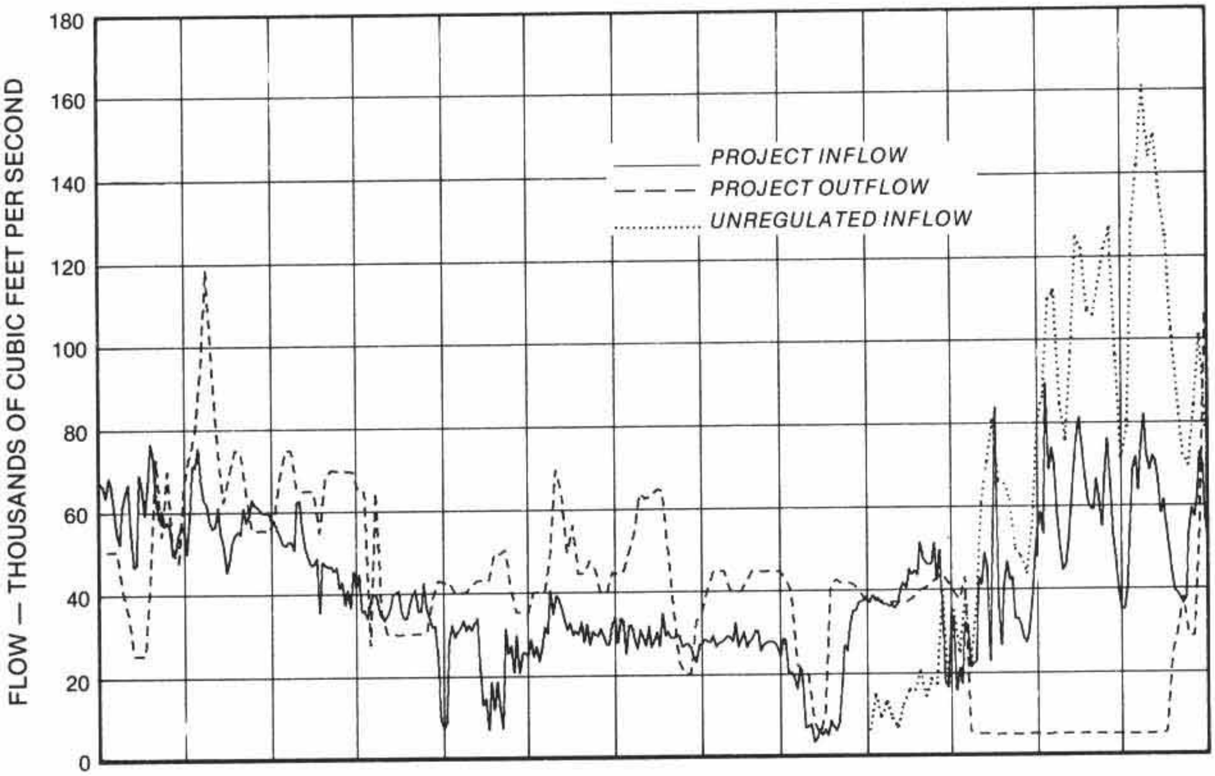

COLUMBIA RIVER TREATY
OPERATING COMMITTEE
SNOWMELT SEASON
TEMPERATURE AND PRECIPITATION
INDICES
COLUMBIA RIVER BASIN
IN CANADA
1975
MARCH
APRIL
MAY
JUNE
JULY
ACCUMULATED PRECIP.
BASIN DAILY PRECIP., INCHES
BASIN TEMPERATURE
(DEGREE DAYS ABOVE 50° F.)
TEMP. DEPARTURE ACCUM.
(DEGREE DAYS)
NOTE:
TEMPERATURE 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.

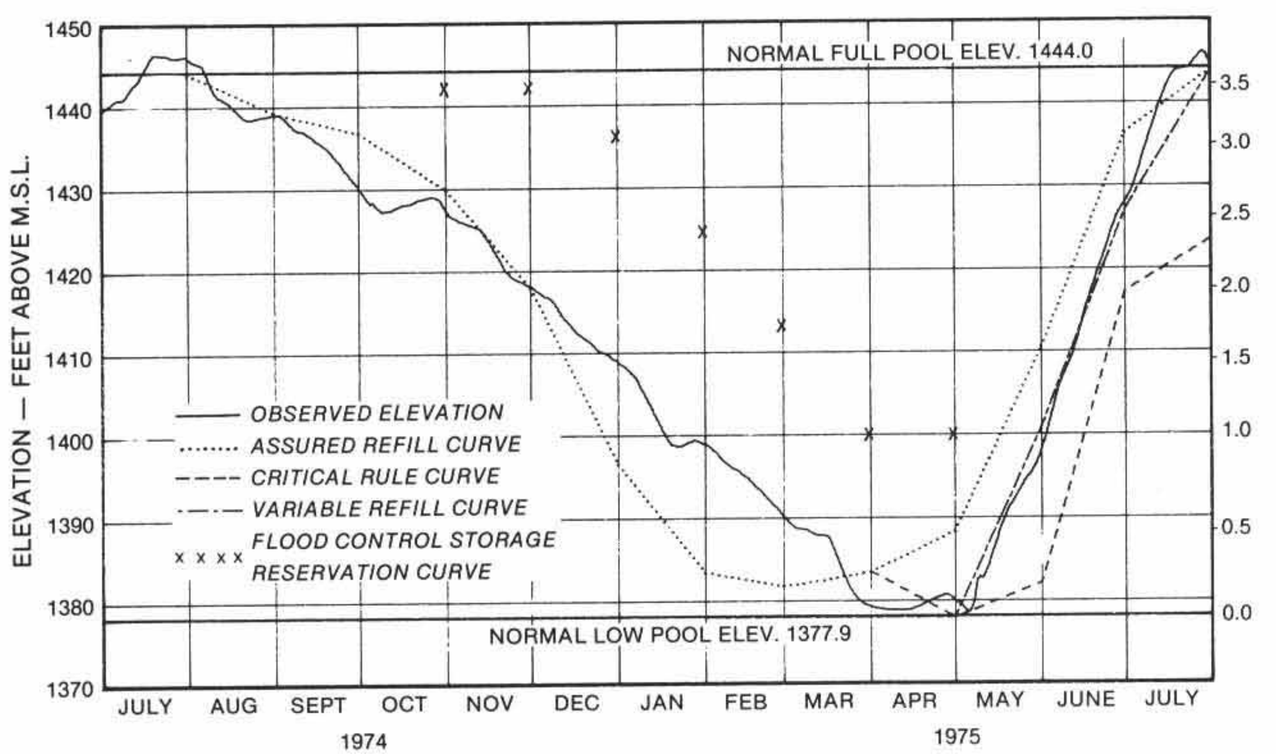
REGULATION OF MICA
1 JULY 1974 — 31 JULY 1975



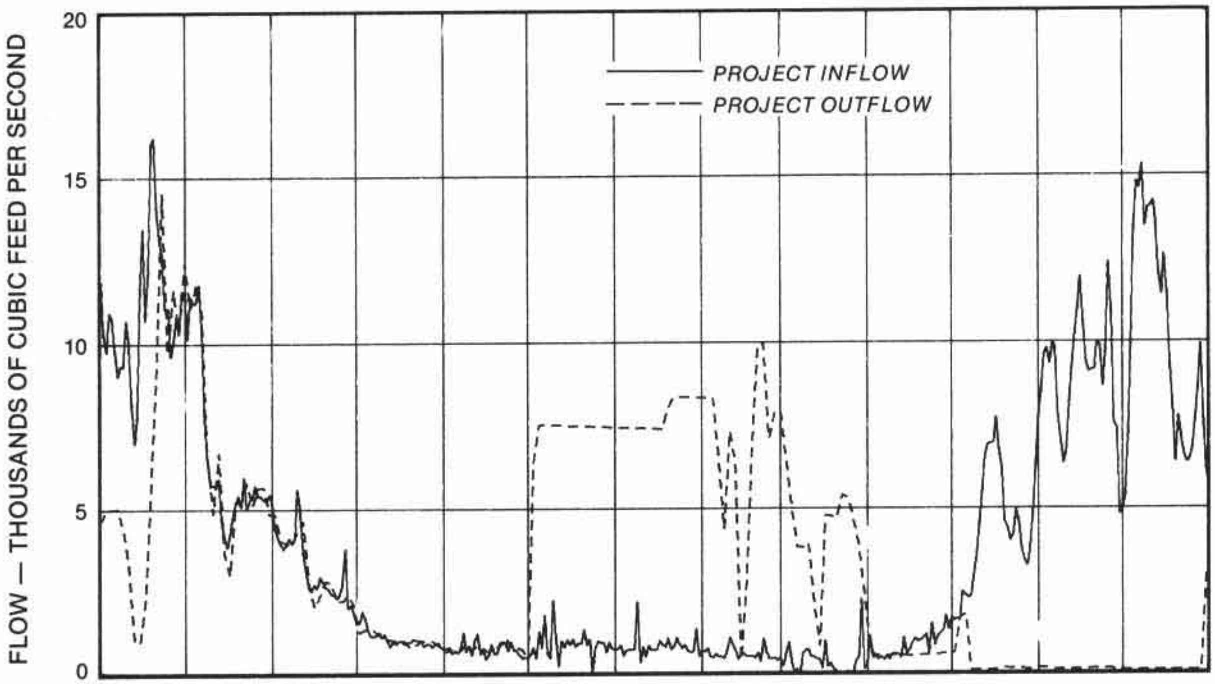


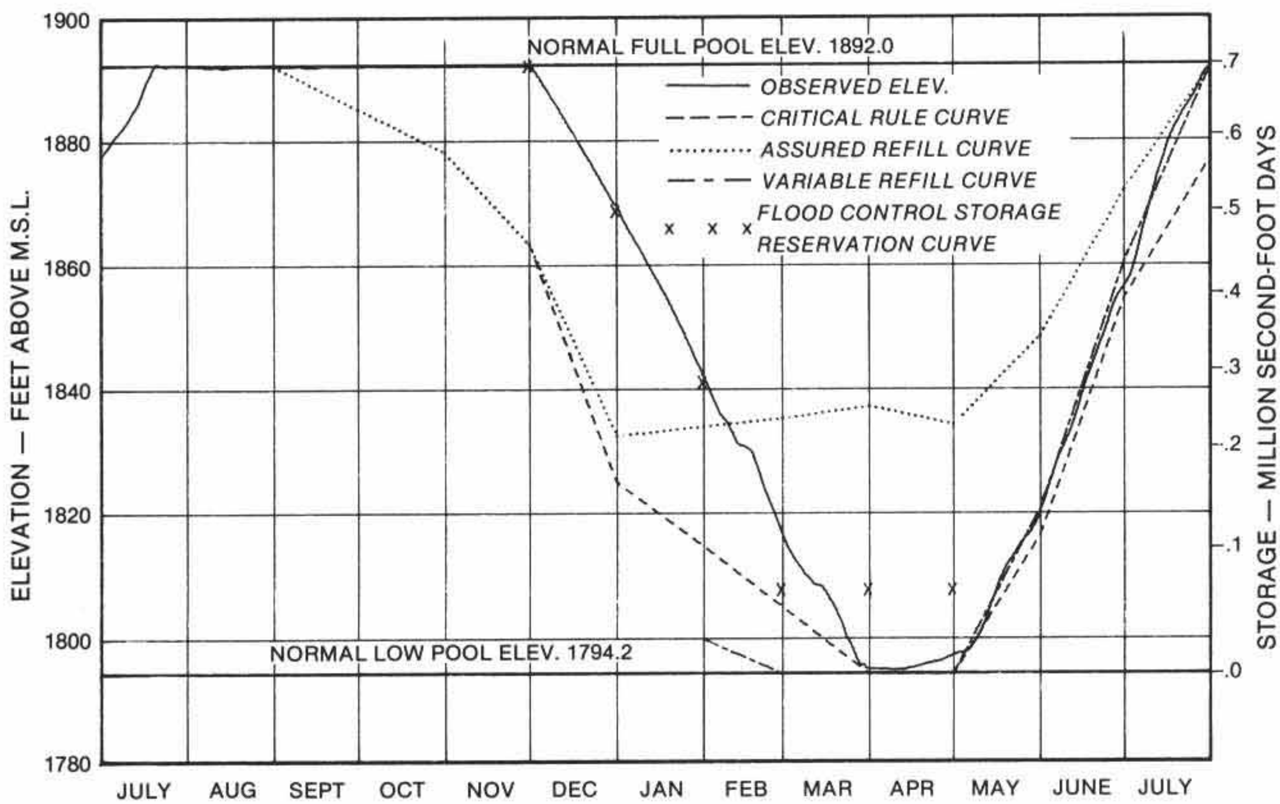
REGULATION OF ARROW
1 JULY 1974 — 31 JULY 1975



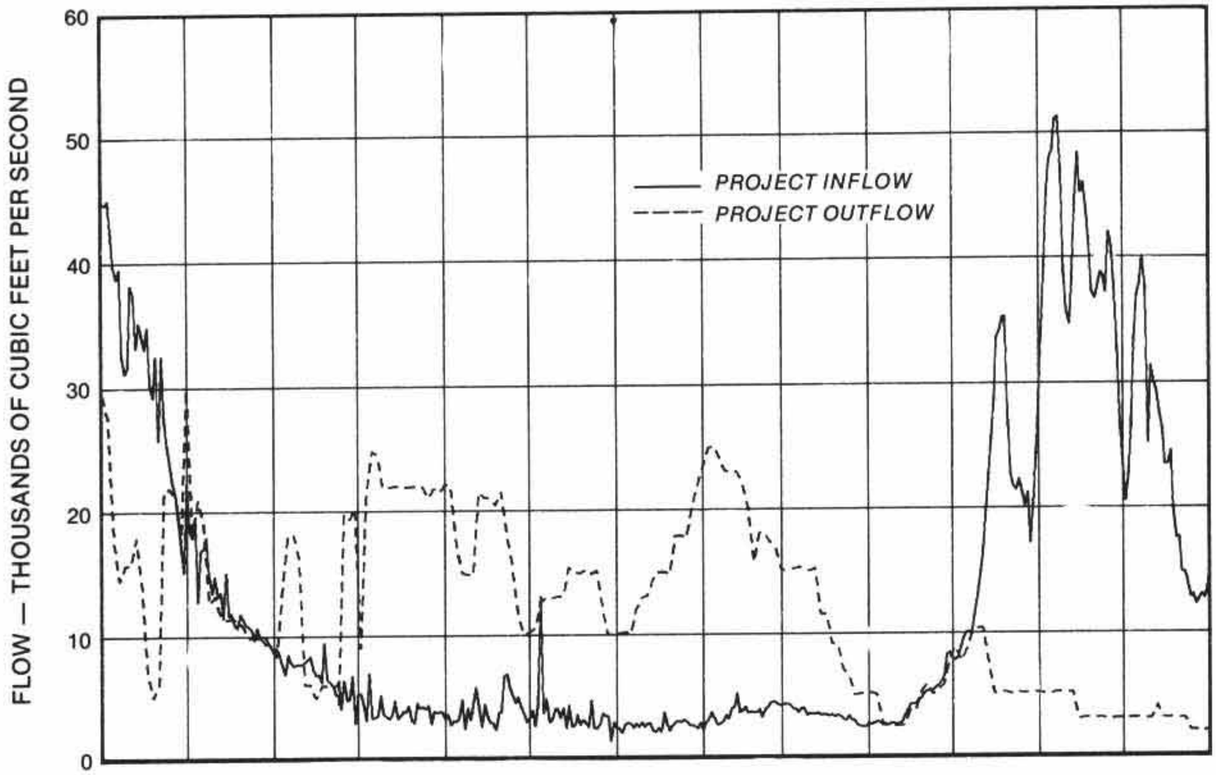


REGULATION OF DUNCAN
1 JULY 1974 — 31 JULY 1975





REGULATION OF LIBBY
1 JULY 1974 — 31 JULY 1975



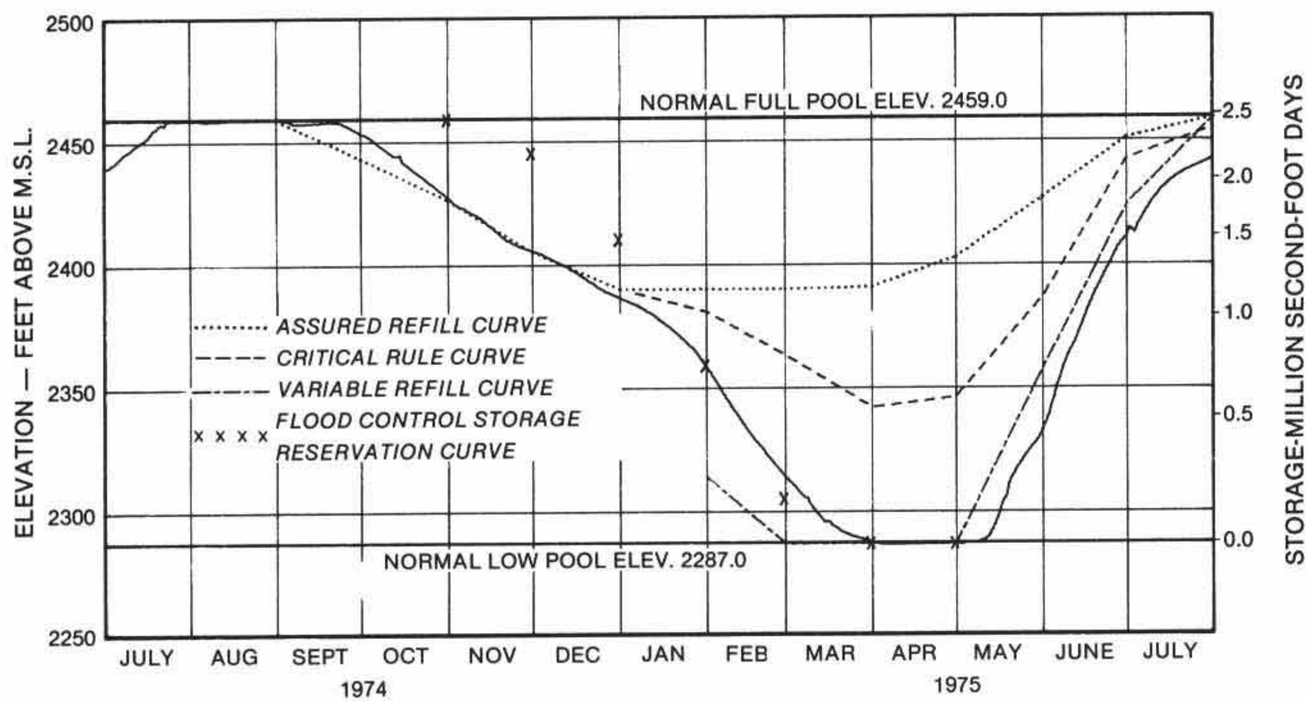
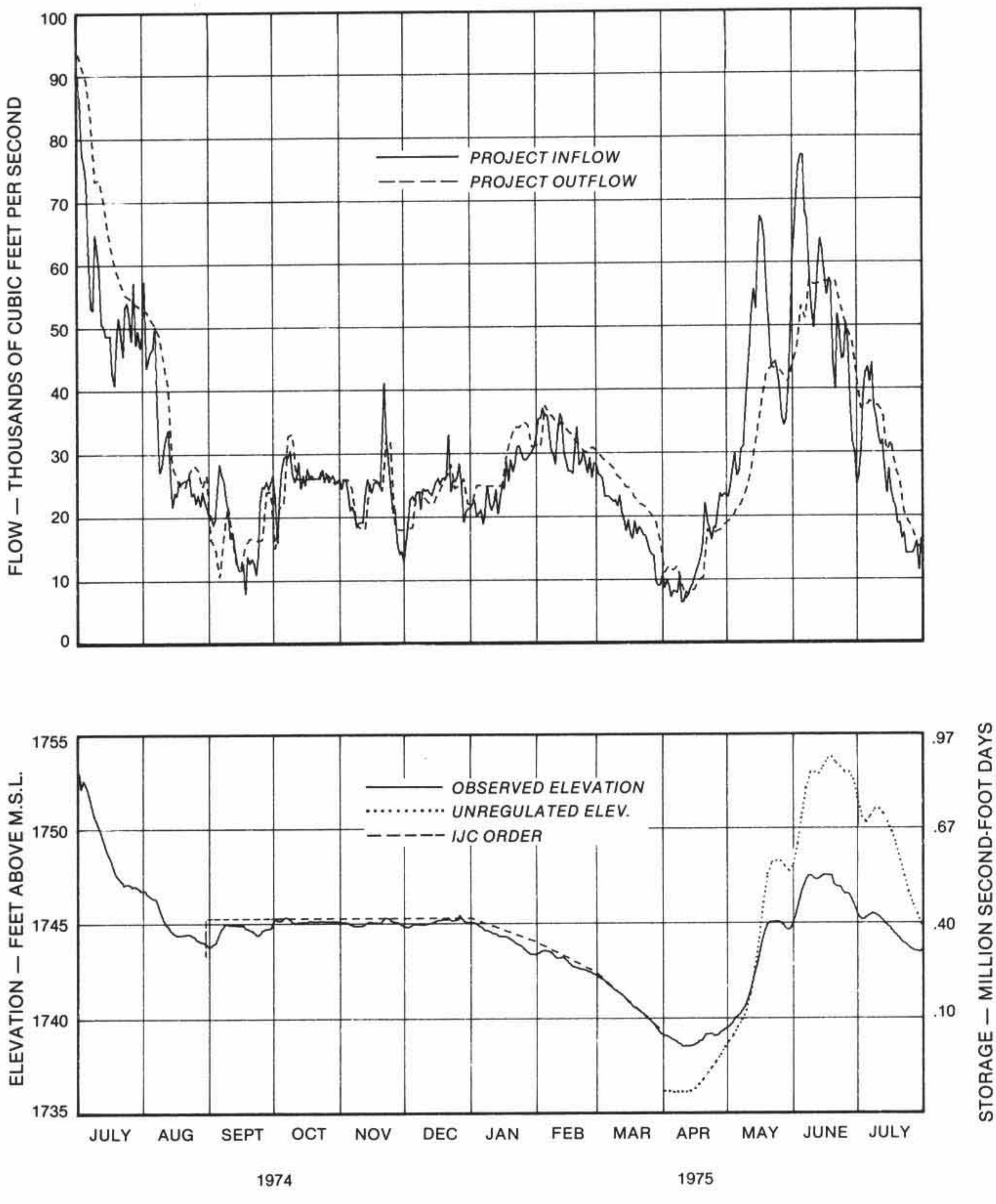


CHART 9
KOOTENAY LAKE

REGULATION OF KOOTENAY LAKE
1 JULY 1974 — 31 JULY 1975



COLUMBIA RIVER AT BIRCHBANK
1 JULY 1974 — 31 JULY 1975

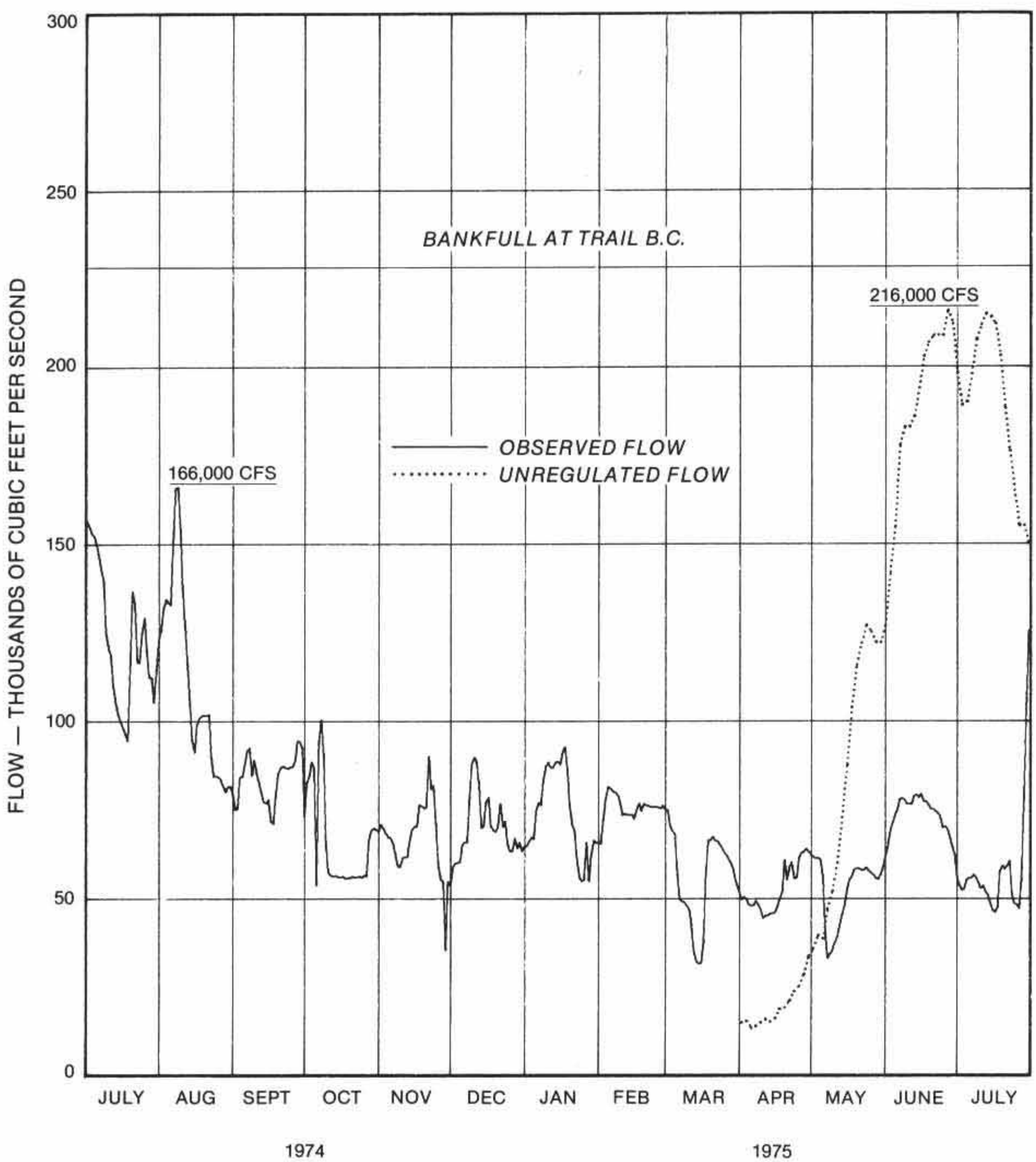
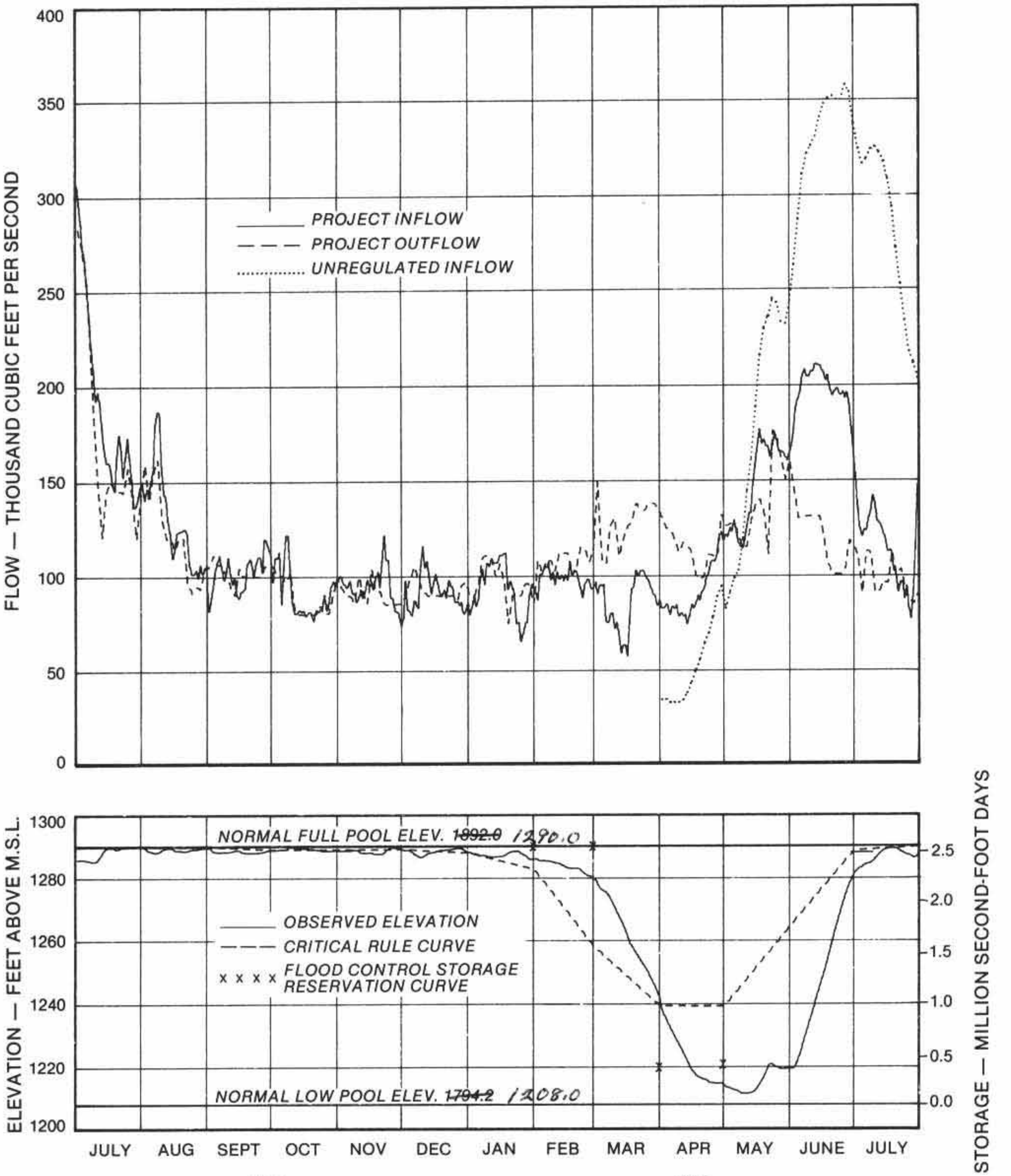
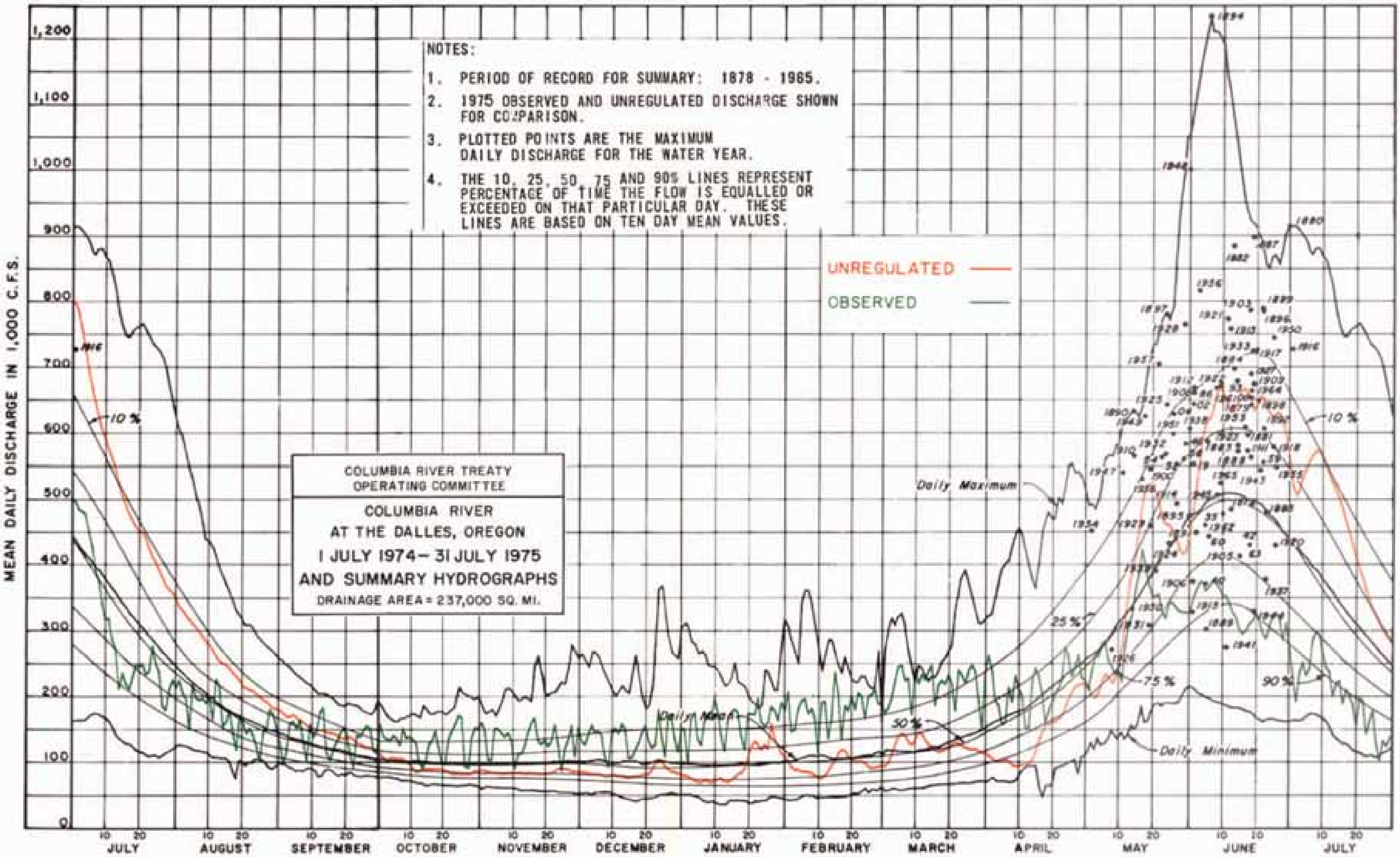


CHART 11
GRAND COULEE

REGULATION OF GRAND COULEE
1 JULY 1974 — 31 JULY 1975




NOTES:
1. PERIOD OF RECORD FOR SUMMARY: 1878 - 1965.
2. 1975 OBSERVED AND UNREGULATED DISCHARGE SHOWN FOR COMPARISON.
3. PLOTTED POINTS ARE THE MAXIMUM DAILY DISCHARGE FOR THE WATER YEAR.
4. THE 10, 25, 50, 75 AND 90% LINES REPRESENT PERCENTAGE OF TIME THE FLOW IS EQUALLED OR EXCEEDED ON THAT PARTICULAR DAY. THESE LINES ARE BASED ON TEN DAY MEAN VALUES.
UNREGULATED
OBSERVED
COLUMBIA RIVER TREATY OPERATING COMMITTEE
COLUMBIA RIVER
AT THE DALLES, OREGON
1 JULY 1974 – 31 JULY 1975
AND SUMMARY HYDROGRAPHS
DRAINAGE AREA = 237,000 SQ. MI.
MEAN DAILY DISCHARGE IN 1,000 C.F.S.
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
Daily Maximum
Daily Mean
Daily Minimum
10%
25%
50%
75%
90%
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY

COLUMBIA RIVER AT THE DALLES
1 APRIL 1975 — 31 JULY 1975

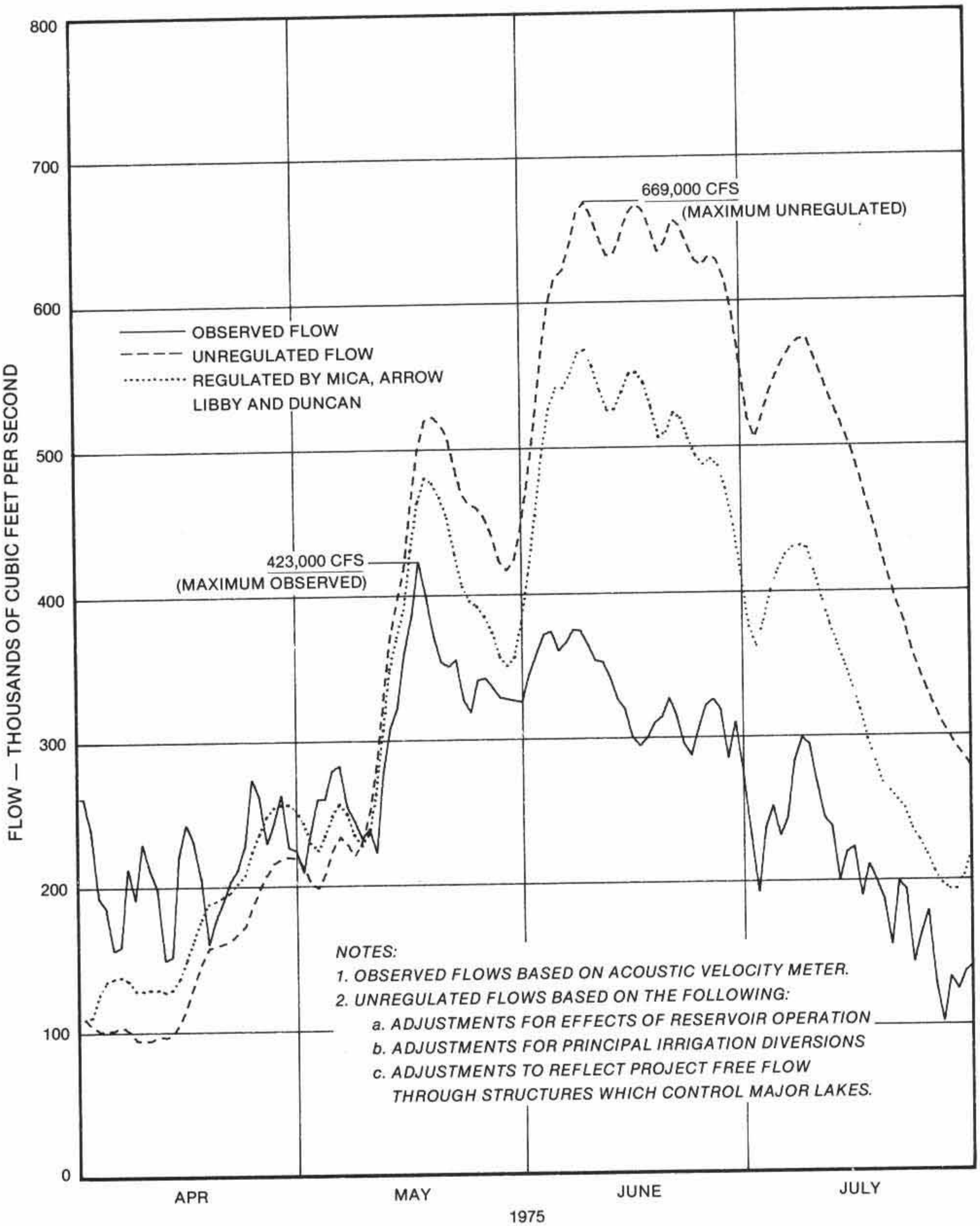
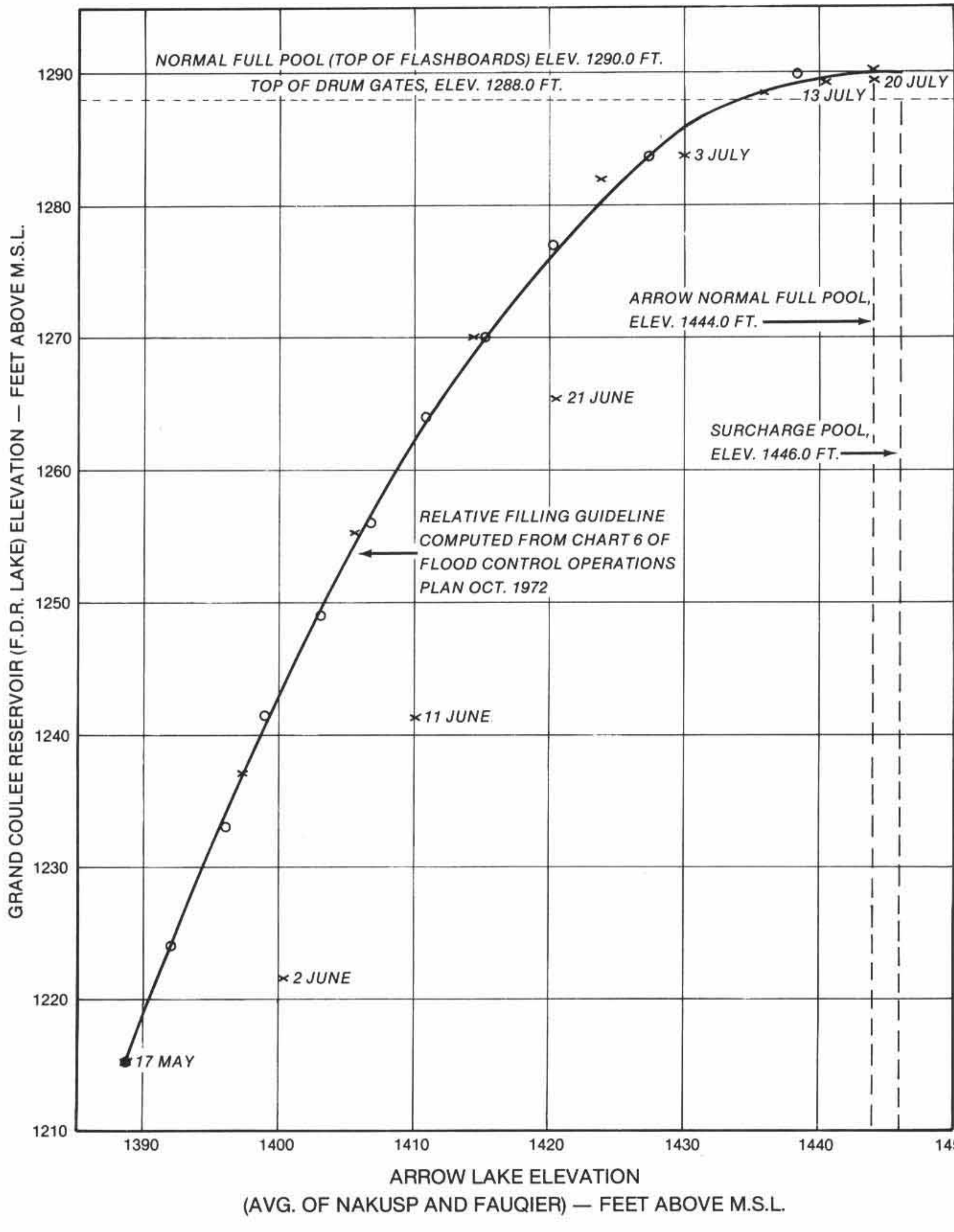


CHART 14
ARROW AND
GRAND COULEE

RELATIVE FILLING ARROW AND GRAND COULEE



REFERENCES

The following documents governed the operation of the Columbia Treaty Projects during the period 1 August 1974 through 31 July 1975:

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 1974 through 31 July 1975", dated September 1974.

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

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