REDACTED

USACE WATER CONTROL MANUAL
FOR
MASON DAM

This project is considered authority of Section 7 for the U.S. Army Corps of Engineers. Mason Dam is owned by the U.S. Bureau of Reclamation and operated by Baker Valley Irrigation District.

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U.S. ARMY CORPS OF ENGINEERS, WALLA WALLA DISTRICT 1985

1985 WATER CONTROL MANUAL STATUS SHEET
MASON DAM, POWDER RIVER, OREGON

CHAPTER NUMBER	ITEM*	PRIORITY	STATUS	PLANNED ACTION
I	INTRODUCTION	3	4	
II	DESCRIPTION	3	4	
III	HISTORY	3	4	ALL MANUAL ITEMS WILL BE REVIEWED PERIODICALLY.
IV	WATERSHED CHARACTERISTICS	3	4	
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SUPPORTING INFORMATION:				
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* Includes charts & tables associated with each chapter

STATUS CODES

APPROVED MANUALS:

1. TECHNICAL ASPECTS ADEQUATE AND APPROVED; FINISHED FORM (up-to-date).
2. TECHNICAL ASPECTS ADEQUATE AND APPROVED; DRAFT FORM (preliminary).
3. APPROVED, BUT SOME ASPECTS INCOMPLETE OR NEED REVISION.

MANUALS NOT APPROVED:

4. DRAFT FORM; NOT ALL ASPECTS APPROVED.
5. PORTIONS INCOMPLETE AND/OR OUTDATED.

6. INCOMPLETE CHAPTER (report published prior to ETL 1110-2-251, " Engineering and Design - Preparation of Water Control Manuals," dated 14 March 1980).

NA - Not applicable

WATER CONTROL MANUAL REVISIONS
FOR MASON DAM (PHILLIPS LAKE)

The following revisions are provided for the updating of this Water Control Manual. This Manual will be reviewed annually and updated if necessary. Major revisions pertaining to format and content in accordance with references ETL 110-2-251 and ER 1110-2-240 will be accomplished as time and manpower become available.

1987 revisions include:

a. (Pink Sheet Pages i-ii).
b. Water Control Management:
   (1)

1985 revisions include:

a. (Pink Sheet Pages i-ii).
b. (Pink Sheet Page iii)
c. Hydrologic Forecasts (Appendix B):
   (1) Bureau of Reclamation (5 Sheets, Page B-1)
d. Water Control Management:
   (1)

1984 revisions include:

a. (Pink Sheet Pages i-ii).
b. Hydrologic Forcasts (Appendix B):
   (1) Bureau of Reclamation (5 Sheets, Page B-1)
c. Water Control Management:
   (1)
   (2)

PRELIMINARY INFORMATION REPORT

Pertaining To

RESERVOIR REGULATIONS

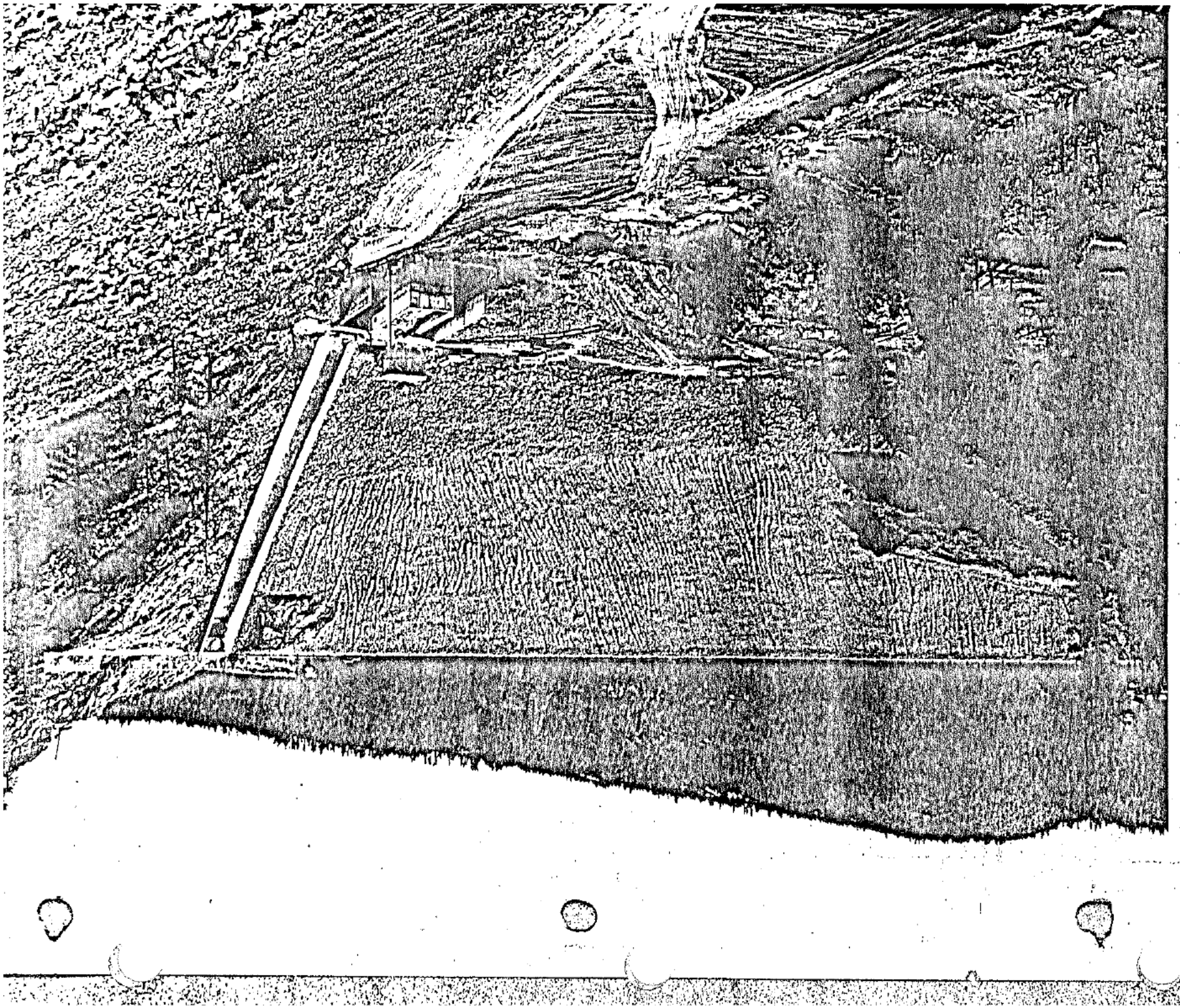
MASON RESERVOIR

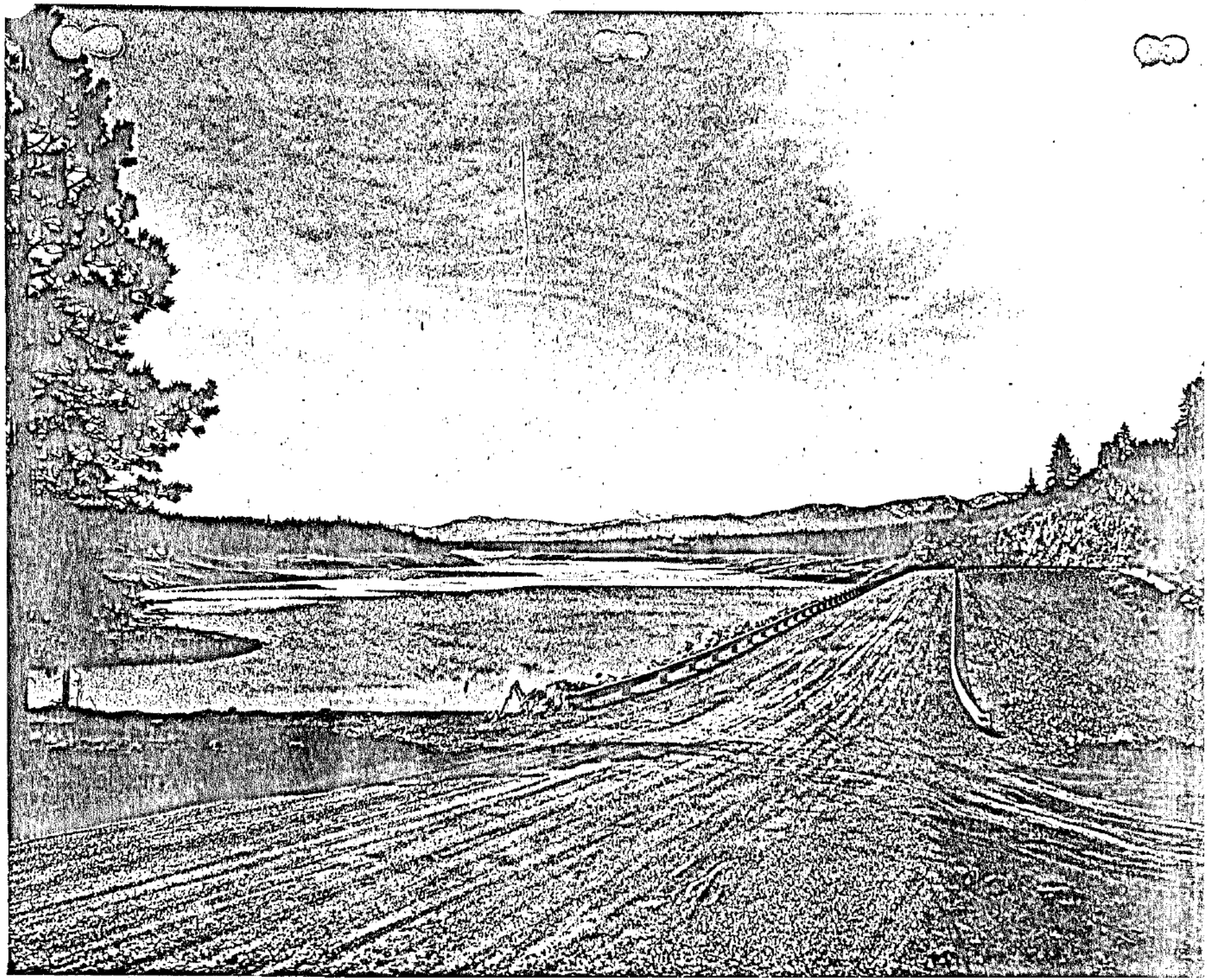
POWDER RIVER, OREGON

U. S. ARMY ENGINEER DISTRICT

WALLA WALLA, WASHINGTON

JANUARY 1969





NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in loose-leaf form, and only those sections, or parts thereof, requiring changes will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep the manual current.

As a continuing program it will be necessary to revise portions of this manual annually in order to keep it up to date. Revisions to this manual will be made by the Walla Walla District's Planning Division - Hydrology Branch. Whenever revisions are necessitated, new pages containing the revised material will be printed with the date of revision and issued to each person having a copy of the manual so that substitution may be made.

TABLE OF CONTENTS

PLATES (CONT'D)

PERTINENT DATA

MASON RESERVOIR - POWDER RIVER, OREGON

LOCATION

In Baker County about 18 miles upstream on the Powder River from the City of Baker via Oregon Highway 220, and about 12 miles downstream from the small town of Sumpter.

RESERVOIR

Total Capacity at Max. pool	(Elev. 4077.25)	106,500 ac. ft.
Total Capacity at full pool	(Elev. 4070.50)	90,519 ac. ft.
Surface Area at full pool	(Elev. 4070.50) approx.	2,450 acres

Storage Allocations:

Purpose	Elevation	Storage - A.F.
Flood Control	4062.40 to 4070.50	17,000
Joint Use	4050.63 to 4062.40	21,000
Irrigation	3981.50 to 4050.63	52,540
Inactive	below 3981.50	5,000

DAM

Type	Sand, gravel, and rockfill with rolled earth core	
Hydraulic Height		156 feet
Volume of Embankment		1,000,000 c.y.
Crest elevation		4082 m.s.l.
Crest length		920 feet
Spillway Type	Uncontrolled concrete-lined chute with concrete stilling basin	
Spillway Crest Elevation		4070.5 m.s.l.
Spillway Capacity (Elev. 4077.25)		1,200 c.f.s.
Outlet Type	Intake structure, tunnel, and gate chamber	
Outlet Capacity at Minimum Pool (Elev. 3981.5)		550 c.f.s.
Outlet Capacity at Maximum Pool (Elev. 4077.25)		885 c.f.s.

HYDROLOGY

Drainage area above dam	175 sq. miles
Drainage area above gage near Baker	230 sq. miles
Estimated annual runoff at dam	70,000 ac. - ft.
Estimated minimum annual runoff at dam (1934)	24,900 ac. - ft.
Estimated maximum annual runoff at dam (1965)	118,000 ac. - ft.
Peak discharge at gage near Baker (3/20/10)	1,820 c.f.s.
Minimum discharge at gage near Baker (9/7/31)	0 c.f.s.
Estimated bankfull at Baker	1,500 c.f.s.
Estimated bankfull below Baker	500 c.f.s.

PRELIMINARY
REPORT ON RESERVOIR REGULATIONS
MASON DAM AND RESERVOIR
POWDER RIVER, OREGON

SECTION I - INTRODUCTION

1.01 AUTHORITY

Section 7 of the Flood Control Act of 1944 (48 Stat. 890) reads in part as follows:

"Hereafter, it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations."

Authority for this report is contained in paragraph 7 of EC 1110-2-22, dated 26 April 1966, which states in part that Reports on Reservoir Regulations will be prepared by District Engineers and submitted through the appropriate Division Engineers for approval of the Chief of Engineers in accordance with instructions in EM 1110-2-3600. Paragraph 7 of EC 1110-2-22, dated 26 April 1966, outlines the material which should be included in a Report on Reservoir Regulations.

1.02 PURPOSE AND SCOPE

Purpose of this report is to present information pertinent to operation for flood control of Mason Reservoir, including details of facilities and regulation criteria. It contains a general description of the drainage basin and development. It describes the plan of operation, including regulation schedules for flood control, and examples of regulation.

Comprehensive pertinent data are presented, including basin and reservoir maps, outlet and spillway discharge curves, storage allocations, discharge rating tables for key stations and climatological data.

1.03. REVISIONS TO THIS REPORT

As a continuing program, it will be necessary to revise portions of this report to keep it up-to-date. Pertinent discharge rating tables must be revised when changes become evident in the stage-discharge relation. Changes in the plan of operation will be made as necessary for the purpose of improving regulation technique. Project developments in the basin may occur which will require revision of the information presented in the report. Whenever revisions are required, new pages containing the revised material will be printed and issued to each person having a copy of the report so that substitution may be made.

SECTION II - BASIN DESCRIPTION

2.01. TOPOGRAPHY AND STREAMS

The Powder River, one of the tributaries of Snake River and a part of the Columbia River drainage system, is located in east central Oregon. In total area, the basin contains about 1,660 square miles. The river is formed on the eastern side of Elk Horn Ridge by the junction of Cracker Creek and McCully Fork, at an elevation of about 4400 feet. It then flows northward through Bowen and Baker valleys, where it is joined by several creeks that drain the surrounding hillsides. It is bordered on the south and west by the rugged and partly timbered slopes of Elk Horn Ridge, and on the east and north by the lower, gently rounded, and sage-covered Farley Hills. The relatively smooth floor of Baker Valley slopes northward from an elevation of 3450 feet above sea level at Baker to about 3300 feet near Haines at the northern end of the valley. A basin map is shown on Plate 1.

Flowing northward out of Baker Valley, the river turns southeasterly to enter Thief Valley Reservoir from which it flows southeasterly to its junction with Snake River. The watercourse from Thief Valley Reservoir to the mouth is generally in a narrow incised canyon with the exception of Lower Powder River Valley and another small valley near Richland, Oregon.

2.02. ECONOMY AND POPULATION

Settlement of the area began with the discovery of gold in 1861 in Sumpter Valley, located near the headwaters of Powder River. Baker Valley also attracted some of the homeseekers following the Oregon Trail toward western Oregon. Baker, situated where the old trail entered the valley,

was first settled in 1863. Many of the pioneers engaged in mining enterprises, but stock raising and farming were undertaken by others to supply food for the miners. Irrigation of this area began in the 1870's, when farmers seeking to improve the native hay meadows made simple diversions from streams. Construction of a railroad (now the Union Pacific) through Baker Valley in 1884 encouraged expansion of the livestock and lumbering industries. The level of settlement and development reached in 1900 has remained nearly unchanged to the present time.

Livestock farming, lumbering, transportation, and gold mining support the community. The 1956-1957 estimate of the Baker Planning Committee shows that 84 percent of the county's farm income of about $13,200,000 came from livestock and livestock products, and the remainder from field crops and several minor enterprises.

In 1960, Baker County had a population of 17,295, an increase of 1,120 from the total of 1950. More than half of the county's population is concentrated in Baker Valley, the city of Baker alone having had a total of 9,986 people in 1960. About 40 percent of the labor force in the area is employed in the extractive industries of agriculture, forestry, and mining. Trades and service industries employ most of the remaining 60 percent.

2.03. FLOOD PLAIN CHARACTERISTICS

Powder River flows northward through Bowen and Baker Valleys, where it is joined by several creeks that drain the surrounding hillsides. At the mouths of the stream canyons, alluvial fans overlie portions of the valley floor. Remnants of a once extensive lake terrace are found along the base

of the hills. Baker and Bowen Valleys constitute the major flood plain for which regulation can be provided by Mason Reservoir. Flood plain properties consist largely of farmland and developed properties in the city of Baker. The greatest part of the damages occur in Baker. Commercial properties subject to inundation include businesses such as a motel, 3 grocery stores, 1 tire shop, 1 trailer sales agency, and 2 sawmills. Public facilities in the flood plain include the city sewage treatment plant and communication and transportation facilities. Approximately 70 percent of the agricultural land is in meadow hay, 20 percent is timothy and red clover, and the balance is in small grains. A flood plain map is shown on Plate 2.

SECTION III - HYDROLOGIC FEATURES

3.01. CLIMATE

The 351-square-mile drainage area above Baker has mean annual temperatures ranging from 46 degrees to 32 degrees and average annual precipitation ranging from 10 inches to over 40 inches, with a basic average of 20 inches. Extreme recorded termperatures are 104 degrees and minus 25 degrees. Temperatures below freezing at Baker usually persist from December through February and the growing season averages about 140 days. Annual precipitation is reasonably uniform throughout the year, but the least amount occurs in the warm summer months. Maximum recorded precipitations at Baker have been 15.75 inches for a year, 4.00 inches for a month, and 1.83 inches for one day. In the cooler months, the precipitation occurs largely as snow. Annual snowfall at Baker averages about 40 inches and several feet of depth of snow accumulates on the ground each year in the mountains. Representative climatological data are shown on Table 1.

3.02. STREAMFLOW CHARACTERISTICS

Flows in Powder River occur from a combination of snowmelt and rains, with snowmelt as the dominant cause of most flows and rainstorms a major factor in intermittent high flows of short duration. Flows are consistently low during months of July through early winter and also usually remain low through February, except on those occasions when warm rains cause rapid increases in flow. Usually flows gradually increase in March from snowmelt and are high in April and May. Flows are normally receding in June, but, occasionally, warm rains during the

month cause some abnormally high flows. Typically, high fluctuating flows endure annually for a period of several days to several weeks during the April-May snowmelt period. Powder River gage near Baker (Salisbury), 8 miles above Baker, has an average flow of 112 cfs and average annual runoff of 81,000 acre/feet, or about 7 inches from the 219 square-mile drainage area. Individual year's runoffs vary from 40 to 150 percent of the mean.

3.03. PAST FLOODS

Frequent flooding has occurred in Baker Valley, with peak discharges in most years being of flood magnitude. In 40 years of 50 years of record, annual flood peaks have exceeded the 500 cfs capacity of the river in the valley below Baker. The channel capacity of 1,500 cfs through Baker has been exceeded 6 times in the same period. The peak discharges of the largest floods at Baker are estimated as follows: February 1957, 2,350 cfs; May 1921, 1,860 cfs; March 1910, 1,820 cfs; April 1904, 1,690 cfs.

Powder River is primarily a snowmelt runoff stream. The major factor causing large flood volumes has usually been abnormally high accumulations of water in snow. The sequence of temperatures occurring during the snowmelt seasons has much to do with the concentration of high flows from snowmelt. Storm rainfall during the snowmelt period has frequently contributed to the magnitude of flood peak flows. The February 1957 flood was caused by rain and warm temperatures occurring chiefly in the area below 5,000 feet elevation. Frozen ground conditions diminished infiltration rates resulting in rapid runoff from rainfall. Upper elevation areas contributed little to the flood runoff.

Although the peak flow at Baker is estimated as 2,350 cfs, the associated peak flow at the gage near Baker was less than 400 cfs.

The floods of 1910 and 1921 resulted from large snowpacks with some rain contribution during the snowmelt. The flood of 1904 resulted from unusually high temperatures melting a large snowpack.

3.04. FLOOD FREQUENCIES

Curves of natural annual flood peak frequencies have been derived from piecemeal data for several locations on Powder River. Estimates of annual flood peak frequencies as affected by regulation of Mason Reservoir have also been made. The curves are shown on Plates 6, 7, and 8, for Powder River near Baker (Salisbury), and near Haines at Baker. A skeleton table of the natural discharge frequencies is shown as follows:

Exceedence Interval (Years)	Near Baker (Salisbury) (cfs)	At Baker (cfs)	Near Haines (cfs)
5	1140	1170	1170
10	1450	1520	1520
20	1740	1900	1900
50	2180	2460	2460
100	2510	2920	2920

Preliminary studies of maximum annual flood volume frequencies were made in 1967 for Powder River near Baker. The record period was 1929 through 1966. The resulting frequency curves of maximum annual 1-day, 3-day, 10-day, 30-day, 60-day and 90-day volumes are shown on Plate 19.

3.05. CHANNEL CAPACITIES AND FLOOD DAMAGES

Very little work has been done to maintain an adequate flood channel for Powder River through Baker Valley. The capacity of the channel to carry water without overbank flooding downstream from the city of Baker is estimated as about 500 cfs. A contributing factor to the flood problem has been the irrigation methods practiced by the valley farmers. Deliberate flooding of lands in the spring has been practiced to offset the lack of water later in the summer and fall seasons. This over-abundance of water in the spring results in raising the water table through the lower end of the valley. The high water table creates drainage problems during flood stage periods which are further aggravated by the level topography of the valley basin.

The channel, for most of its length through Baker, has been improved through the efforts of the city in the form of stone masonry bank protection and intermittent levee systems. The Corps of Engineers performed a clearing and snagging job on the channel through Baker in 1964. This work provided a continuous capacity of 1,500 cfs and removed obstructions which had previously caused ice jams which had backed flood water onto residential and commercial properties. Discharge-damage curves are shown on Plates 9, 10 and 11.

SECTION IV - PROJECT DESCRIPTION

4.01. PROJECT PURPOSES

The primary purposes of Mason Reservoir are to provide irrigation water for 18,000 acres in Baker Valley and reduction of flood damages. 52,540 acre-feet of reservoir storage will be operated exclusively to supply irrigation water; 21,000 acre-feet of storage will be operated on a forecast basis for the joint use of flood control and irrigation; and 17,000 acre-feet of reservoir space will be reserved for the exclusive purpose of flood reduction. Operation and maintenance is by the Baker Valley Irrigation District. Other project purposes include recreation and fish and wildlife enhancement.

4.02. PROJECT HISTORY

Nine reports on various aspects of land and water resources of the area have been issued and are identified in the following paragraphs.

Soil Survey of the Baker City Area, 1904, by Charles A. Jensen and W. W. Mackie, Bureau of Soils, United States Department of Agriculture.

Ground Water in Baker Valley, Oregon, 1928, by A. M. Piper, Geological Survey, United States Department of the Interior.

Progress Report, Irrigation and Drainage Study, Baker Valley, 1929, by M. R. Lewis, Department of Soils, Oregon Agricultural Experiment Station, and the Division of Agricultural Engineering, United States Department of Agriculture, cooperating. This report asserted that there was a pressing need for late-season water supplies, and pointed to the acreage

of lands damaged by alkali. It recommended lowering of the water table to permit leaching of the accumulated alkali, and suggested that water pumped to lower the water table could be utilized to supplement present irrigation water supplies.

Water Supply Study, Surveys, and Preliminary Estimates of Storage Costs for Land Irrigated from Powder River near Baker, Oregon, 1932, by L. A. McAllister and L. E. Rydel, under supervision of Charles E. Stricklin, Oregon State Engineer. This report favored construction of a storage reservoir in Bowen Valley, and indicated that sufficient storage could be obtained at reasonable cost to serve 23,000 acres of land having decreed rights to Powder River flows.

Baker Project Investigations, Oregon, 1934, by E. B. Debler and L. J. Foster, Bureau of Reclamation. Three alternative plans all based upon storage of Powder River flows, were advanced by this report. Plan I contemplated storage of surplus river waters and sale of storage water to owners of 20,000 acres with decreed water rights, but included no provisions for drainage or distribution system improvements. Plan II involved the pooling of all water rights and water supply, equal distribution of storage water to all lands with natural flow rights except those served by the Lilley pumps, provisions for drainage, and reconstruction of the distribution system. Plan III provided for full development of the land and water resources of Baker Valley. In addition to all features of Plan II, this plan suggested pumping from ground water to provide drainage and supplemental water. A small hydro-electric plant was proposed at Mason Dam to supply

power for pumping. No action was taken on this report, because it was the consensus of water users that costs would exceed their repayment ability.

Survey for Flood Control and Other Purposes of Powder River, Oregon, 1941, by C. R. Moore, District Engineer, Corps of Engineers War Department. This report embodied features of the Bureau's 1934 plan for a multipurpose project involving irrigation, drainage, and flood control, but specified a larger reservoir capacity to provide full control of floods. The report stated that flood control benefits anticipated over a 50-year period would total $663,000.

Soil Survey Baker Area Oregon, 1954, by Soil Conservation Service and Oregon Agricultural Experiment Station. This report maps, indentifies, and describes the soil series of Baker Valley.

Baker Project, Oregon, Upper Division, 1954, by the Bureau of Reclamation. This report contemplated storage of Powder River flows in a 100,000 acre-foot capacity Mason Reservoir in Sumpter Valley. Stored water was to be released for diversion to project lands through existing irrigation facilities. The plan did not contemplate construction of any waterways or drainage works. The plan was considered acceptable to local interests, and an irrigation district was formed. However, some of the landowners were opposed to the development and withdrew from the project during the formation of the irrigation district. As a result, it became necessary to revise the project plan around the legally formed irrigation district.

Baker Project, Oregon, Upper Division, 1961, by the Bureau of Reclamation updated and revised the 1954 report. Additional investigations included field checking of land classification, ownerships, rights-of-way, and a field survey for a new pumping plant for the Lilley pump area. Engineering, economic, and water supply studies were also updated and revised and justification established.

Emergency Clearing and Snagging Flood Control Project, Baker, Oregon, 1963, by Corps of Engineers, Department of the Army. This letter report recommended a practical degree of flood protection by channel improvements within the city of Baker.

4.03. PHYSICAL FEATURES OF PROJECT

The major project works are Mason Dam and Reservoir, the main Lilley Pumping Plant, and the Lilley Relift Plant. The Lilley pump area is about 7 miles long and 4 miles wide and consists of 3,080 irrigable acres lying north and east of the Powder River, about 6 miles east of Haines and 9 miles north of Baker. The lands lie on the slopes forming the northeastern boundary of Baker Valley. In addition, a small relift plant serves 670 acres above the main canal.

Mason Dam is in Baker County on the Powder River, about 18 miles upstream from the city of Baker via Oregon State Highway 220, and about 12 miles downstream from the town of Sumpter. The dam axis is in the SE¼ of sec. 24 and the NE¼ of sec. 25, T. 10 S., R. 38 E., W.M. The dam is a sand, gravel, and rockfill structure with a rolled-earth core. The crest length is 920 feet, and maximum height is 182 feet. The dam

contains about 1,000,000 cubic yards of embankment materials. Crest elevation of the dam at 4082 feet and of the fixed crest of the overflow-type spillway at 4070.5 feet provides a total of 11.5 feet for flood flow surcharge and freeboard.

The spillway is a concrete-lined chute on the left abutment, anchored in rock. The chute has an uncontrolled crest, and empties into a concrete stilling basin at the toe of the dam. A concrete bridge is constructed over the spillway section. The width of the spillway is 20 feet and has a total capacity of about 1200 cfs with maximum pool elevation of 4077.25 feet.

The outlet works consist of an intake structure, tunnel, and gate chamber located in the left abutment. The outlet has a discharge capacity of about 550 cfs at water surface elevation 3981.5 feet at the bottom of the irrigation storage space. At the bottom of the joint-use flood control and irrigation space, elevation 4050.63, the outlet capacity is about 800 cfs. The sill of the intake structure is at elevation 3975 and protected by a trashrack. A gate chamber with high-pressure operating and emergency gates is provided in the outlet tunnel. The outlet tunnel from the intake structure to the gate chamber is circular section, 6 feet, 6 inches in diameter. From the gate chamber to the stilling basin, an 8-foot, 9-inch tunnel with flat bottom is provided. A general plan and sections of the dam are shown on Plate 3. Plan, profile, and sections of the spillway and outlet works are shown on Plate 5.

Mason Reservoir occupies the lower half of Sumpter Valley. It is about 5.8 miles long and has 2,450 acres of surface area at normal water

surface elevation. Permanent quarters are provided for a reservoir attendant near the dam. A reservoir map is shown on Plate 4.

4.04. PROSPECTIVE CHANNEL IMPROVEMENTS

It is anticipated that some flooding will occur in Baker even with maximum control of river flows at Mason Dam. It is possible for river flows of flood magnitude to originate in the drainage area between Mason Dam and Baker. Justification for future channel work to alleviate these flood problems will probably await future economic development and collection of additional streamflow records.

SECTION V - FLOOD CONTROL REGULATIONS PROPOSED

5.01. PART 208

Pursuant to the provisions of Section 7 of the Act of Congress approved 22 December 1944 (58 Stat. 890; 33 U.S.C. 709) the following #208____ is hereby prescribed to govern the use and operation of Mason Dam and Reservoir on Powder River, Oregon, for flood control purposes.

#208____ Mason Dam and Reservoir, Powder River, Oregon.

The Bureau of Reclamation, acting through the Baker Valley Irrigation District, shall operate Mason Dam and Reservoir in the interest of flood control, as follows:

a. Storage space in Mason Reservoir up to 38,000 acre-feet between elevations 4050.63 feet and 4070.50 feet will be kept available for flood purposes in accordance with the Flood Control Regulation Schedule currently in force.

b. Releases from Mason Reservoir shall limit the flow of Powder River downstream from Baker, Oregon, to bankfull capacity or less insofar as this can be accomplished by use of the authorized flood control storage space in the reservoir. The bankfull capacity is presently estimated as 500 cubic feet per second.

c. The Flood Control Regulations of this Section are subject to temporary modification by the District Engineer, Corps of Engineers, if found necessary in time of emergency. Request for action on such modifications may be made by any available means of communication, and the action requested by the District Engineer shall be confirmed in

writing under date of the same day to the office of the Regional Director of the Bureau of Reclamation which has jurisdiction of the area in which the project is located.

d. The Flood Control Regulation Schedule for Mason Reservoir currently in force as of the promulgation of this Section is the one dated _____, File No. PW-123-2/1, and is on file in the office of the Chief of Engineers, Department of the Army, Washington, D.C., and in the office of the Commissioner, Bureau of Reclamation, Washington, D.C. Modification of the Flood Control Regulation Schedule for Mason Reservoir may be made from time to time as deemed necessary and approved by the Corps of Engineers and the Bureau of Reclamation. Each such revision shall be effective upon the date specified in the approval thereof by the Chief of Engineers and the Commissioner of Reclamation, and from that date until rescinded shall be in force for purposes of this Section. Copies of the Flood Control Regulation Schedule currently in force shall be kept on file in the office of the District Engineer, Corps of Engineers, and the Regional Director, Bureau of Reclamation, charged with the responsibility of the project, and may be obtained from the respective offices.

e. Nothing in the regulations in this Section shall be construed to require dangerously rapid changes in magnitude of reservoir releases, or that releases be made at rates or in a manner that would be inconsistent with requirements for protecting the dam and the reservoir from major damage.

f. The Bureau of Reclamation shall procure current basic hydrological data, make determinations of the required flood control space reservations to effect the regulation set forth in the objectives prescribed in these regulations, and make calculations of permissible releases from the reservoir as are required to accomplish the flood control objectives prescribed in this Section.

g. The Bureau of Reclamation shall keep the District Engineer, Corps of Engineers, advised of hydrological conditions and other operating criteria which affect the flood control operation. Also, the Bureau of Reclamation shall keep the Watermaster, acting under the control and supervision of the State Engineer of Oregon, currently advised of reservoir releases.

5.02. FLOOD CONTROL REGULATION SCHEDULE

The controlling flood control space reservation at any time is the maximum space requirement as determined from any one of the applicable parts of this schedule. Reservoir releases shall be planned to provide flood control storage space in amounts at least equal to the current flood control space reservation requirements; and to accomplish this with minimum practical rates and fluctuations in discharge. Storage

of water within the space reserved for flood control will be permitted only as required to prevent or reduce flood damages downstream. Control location for flood regulation is Powder River at Baker, Oregon. Insofar as possible under criteria established herein, river flows in Powder River will be controlled to 500 cubic feet per second or less. To the extent possible, reservoir releases in excess of inflow shall not be made when the flow at Baker, Oregon, exceeds 500 cubic feet per second.

Part 1. - Rule Curve Schedule. A minimum flood control space reservation of 17,000 acre-feet between reservoir elevation 4062.4 and 4070.5 shall be provided for the exclusive purpose of controlling floods.

Part 2. - Forecast Schedule. This schedule applies to 21,000 acre-feet of joint use space between elevation 4050.63 and 4062.40 during the snowmelt season from 1 February through 30 June each year. Storage space shall be kept available for flood control purposes in accordance with the Flood Control Reservation Diagram currently in force and a current forecast of reservoir inflow. Reservoir releases will be scheduled to evacuate and refill reservoir space without exceeding the downstream bankfull capacity. The Flood Control Storage Reservation Diagram currently in force is attached, having File No. PW-123-2/2. Forecasts of inflow to Mason Reservoir shall be made according to procedures contained in the Report on Reservoir Regulations for Flood Control, Mason Reservoir, Powder River, Oregon. The Flood Control Storage Reservation Diagram is included in this preliminary report as Plate 22.

5.03 RESERVOIR STORAGE SPACE RESERVATIONS.

Allocation of Mason Reservoir storage to various functions was accomplished during project planning. They are as follows:

Purpose	Elevation	Storage-A.F.
Flood Control	4062.40 to 4070.50	17,000
Joint Use	4050.63 to 4062.40	21,000
Irrigation	3981.50 to 4050.63	52,540
Inactive	below 3981.50	5,000

A total of 38,000 acre-feet of storage space is available for use of controlling floods.

The curves envelope space requirements for control to 450 cfs outflow during the entire period of streamflow record. It was assumed that

control to 450 cfs outflow would be equivalent to 500 cfs at Baker. The 17,000 acre-feet of exclusive flood control space will be considered to partly fulfill the requirements of Plate 22 for flood control space.

5.04. EVACUATION OF FLOOD CONTROL SPACE.

Reservoir evacuation procedures have been studied in detail. Only that amount of space required in excess of the 17,000 acre-feet of exclusive flood control space will require evacuation since the exclusive space will at all times be protected by releasing up to 500 cfs at Baker, and because the exclusive space can be considered to partly fulfill the total space requirement. During the study period from 1939 to 1967, only during the months of April and May was reservoir space in excess of 17,000 acre-feet required by the forecast.

The amount of flood control space required is determined from Plate 22 using the latest forecast of seasonal inflow volume. Deficiencies of flood control space will be corrected by reservoir releases up to 500 cfs at Baker. It shall be the object of such evacuation to obtain the required space within 10 days whenever possible without exceeding 500 cfs at Baker.

Other evacuation procedures studied to provide the space required on 1 April have been found to be less desireable in view of possibility of major storms during March.

5.05. REGULATION OF HISTORICAL FLOODS.

The adequacy of the proposed plan of flood regulation has been tested by application to all historical floods. The derivation of the Flood Control Storage Reservation Diagram included modification to provide

complete regulation of historical floods even with maximum forecast errors. Since 1904, there have been 6 floods which would have required some reservoir space in addition to the 17,000 acre-feet of exclusive flood control space. They were 1904, 1910, 1921, 1956, 1958, and 1965. Regulation of these floods, except 1921, are shown on Plates 14 through 18, Records of the 1921 flood are not available for the gaging station near Baker.

5.06. REGULATION OF VERY LARGE FLOODS

A standard project flood for Mason Reservoir (Phillips Lake) has not been derived. In lieu thereof, an estimated 1,000-year frequency flood was derived for testing the adequacy of the plan of regulation. It results from combining the duration-discharges shown on Plate 19 for the indicated 1,000-year recurrence interval. The timing of combinations is controlled by the historical average beginning dates of the maximum annual 1-day, 3-day, 10-day, 30-day, 60-day, and 90-day volumes. Regulation of the 1,000-year flood hydrograph is shown on Plate 23. For this regulation, the entire 21,000 acre-feet of joint-use space was evacuated during February and reservoir outflow was controlled to 450 cfs.

5.07. REGULATION OF SPILLWAY DESIGN FLOOD

The USBR-derived spillway design flood for Mason Dam has a peak discharge of 9,560 cfs and a 15-day volume of 69,400 acre-feet. The hydrograph and its regulation are shown on Plate 20. The regulation assumes that 17,000 acre-feet of exclusive flood control space is available at the

beginning of the flood, and only 450 cfs is released through the outlets prior to the time that the reservoir level exceeds the spillway crest. The resulting maximum discharge is 2,085 cfs, of which 1,200 cfs passes over the spillway and 885 cfs through the outlets. The resulting maximum pool level is 4077.25 feet.

5-08. FORECAST PROCEDURE.

Implementation of the operating plan depends upon runoff forecasts, especially in the years of large runoff when more than 17,000 acre-feet of flood control space will be required. Because much of the runoff above Mason Dam results from melting of the accumulated winter and spring snowpack, forecasts of runoff volume can be made with a reasonable degree of accuracy. In accordance with the operating plan, the Bureau of Reclamation will make forecasts of seasonal volume runoff for operation of reservoirs periodically commencing with 1 January each year after consultation with the Corps of Engineers. The forecasting equations developed by the Bureau are included in Appendix B of this Manual.

6.02. DEVIATIONS FROM PLANNING ASSUMPTIONS AND THEIR EFFECTS.

Section V of this report proposes Flood Control Regulations and Schedule for operation of Mason Reservoir (Phillips Lake). Paragraph 6.01 above presents the assumptions which served as a basis for allocation of flood control benefits. Several deviations from the planning assumptions have occurred. Those deviations and their effects are discussed in this paragraph.

a. Mason Dam Design. Mason Dam was constructed essentially as shown on Plates 3 and 5. This project is significantly different from that proposed on Plate 21 which was assumed as a basis for benefit evaluation. Some of the more flexible features of the project were again revised in September 1968. Those changes most significant for controlling floods are shown in the following tabulation:

Feature	Planned 1961	As-Built 1965	Revised Sept 1968
Top of Dam	4085.0 msl	4082.0 msl	—
Crest of Spillway	4071.0 msl	4070.5 msl	—
Maximum pool level	4078.6 msl	4076.0 msl	4077.25 msl
Freeboard above max. pool	6.4 feet	6.0 feet	4.75 feet
Width of spillway	50.0 feet	20.0 feet	- -
Spillway Capacity (Max. pool)	3,760 cfs	900 cfs	1200 cfs
Surcharge capacity	17,000 a.f.	12,870 a.f.	16,000 a.f.
Outlet capacity (Max. pool)	1,000 cfs	870 cfs	885 cfs
Reservoir capacity (Max. pool)	117,000 a.f.	103,385 a.f.	106,500 a.f.
Reservoir capacity (full pool)	100,000 a.f.	90,519 a.f.	—

d. Flood Control Benefits. A comparison of the degree of flood regulation expected by use of the proposed Part 208 Regulations and the degree expected from original assumptions for flood control benefit allocation is shown on Plate 6. The red curve shows the regulated discharge frequencies expected to result from the proposed Part 208 Regulations. It was drawn on the basis of the following 3 considerations:

(1) All historical floods of about 50 years record have been shown to regulate to 450 cfs or less at the dam.

(2) The 1,000-year frequency flood has been shown to regulate to 450 cfs at the dam. 520 on Curve (Red)

(3) The maximum capacity of the dam to pass water at maximum pool elevation is limited to 2,085 cfs.

No direct evaluation of flood control benefits resulting from the revised regulated frequency curve has been made. However, it is obvious that the flood control benefits resulting from the proposed Part 208 Regulations would substantially exceed the amount allocated in 1958.

e. Hydrologic Reporting Network. The basic objective of the flood regulation program at Mason Dam is to control flows in Powder River at Baker, Oregon to 500 cfs or less. In order to achieve such regulation, a gaging facility at Baker is required to ascertain the amount of discharge in the river at the control point. Except for the need of a stream gaging station at Baker, the hydrologic reporting network shown on Plate 1 is considered adequate to implement the Flood Control Regulations The Bureau of Reclamation is pursuing establishment of a stream gaging station at Baker through cooperation with the Baker Valley Irrigation District and the State of Oregon.

SECTION VII - WATER CONTROL MANAGEMENT

7-01. General. Flood Control and irrigation interests affected by the regulation of the of the Mason Project Powder River reservoir, Phillips Lake, requires close cooperation and coordination between (1) the Corps of Engineers and the Bureau of Reclamation (USBR), (2) the USBR and Water District 8 irrigation district (Baker Valley Irrigation District), and (3) the irrigation district and the State of Oregon Water Resources Department. The administration of regulating programs will at all times reflect due consideration of the integrated interests involved.

7-02. Bureau of Reclamation. The Regional Office, Region 1, Bureau of Reclamation in Boise, Idaho, is directly responsible for the operation of the Mason Project Powder River reservoir (Phillips Lake) to accomplish the flood control and refill regulation objectives. These objectives will at all times be in accordance with the criteria set forth in this Manual, Section V - Flood Control Regulations Proposed (Paragraph 5-01 - Part 208 and Paragraph 5-02 - Flood Control Regulation Schedule). The Water Resources and Operations Branch Chief is responsible for the coordination of flood control and refill regulation for all Bureau reservoirs in Region 1. The Central Snake Projects Office is responsible for implementing the flood control and refill regulation plans for Phillips Lake reservoir on a day-to-day basis during the flood season. The Central Snake Projects Superintendent and his staff is also responsible for the operation and maintenance of the Mason Project dam and reservoir.

Responsibilities of the Bureau of Reclamation for flood control include:

1. Maintenance of adequate hydrologic reporting network.

2. Collection and dissemination of hydrologic and reservoir data.

3. Preparation of periodic forecasts of runoff for the period and establish details of the flood control evacuation and refill schedules.

4. Passing on runoff volume forecasts and provide flood control regulation instructions via the Central Snake Projects Office to the Baker Valley Irrigation District for making releases from the Mason reservoir in order to conform with flood control criteria in this Manual or as these criteria may be modified by agreement between the Corps of Engineers and Bureau of Reclamation.

and also includes areas of Union, Wallowa, and Malheur Counties.

7-06. Other Agencies. While not involved with project regulation, the National Weather Service, Soil Conservation Service, and the Geological Survey collect support data (precipitation and temperature, snow survey measurements, and streamflows) under contract with the regulating agencies. This data is essential for the regulation and these data collection programs must be supported and continued.

7-07. Public Information. The regulating agencies have an obligation to provide pertinent regulation information to the Oregon Department of Water Resources so that they can routinely monitor the regulation and evaluate the effectiveness of regulation. When significant regulation and release changes are necessary, the regulating agencies have an obligation to provide public information news releases.

TABLE 1
Climatological Data

Average Temperatures

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	De
Baker KBKR	25.6	30.3	37.5	45.8	53.1	59.0	67.8	65.7	58.5	48.6	36.2	29.

Average Precipitation

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov.	De
Baker KBKR	0.98	0.88	1.05	0.87	1.11	1.31	0.48	0.38	0.60	0.82	1.00	1.0
Rock Creek	2.64	2.42	1.89	1.49	1.97	1.98	0.64	0.66	0.77	1.67	2.21	2.8

TABLE 2

REPRESENTATIVE SNOW COURSE-DATA

Snow Course	Map No.	Elevation	Years of Record and Average Water Equivalent — Inches									
			January 1st		February 1st		March 1st		April 1st		May 1st	
			Years	W. E.	Years	W.E.	Years	W. E.	Years	W. E.	Years	W.E.
Gold Center	1	5340	—	—	25	8.48	25	11.54	26	12.27	8	2.38
Bourne	2	5800	—	—	25	10.47	28	14.99	29	15.96	8	7.19
Goodrich Lake	3	6775	—	—	10	27.06	13	30.24	14	36.59	—	—
Eilertson Meadows	4	5400	22	4.42	27	8.17	27	10.69	30	11.82	8	4.89
Anthony Lake	5	7125	26	10.97	24	18.03	25	23.65	29	29.04	11	30.24
Tipton	6	5100	12	3.62	26	7.45	21	9.88	28	9.93	12	1.40
Dooley Mtn.	7	5430	27	3.41	27	6.00	27	8.17	27	8.16	11	1.73

Note: Records are not always consecutive or concurrent.

PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
3981.5	0.	3.	6.	8.	11.	14.	16.	19.	22.	24.	261.
3981.6	26.	29.	32.	35.	37.	40.	42.	45.	48.	50.	262.
3981.7	52.	55.	58.	61.	63.	66.	69.	71.	74.	76.	263.
3981.8	78.	82.	84.	87.	89.	92.	95.	97.	100.	102.	264.
3981.9	105.	108.	110.	113.	116.	118.	121.	123.	126.	129.	265.
3982.0	131.	134.	137.	139.	142.	145.	147.	150.	153.	156.	265.
3982.1	158.	161.	164.	166.	169.	172.	175.	177.	180.	183.	267.
3982.2	185.	188.	191.	194.	196.	199.	202.	204.	207.	210.	268.
3982.3	212.	215.	218.	221.	223.	226.	229.	231.	234.	237.	269.
3982.4	239.	242.	245.	248.	250.	253.	256.	259.	261.	264.	270.
3982.5	266.	269.	272.	275.	278.	280.	283.	286.	288.	291.	271.
3982.6	293.	296.	299.	302.	305.	307.	310.	313.	315.	318.	272.
3982.7	320.	324.	326.	329.	332.	334.	337.	340.	343.	345.	273.
3982.8	347.	351.	353.	356.	359.	362.	364.	367.	370.	372.	274.
3982.9	375.	378.	380.	383.	386.	389.	391.	394.	397.	399.	275.
3983.0	402.	405.	408.	411.	413.	416.	419.	422.	425.	428.	276.
3983.1	430.	433.	436.	439.	442.	445.	447.	450.	453.	456.	278.
3983.2	458.	461.	464.	467.	470.	473.	476.	478.	481.	484.	279.
3983.3	486.	490.	493.	495.	498.	501.	504.	507.	510.	512.	280.
3983.4	515.	518.	521.	524.	526.	529.	532.	535.	538.	541.	281.
3983.5	543.	546.	549.	552.	555.	558.	560.	563.	566.	569.	283.
3983.6	571.	574.	577.	580.	583.	586.	589.	591.	594.	597.	284.
3983.7	599.	603.	606.	608.	611.	614.	617.	620.	623.	625.	285.
3983.8	628.	631.	634.	637.	639.	642.	645.	648.	651.	654.	286.
3983.9	656.	659.	662.	665.	668.	671.	673.	676.	679.	682.	287.
3984.0	684.	688.	691.	694.	696.	699.	702.	705.	708.	711.	289.
3984.1	714.	717.	720.	723.	726.	729.	732.	735.	738.	741.	290.
3984.2	743.	747.	750.	752.	755.	758.	761.	764.	767.	770.	291.
3984.3	773.	776.	779.	782.	785.	788.	791.	794.	797.	800.	292.
3984.4	802.	806.	808.	811.	814.	817.	820.	823.	826.	829.	294.
3984.5	832.	835.	838.	841.	844.	847.	850.	853.	856.	859.	295.
3984.6	861.	865.	867.	870.	873.	876.	879.	882.	885.	888.	296.
3984.7	891.	894.	897.	900.	903.	906.	909.	912.	915.	918.	297.
3984.8	920.	923.	926.	929.	932.	935.	938.	941.	944.	947.	299.
3984.9	950.	953.	956.	959.	962.	965.	968.	971.	974.	977.	300.

PHILLIPS RF

ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
3985.0	979.	983.	986.	989.	992.	995.	998.	1001.	1004.	1007.	301.
3985.1	1010.	1013.	1016.	1019.	1022.	1025.	1028.	1032.	1035.	1038.	302.
3985.2	1040.	1044.	1047.	1050.	1053.	1056.	1059.	1062.	1065.	1068.	303.
3985.3	1071.	1074.	1077.	1080.	1084.	1087.	1090.	1093.	1096.	1099.	304.
3985.4	1101.	1105.	1108.	1111.	1114.	1117.	1120.	1123.	1126.	1129.	305.
3985.5	1132.	1136.	1139.	1142.	1145.	1148.	1151.	1154.	1157.	1160.	306.
3985.6	1163.	1166.	1169.	1172.	1175.	1178.	1181.	1185.	1188.	1191.	307.
3985.7	1193.	1197.	1200.	1203.	1206.	1209.	1212.	1215.	1218.	1221.	308.
3985.8	1224.	1227.	1230.	1233.	1237.	1240.	1243.	1246.	1249.	1252.	309.
3985.9	1254.	1258.	1261.	1264.	1267.	1270.	1273.	1276.	1279.	1282.	310.
3986.0	1285.	1289.	1292.	1295.	1298.	1301.	1304.	1308.	1311.	1314.	311.
3986.1	1317.	1320.	1323.	1327.	1330.	1333.	1336.	1339.	1342.	1346.	312.
3986.2	1348.	1352.	1355.	1358.	1361.	1365.	1368.	1371.	1374.	1377.	313.
3986.3	1380.	1383.	1387.	1390.	1393.	1396.	1399.	1402.	1406.	1409.	314.
3986.4	1411.	1415.	1418.	1421.	1425.	1428.	1431.	1434.	1437.	1440.	315.
3986.5	1443.	1447.	1450.	1453.	1456.	1459.	1463.	1466.	1469.	1472.	316.
3986.6	1475.	1478.	1482.	1485.	1488.	1491.	1494.	1497.	1500.	1504.	317.
3986.7	1506.	1510.	1513.	1516.	1519.	1523.	1526.	1529.	1532.	1535.	318.
3986.8	1538.	1542.	1545.	1548.	1551.	1554.	1557.	1561.	1564.	1567.	319.
3986.9	1570.	1573.	1576.	1580.	1583.	1586.	1589.	1592.	1595.	1599.	320.
3987.0	1601.	1605.	1608.	1611.	1615.	1618.	1621.	1625.	1628.	1631.	321.
3987.1	1634.	1638.	1641.	1644.	1647.	1651.	1654.	1657.	1660.	1664.	322.
3987.2	1667.	1670.	1674.	1677.	1680.	1683.	1687.	1690.	1693.	1696.	324.
3987.3	1699.	1703.	1706.	1709.	1713.	1716.	1719.	1723.	1726.	1729.	325.
3987.4	1732.	1736.	1739.	1742.	1745.	1749.	1752.	1755.	1759.	1762.	326.
3987.5	1765.	1768.	1772.	1775.	1778.	1781.	1785.	1788.	1791.	1794.	327.
3987.6	1797.	1801.	1804.	1808.	1811.	1814.	1817.	1821.	1824.	1827.	328.
3987.7	1830.	1834.	1837.	1840.	1843.	1847.	1850.	1853.	1857.	1860.	329.
3987.8	1863.	1866.	1870.	1873.	1876.	1879.	1883.	1886.	1889.	1892.	330.
3987.9	1895.	1899.	1902.	1906.	1909.	1912.	1915.	1919.	1922.	1925.	331.
3988.0	1928.	1932.	1935.	1939.	1942.	1945.	1949.	1952.	1955.	1959.	332.
3988.1	1962.	1966.	1969.	1972.	1976.	1979.	1982.	1986.	1989.	1993.	333.
3988.2	1995.	1999.	2003.	2006.	2009.	2013.	2016.	2020.	2023.	2026.	334.
3988.3	2029.	2033.	2036.	2040.	2043.	2047.	2050.	2053.	2057.	2060.	335.
3988.4	2063.	2067.	2070.	2074.	2077.	2080.	2084.	2087.	2090.	2094.	336.
3988.5	2097.	2101.	2104.	2107.	2111.	2114.	2117.	2121.	2124.	2127.	337.
3988.6	2130.	2134.	2138.	2141.	2144.	2148.	2151.	2154.	2158.	2161.	338.
3988.7	2164.	2168.	2171.	2175.	2178.	2181.	2185.	2188.	2192.	2195.	340.
3988.8	2198.	2202.	2205.	2208.	2212.	2215.	2219.	2222.	2225.	2229.	341.
3988.9	2232.	2235.	2239.	2242.	2246.	2249.	2252.	2256.	2259.	2262.	342.

TABLE 3 Page 2 of 2

PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET

MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
3989.0	2265.	2269.	2273.	2276.	2280.	2283.	2287.	2290.	2294.	2297.	343.
3989.1	2300.	2304.	2308.	2311.	2315.	2318.	2321.	2325.	2328.	2332.	344.
3989.2	2335.	2339.	2342.	2346.	2349.	2353.	2356.	2360.	2363.	2367.	345.
3989.3	2370.	2374.	2377.	2381.	2384.	2388.	2391.	2394.	2398.	2401.	346.
3989.4	2404.	2408.	2412.	2415.	2419.	2422.	2426.	2429.	2433.	2436.	347.
3989.5	2439.	2443.	2447.	2450.	2454.	2457.	2461.	2464.	2468.	2471.	348.
3989.6	2474.	2478.	2481.	2485.	2488.	2492.	2495.	2499.	2502.	2506.	349.
3989.7	2509.	2513.	2516.	2520.	2523.	2527.	2530.	2534.	2537.	2541.	350.
3989.8	2544.	2547.	2551.	2554.	2558.	2561.	2565.	2568.	2572.	2575.	351.
3989.9	2578.	2582.	2586.	2589.	2593.	2596.	2600.	2603.	2607.	2610.	352.
3990.0	2613.	2617.	2621.	2624.	2628.	2631.	2635.	2639.	2642.	2646.	353.
3990.1	2649.	2653.	2656.	2660.	2664.	2667.	2671.	2674.	2678.	2681.	354.
3990.2	2685.	2689.	2692.	2696.	2699.	2703.	2707.	2710.	2714.	2717.	355.
3990.3	2720.	2724.	2728.	2732.	2735.	2739.	2742.	2746.	2749.	2753.	356.
3990.4	2756.	2760.	2764.	2767.	2771.	2774.	2778.	2782.	2785.	2789.	357.
3990.5	2792.	2796.	2799.	2803.	2807.	2810.	2814.	2817.	2821.	2825.	358.
3990.6	2828.	2832.	2835.	2839.	2842.	2846.	2850.	2853.	2857.	2860.	359.
3990.7	2863.	2867.	2871.	2875.	2878.	2882.	2885.	2889.	2892.	2896.	359.
3990.8	2899.	2903.	2907.	2910.	2914.	2917.	2921.	2925.	2928.	2932.	360.
3990.9	2935.	2939.	2943.	2946.	2950.	2953.	2957.	2960.	2964.	2968.	361.
3991.0	2971.	2975.	2978.	2982.	2986.	2989.	2993.	2997.	3000.	3004.	362.
3991.1	3007.	3011.	3015.	3019.	3022.	3026.	3030.	3033.	3037.	3041.	363.
3991.2	3044.	3048.	3052.	3055.	3059.	3063.	3067.	3070.	3074.	3078.	364.
3991.3	3081.	3085.	3089.	3092.	3096.	3100.	3103.	3107.	3111.	3114.	365.
3991.4	3117.	3122.	3125.	3129.	3133.	3136.	3140.	3144.	3147.	3151.	366.
3991.5	3154.	3158.	3162.	3166.	3169.	3173.	3177.	3180.	3184.	3188.	367.
3991.6	3191.	3195.	3199.	3202.	3206.	3210.	3213.	3217.	3221.	3224.	368.
3991.7	3227.	3232.	3235.	3239.	3243.	3246.	3250.	3254.	3257.	3261.	369.
3991.8	3264.	3268.	3272.	3276.	3279.	3283.	3287.	3290.	3294.	3298.	370.
3991.9	3301.	3305.	3309.	3312.	3316.	3320.	3323.	3327.	3331.	3334.	371.
3992.0	3337.	3342.	3346.	3349.	3353.	3357.	3361.	3364.	3368.	3372.	371.
3992.1	3375.	3379.	3383.	3387.	3391.	3394.	3398.	3402.	3406.	3409.	372.
3992.2	3413.	3417.	3421.	3424.	3428.	3432.	3436.	3439.	3443.	3447.	373.
3992.3	3450.	3455.	3458.	3462.	3466.	3470.	3473.	3477.	3481.	3485.	374.
3992.4	3488.	3492.	3496.	3500.	3503.	3507.	3511.	3515.	3518.	3522.	375.
3992.5	3525.	3530.	3533.	3537.	3541.	3545.	3549.	3552.	3556.	3560.	376.
3992.6	3563.	3567.	3571.	3575.	3579.	3582.	3586.	3590.	3594.	3597.	377.
3992.7	3601.	3605.	3609.	3612.	3616.	3620.	3624.	3627.	3631.	3635.	378.
3992.8	3638.	3642.	3646.	3650.	3654.						

PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
3993.0	3713.	3718.	3722.	3725.	3729.	3733.	3737.	3741.	3745.	3749.	380.
3993.1	3752.	3756.	3760.	3764.	3768.	3772.	3776.	3779.	3783.	3787.	381.
3993.2	3790.	3795.	3799.	3802.	3806.	3810.	3814.	3818.	3822.	3826.	382.
3993.3	3829.	3833.	3837.	3841.	3845.	3849.	3853.	3856.	3860.	3864.	383.
3993.4	3867.	3872.	3876.	3879.	3883.	3887.	3891.	3895.	3899.	3903.	384.
3993.5	3906.	3910.	3914.	3918.	3922.	3926.	3929.	3933.	3937.	3941.	385.
3993.6	3944.	3949.	3953.	3956.	3960.	3964.	3968.	3972.	3976.	3980.	386.
3993.7	3983.	3987.	3991.	3995.	3999.	4003.	4006.	4010.	4014.	4018.	387.
3993.8	4021.	4026.	4030.	4033.	4037.	4041.	4045.	4049.	4053.	4057.	388.
3993.9	4060.	4064.	4068.	4072.	4076.	4080.	4083.	4087.	4091.	4095.	389.
3994.0	4098.	4103.	4107.	4111.	4115.	4119.	4123.	4126.	4130.	4134.	390.
3994.1	4138.	4142.	4146.	4150.	4154.	4158.	4162.	4166.	4170.	4174.	390.
3994.2	4177.	4182.	4186.	4190.	4194.	4197.	4201.	4205.	4209.	4213.	391.
3994.3	4217.	4221.	4225.	4229.	4233.	4237.	4241.	4245.	4249.	4253.	392.
3994.4	4256.	4261.	4264.	4268.	4272.	4276.	4280.	4284.	4288.	4292.	393.
3994.5	4296.	4300.	4304.	4308.	4312.	4316.	4320.	4324.	4328.	4331.	394.
3994.6	4335.	4339.	4343.	4347.	4351.	4355.	4359.	4363.	4367.	4371.	395.
3994.7	4374.	4379.	4383.	4387.	4391.	4395.	4399.	4402.	4406.	4410.	396.
3994.8	4414.	4418.	4422.	4426.	4430.	4434.	4438.	4442.	4446.	4450.	397.
3994.9	4453.	4458.	4462.	4466.	4469.	4473.	4477.	4481.	4485.	4489.	398.
3995.0	4493.	4497.	4501.	4505.	4509.	4513.	4517.	4521.	4525.	4530.	399.
3995.1	4533.	4538.	4542.	4546.	4550.	4554.	4558.	4562.	4566.	4570.	400.
3995.2	4573.	4578.	4582.	4586.	4590.	4594.	4598.	4602.	4606.	4610.	401.
3995.3	4614.	4618.	4622.	4626.	4631.	4635.	4639.	4643.	4647.	4651.	402.
3995.4	4654.	4659.	4663.	4667.	4671.	4675.	4679.	4683.	4687.	4691.	403.
3995.5	4695.	4699.	4703.	4707.	4711.	4715.	4719.	4723.	4727.	4732.	404.
3995.6	4735.	4740.	4744.	4748.	4752.	4756.	4760.	4764.	4768.	4772.	405.
3995.7	4775.	4780.	4784.	4788.	4792.	4796.	4800.	4804.	4808.	4812.	406.
3995.8	4816.	4820.	4824.	4828.	4833.	4837.	4841.	4845.	4849.	4853.	407.
3995.9	4856.	4861.	4865.	4869.	4873.	4877.	4881.	4885.	4889.	4893.	408.
3996.0	4897.	4901.	4905.	4910.	4914.	4918.	4922.	4926.	4930.	4934.	409.
3996.1	4938.	4943.	4947.	4951.	4955.	4959.	4963.	4968.	4972.	4976.	410.
3996.2	4980.	4984.	4988.	4992.	4997.	5001.	5005.	5009.	5013.	5017.	411.
3996.3	5021.	5026.	5030.	5034.	5038.	5042.	5046.	5050.	5055.	5059.	412.
3996.4	5062.	5067.	5071.	5075.	5079.	5084.	5088.	5092.	5096.	5100.	413.
3996.5	5104.	5108.	5113.	5117.	5121.	5125.	5129.	5133.	5137.	5142.	414.
3996.6	5145.	5150.	5154.	5158.	5162.	5166.	5171.	5175.	5179.	5183.	415.
3996.7	5187.	5191.	5195.	5200.	5204.	5208.	5212.	5216.	5220.	5224.	416.
3996.8	5228.	5233.	5237.	5241.	5245.	5249.	5253.				

TABLE 3
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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET

MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
3997.0	5311.	5316.	5320.	5324.	5328.	5333.	5337.	5341.	5345.	5350.	420.
3997.1	5353.	5358.	5362.	5367.	5371.	5375.	5379.	5384.	5388.	5392.	421.
3997.2	5396.	5401.	5405.	5409.	5413.	5418.	5422.	5426.	5430.	5435.	422.
3997.3	5438.	5443.	5447.	5452.	5456.	5460.	5464.	5469.	5473.	5477.	423.
3997.4	5481.	5486.	5490.	5494.	5498.	5503.	5507.	5511.	5515.	5520.	424.
3997.5	5523.	5528.	5532.	5537.	5541.	5545.	5549.	5554.	5558.	5562.	425.
3997.6	5566.	5571.	5575.	5579.	5583.	5588.	5592.	5596.	5600.	5605.	426.
3997.7	5608.	5613.	5617.	5622.	5626.	5630.	5634.	5639.	5643.	5647.	427.
3997.8	5651.	5656.	5660.	5664.	5668.	5673.	5677.	5681.	5685.	5690.	428.
3997.9	5693.	5698.	5702.	5707.	5711.	5715.	5719.	5724.	5728.	5732.	429.
3998.0	5736.	5741.	5745.	5749.	5754.	5758.	5762.	5767.	5771.	5775.	430.
3998.1	5779.	5784.	5789.	5793.	5797.	5802.	5806.	5810.	5815.	5819.	431.
3998.2	5823.	5828.	5832.	5836.	5841.	5845.	5849.	5854.	5858.	5863.	432.
3998.3	5866.	5871.	5876.	5880.	5884.	5889.	5893.	5897.	5902.	5906.	433.
3998.4	5910.	5915.	5919.	5923.	5928.	5932.	5937.	5941.	5945.	5950.	434.
3998.5	5953.	5958.	5963.	5967.	5971.	5976.	5980.	5984.	5989.	5993.	435.
3998.6	5997.	6002.	6006.	6011.	6015.	6019.	6024.	6028.	6032.	6037.	436.
3998.7	6041.	6045.	6050.	6054.	6058.	6063.	6067.	6071.	6076.	6080.	437.
3998.8	6084.	6089.	6093.	6098.	6102.	6106.	6111.	6115.	6119.	6124.	438.
3998.9	6128.	6132.	6137.	6141.	6145.	6150.	6154.	6159.	6163.	6167.	439.
3999.0	6171.	6176.	6181.	6185.	6189.	6194.	6198.	6203.	6207.	6212.	441.
3999.1	6216.	6221.	6225.	6230.	6234.	6238.	6243.	6247.	6252.	6256.	441.
3999.2	6260.	6265.	6270.	6274.	6279.	6283.	6287.	6292.	6296.	6301.	442.
3999.3	6305.	6310.	6314.	6319.	6323.	6328.	6332.	6336.	6341.	6345.	443.
3999.4	6349.	6354.	6359.	6363.	6368.	6372.	6377.	6381.	6385.	6390.	444.
3999.5	6394.	6399.	6403.	6408.	6412.	6417.	6421.	6426.	6430.	6434.	445.
3999.6	6438.	6443.	6448.	6452.	6457.	6461.	6466.	6470.	6475.	6479.	446.
3999.7	6483.	6488.	6492.	6497.	6501.	6506.	6510.	6515.	6519.	6524.	447.
3999.8	6527.	6532.	6537.	6541.	6546.	6550.	6555.	6559.	6564.	6568.	448.
3999.9	6572.	6577.	6581.	6586.	6590.	6595.	6599.	6604.	6608.	6613.	449.
4000.0	6617.	6622.	6626.	6631.	6635.	6640.	6644.	6649.	6653.	6658.	450.
4000.1	6662.	6667.	6672.	6676.	6681.	6685.	6690.	6694.	6699.	6703.	451.
4000.2	6708.	6713.	6717.	6722.	6726.	6731.	6735.	6740.	6744.	6749.	452.
4000.3	6753.	6758.	6763.	6767.	6772.	6776.	6781.	6785.	6790.	6794.	453.
4000.4	6799.	6804.	6808.	6813.	6817.	6822.	6826.	6831.	6835.	6840.	454.
4000.5	6844.	6849.	6854.	6858.	6863.	6867.	6872.	6876.	6881.	6885.	455.
4000.6	6889.	6895.	6899.	6904.	6908.	6913.	6917.	6922.	6926.	6931.	456.
4000.7	6935.	6940.	6945.	6949.	6954.	6958.	6963.	6967.	6972.	6976.	457.
4000.8	6980.	6986.	6990.								

TABLE 3
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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4001.0	7071.	7077.	7081.	7086.	7090.	7095.	7100.	7104.	7109.	7114.	459.
4001.1	7118.	7123.	7128.	7132.	7137.	7141.	7146.	7151.	7155.	7160.	460.
4001.2	7164.	7169.	7174.	7179.	7183.	7188.	7192.	7197.	7202.	7206.	461.
4001.3	7211.	7216.	7220.	7225.	7230.	7234.	7239.	7243.	7248.	7253.	462.
4001.4	7257.	7262.	7267.	7271.	7276.	7281.	7285.	7290.	7294.	7299.	463.
4001.5	7303.	7308.	7313.	7318.	7322.	7327.	7332.	7336.	7341.	7345.	464.
4001.6	7350.	7355.	7359.	7364.	7369.	7373.	7378.	7383.	7387.	7392.	464.
4001.7	7396.	7401.	7406.	7410.	7415.	7420.	7424.	7429.	7434.	7438.	465.
4001.8	7442.	7447.	7452.	7457.	7461.	7466.	7471.	7475.	7480.	7485.	466.
4001.9	7489.	7494.	7498.	7503.	7508.	7512.	7517.	7522.	7526.	7531.	467.
4002.0	7535.	7540.	7545.	7550.	7554.	7559.	7564.	7569.	7573.	7578.	468.
4002.1	7582.	7587.	7592.	7597.	7602.	7606.	7611.	7616.	7620.	7625.	469.
4002.2	7629.	7635.	7639.	7644.	7649.	7653.	7658.	7663.	7668.	7672.	469.
4002.3	7677.	7682.	7686.	7691.	7696.	7701.	7705.	7710.	7715.	7720.	470.
4002.4	7724.	7729.	7734.	7738.	7743.	7748.	7753.	7757.	7762.	7767.	471.
4002.5	7771.	7776.	7781.	7786.	7790.	7795.	7800.	7804.	7809.	7814.	472.
4002.6	7818.	7823.	7828.	7833.	7837.	7842.	7847.	7852.	7856.	7861.	473.
4002.7	7865.	7870.	7875.	7880.	7885.	7889.	7894.	7899.	7904.	7908.	473.
4002.8	7912.	7918.	7922.	7927.	7932.	7937.	7941.	7946.	7951.	7955.	474.
4002.9	7960.	7965.	7970.	7974.	7979.	7984.	7988.	7993.	7998.	8003.	475.
4003.0	8007.	8012.	8017.	8022.	8027.	8031.	8036.	8041.	8046.	8051.	476.
4003.1	8055.	8060.	8065.	8070.	8075.	8079.	8084.	8089.	8094.	8099.	477.
4003.2	8103.	8108.	8113.	8118.	8123.	8127.	8132.	8137.	8142.	8147.	478.
4003.3	8151.	8156.	8161.	8166.	8171.	8175.	8180.	8185.	8190.	8195.	479.
4003.4	8199.	8204.	8209.	8214.	8219.	8223.	8228.	8233.	8238.	8243.	479.
4003.5	8247.	8252.	8257.	8262.	8267.	8271.	8276.	8281.	8286.	8291.	480.
4003.6	8295.	8300.	8305.	8310.	8315.	8320.	8324.	8329.	8334.	8339.	481.
4003.7	8343.	8348.	8353.	8358.	8363.	8368.	8372.	8377.	8382.	8387.	482.
4003.8	8391.	8396.	8401.	8406.	8411.	8416.	8420.	8425.	8430.	8435.	483.
4003.9	8439.	8444.	8449.	8454.	8459.	8464.	8468.	8473.	8478.	8483.	484.
4004.0	8487.	8493.	8497.	8502.	8507.	8512.	8517.	8522.	8527.	8532.	485.
4004.1	8536.	8541.	8546.	8551.	8556.	8561.	8566.	8571.	8576.	8581.	486.
4004.2	8585.	8590.	8595.	8600.	8605.	8610.	8615.	8620.	8625.	8630.	487.
4004.3	8634.	8639.	8644.	8649.	8654.	8659.	8664.	8669.	8674.	8679.	488.
4004.4	8683.	8688.	8693.	8698.	8703.	8708.	8713.	8718.	8723.	8727.	489.
4004.5	8732.	8737.	8742.	8747.	8752.	8757.	8762.	8767.	8772.	8776.	490.
4004.6	8781.	8786.	8791.	8796.	8801.	8806.	8811.	8816.	8821.	8825.	491.
4004.7	8830.	8835.	8840.	8845.	8850.	8855.	8860.	8865.	8869.	8874.	492.

TABLE 3
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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4005.0	8977.	8982.	8987.	8992.	8997.	9002.	9007.	9012.	9017.	9022.	495.
4005.1	9027.	9032.	9037.	9042.	9047.	9052.	9057.	9062.	9067.	9072.	496.
4005.2	9077.	9082.	9087.	9092.	9097.	9102.	9107.	9112.	9117.	9122.	497.
4005.3	9127.	9132.	9137.	9142.	9147.	9152.	9157.	9162.	9167.	9172.	498.
4005.4	9177.	9182.	9187.	9192.	9197.	9202.	9207.	9212.	9217.	9222.	499.
4005.5	9227.	9232.	9237.	9242.	9247.	9252.	9257.	9262.	9267.	9272.	500.
4005.6	9277.	9282.	9287.	9292.	9297.	9302.	9307.	9312.	9317.	9322.	501.
4005.7	9327.	9332.	9337.	9342.	9347.	9352.	9357.	9362.	9367.	9372.	502.
4005.8	9377.	9382.	9387.	9392.	9397.	9402.	9407.	9412.	9417.	9422.	503.
4005.9	9427.	9432.	9437.	9442.	9447.	9452.	9457.	9462.	9467.	9472.	504.
4006.0	9477.	9482.	9487.	9493.	9498.	9503.	9508.	9513.	9518.	9523.	506.
4006.1	9528.	9533.	9539.	9544.	9549.	9554.	9559.	9564.	9569.	9574.	507.
4006.2	9579.	9585.	9590.	9595.	9600.	9605.	9610.	9615.	9620.	9626.	508.
4006.3	9630.	9636.	9641.	9646.	9651.	9656.	9661.	9666.	9672.	9677.	509.
4006.4	9681.	9687.	9692.	9697.	9702.	9707.	9712.	9718.	9723.	9728.	510.
4006.5	9732.	9738.	9743.	9748.	9753.	9759.	9764.	9769.	9774.	9779.	511.
4006.6	9784.	9789.	9794.	9799.	9805.	9810.	9815.	9820.	9825.	9830.	513.
4006.7	9835.	9840.	9845.	9851.	9856.	9861.	9866.	9871.	9876.	9881.	514.
4006.8	9886.	9892.	9897.	9902.	9907.	9912.	9917.	9922.	9927.	9932.	515.
4006.9	9937.	9943.	9948.	9953.	9958.	9963.	9968.	9973.	9978.	9984.	516.
4007.0	9988.	9994.	9999.	10004.	10010.	10015.	10020.	10025.	10031.	10036.	517.
4007.1	10041.	10046.	10052.	10057.	10062.	10067.	10072.	10078.	10083.	10088.	519.
4007.2	10093.	10099.	10104.	10109.	10114.	10120.	10125.	10130.	10135.	10141.	520.
4007.3	10145.	10151.	10156.	10161.	10167.	10172.	10177.	10182.	10188.	10193.	521.
4007.4	10198.	10203.	10209.	10214.	10219.	10224.	10230.	10235.	10240.	10245.	522.
4007.5	10250.	10256.	10261.	10266.	10271.	10277.	10282.	10287.	10292.	10298.	524.
4007.6	10302.	10308.	10313.	10319.	10324.	10329.	10334.	10340.	10345.	10350.	525.
4007.7	10355.	10360.	10366.	10371.	10376.	10381.	10387.	10392.	10397.	10402.	526.
4007.8	10407.	10413.	10418.	10423.	10429.	10434.	10439.	10444.	10450.	10455.	527.
4007.9	10459.	10465.	10470.	10476.	10481.	10486.	10491.	10497.	10502.	10507.	529.
4008.0	10512.	10518.	10523.	10528.	10534.	10539.	10545.	10550.	10555.	10561.	530.
4008.1	10565.	10571.	10577.	10582.	10587.	10593.	10598.	10604.	10609.	10614.	531.
4008.2	10619.	10625.	10630.	10636.	10641.	10646.	10652.	10657.	10663.	10668.	533.
4008.3	10673.	10679.	10684.	10689.	10695.	10700.	10705.	10711.	10716.	10722.	534.
4008.4	10726.	10732.	10738.	10743.	10748.	10754.	10759.	10764.	10770.	10775.	535.
4008.5	10780.	10786.	10791.	10797.	10802.	10807.	10813.	10818.	10823.	10829.	536.
4008.6	10834.	10840.	10845.	10850.	10856.	10861.	10866.	10872.	10877.	10883.	538.
4008.7	10887.	10893.	10899.	10904.	10909.	10915.	10920.	10925.	10931.	10936.	539.
4008.8	10941.	10947.	10952.	10958.	10963.	10968.	10974.	10979.	10984.		

TABLE 3
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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4009.0	11048.	11054.	11060.	11065.	11071.	11076.	11082.	11087.	11093.	11098.	543.
4009.1	11103.	11109.	11115.	11120.	11126.	11131.	11137.	11142.	11148.	11153.	544.
4009.2	11158.	11164.	11170.	11175.	11181.	11186.	11192.	11197.	11203.	11208.	546.
4009.3	11213.	11219.	11225.	11230.	11236.	11241.	11247.	11252.	11258.	11263.	547.
4009.4	11268.	11274.	11280.	11285.	11291.	11296.	11302.	11307.	11313.	11318.	548.
4009.5	11323.	11329.	11335.	11340.	11346.	11351.	11357.	11362.	11368.	11373.	550.
4009.6	11378.	11384.	11390.	11395.	11401.	11406.	11412.	11417.	11423.	11428.	551.
4009.7	11433.	11439.	11445.	11450.	11456.	11461.	11467.	11472.	11478.	11483.	552.
4009.8	11488.	11494.	11500.	11505.	11511.	11516.	11522.	11527.	11533.	11538.	554.
4009.9	11543.	11549.	11555.	11560.	11566.	11571.	11577.	11582.	11588.	11593.	555.
4010.0	11598.	11604.	11610.	11615.	11621.	11627.	11632.	11638.	11644.	11649.	557.
4010.1	11654.	11661.	11666.	11672.	11677.	11683.	11689.	11694.	11700.	11706.	558.
4010.2	11711.	11717.	11723.	11728.	11734.	11739.	11745.	11751.	11756.	11762.	559.
4010.3	11767.	11773.	11779.	11784.	11790.	11796.	11801.	11807.	11813.	11818.	561.
4010.4	11823.	11830.	11835.	11841.	11846.	11852.	11858.	11863.	11869.	11875.	562.
4010.5	11880.	11886.	11892.	11897.	11903.	11908.	11914.	11920.	11925.	11931.	563.
4010.6	11936.	11942.	11948.	11954.	11959.	11965.	11970.	11976.	11982.	11987.	565.
4010.7	11992.	11999.	12004.	12010.	12016.	12021.	12027.	12032.	12038.	12044.	566.
4010.8	12049.	12055.	12061.	12066.	12072.	12077.	12083.	12089.	12094.	12100.	568.
4010.9	12105.	12111.	12117.	12123.	12128.	12134.	12139.	12145.	12151.	12156.	569.
4011.0	12162.	12168.	12174.	12179.	12185.	12191.	12197.	12202.	12208.	12214.	570.
4011.1	12219.	12226.	12231.	12237.	12243.	12249.	12254.	12260.	12266.	12272.	572.
4011.2	12277.	12283.	12289.	12295.	12301.	12306.	12312.	12318.	12324.	12330.	573.
4011.3	12335.	12341.	12347.	12353.	12358.	12364.	12370.	12376.	12381.	12387.	575.
4011.4	12393.	12399.	12405.	12410.	12416.	12422.	12428.	12433.	12439.	12445.	576.
4011.5	12450.	12457.	12462.	12468.	12474.	12480.	12485.	12491.	12497.	12503.	578.
4011.6	12508.	12514.	12520.	12526.	12532.	12537.	12543.	12549.	12555.	12561.	579.
4011.7	12566.	12572.	12578.	12584.	12589.	12595.	12601.	12607.	12613.	12618.	580.
4011.8	12624.	12630.	12636.	12641.	12647.	12653.	12659.	12665.	12670.	12676.	582.
4011.9	12681.	12688.	12693.	12699.	12705.	12711.	12717.	12722.	12728.	12734.	583.
4012.0	12739.	12746.	12751.	12757.	12763.	12769.	12775.	12781.	12787.	12793.	585.
4012.1	12798.	12805.	12811.	12817.	12823.	12828.	12834.	12840.	12846.	12852.	586.
4012.2	12858.	12864.	12870.	12876.	12882.	12888.	12894.	12900.	12905.	12911.	588.
4012.3	12917.	12923.	12929.	12935.	12941.	12947.	12953.	12959.	12965.	12971.	589.
4012.4	12976.	12982.	12988.	12994.	13000.	13006.	13012.	13018.	13024.	13030.	591.
4012.5	13035.	13042.	13048.	13054.	13059.	13065.	13071.	13077.	13083.	13089.	592.
4012.6	13094.	13101.	13107.	13113.	13119.	13125.	13131.	13136.	13142.	13148.	594.
4012.7	13154.	13160.	13166.	13172.	13178.	13184.	13190.	13196.	13202.	13207.	595.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET

MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4013.0	13331.	13338.	13344.	13350.	13356.	13362.	13368.	13374.	13380.	13387.	600.
4013.1	13392.	13399.	13405.	13411.	13417.	13423.	13429.	13435.	13441.	13447.	601.
4013.2	13453.	13459.	13466.	13472.	13478.	13484.	13490.	13496.	13502.	13508.	603.
4013.3	13514.	13520.	13526.	13532.	13538.	13544.	13551.	13557.	13563.	13569.	604.
4013.4	13574.	13581.	13587.	13593.	13599.	13605.	13611.	13617.	13623.	13630.	606.
4013.5	13635.	13642.	13648.	13654.	13660.	13666.	13672.	13678.	13684.	13690.	607.
4013.6	13696.	13702.	13708.	13715.	13721.	13727.	13733.	13739.	13745.	13751.	609.
4013.7	13757.	13763.	13769.	13775.	13781.	13787.	13794.	13800.	13806.	13812.	611.
4013.8	13817.	13824.	13830.	13836.	13842.	13848.	13854.	13860.	13866.	13872.	612.
4013.9	13878.	13885.	13891.	13897.	13903.	13909.	13915.	13921.	13927.	13933.	614.
4014.0	13939.	13946.	13952.	13958.	13964.	13970.	13977.	13983.	13989.	13995.	615.
4014.1	14001.	14008.	14014.	14020.	14027.	14033.	14039.	14045.	14051.	14058.	617.
4014.2	14063.	14070.	14076.	14083.	14089.	14095.	14101.	14108.	14114.	14120.	618.
4014.3	14126.	14133.	14139.	14145.	14151.	14157.	14164.	14170.	14176.	14182.	620.
4014.4	14188.	14195.	14201.	14207.	14214.	14220.	14226.	14232.	14238.	14245.	622.
4014.5	14250.	14257.	14263.	14270.	14276.	14282.	14288.	14295.	14301.	14307.	623.
4014.6	14313.	14319.	14326.	14332.	14338.	14344.	14351.	14357.	14363.	14369.	625.
4014.7	14375.	14382.	14388.	14394.	14400.	14407.	14413.	14419.	14425.	14432.	626.
4014.8	14437.	14444.	14450.	14457.	14463.	14469.	14475.	14481.	14488.	14494.	628.
4014.9	14500.	14506.	14513.	14519.	14525.	14531.	14538.	14544.	14550.	14556.	630.
4015.0	14562.	14569.	14575.	14582.	14588.	14594.	14601.	14607.	14614.	14620.	631.
4015.1	14626.	14633.	14639.	14646.	14652.	14658.	14665.	14671.	14678.	14684.	633.
4015.2	14690.	14697.	14703.	14710.	14716.	14722.	14729.	14735.	14742.	14748.	635.
4015.3	14754.	14761.	14767.	14774.	14780.	14786.	14793.	14799.	14806.	14812.	636.
4015.4	14818.	14825.	14831.	14837.	14844.	14850.	14857.	14863.	14869.	14876.	638.
4015.5	14882.	14889.	14895.	14901.	14908.	14914.	14921.	14927.	14933.	14940.	639.
4015.6	14946.	14953.	14959.	14965.	14972.	14978.	14985.	14991.	14997.	15004.	641.
4015.7	15010.	15017.	15023.	15029.	15036.	15042.	15049.	15055.	15061.	15068.	643.
4015.8	15074.	15080.	15087.	15093.	15100.	15106.	15112.	15119.	15125.	15132.	644.
4015.9	15138.	15144.	15151.	15157.	15164.	15170.	15176.	15183.	15189.	15196.	646.
4016.0	15201.	15209.	15215.	15222.	15228.	15235.	15241.	15248.	15254.	15261.	648.
4016.1	15267.	15274.	15281.	15287.	15294.	15300.	15307.	15314.	15320.	15327.	649.
4016.2	15333.	15340.	15346.	15353.	15360.	15366.	15373.	15379.	15386.	15392.	651.
4016.3	15398.	15405.	15412.	15419.	15425.	15432.	15438.	15445.	15451.	15458.	653.
4016.4	15464.	15471.	15478.	15484.	15491.	15497.	15504.	15510.	15517.	15524.	655.
4016.5	15530.	15537.	15543.	15550.	15556.	15563.	15570.	15576.	15583.	15589.	656.
4016.6	15595.	15602.	15609.	15615.	15622.	15629.	15635.	15642.	15648.	15655.	658.
4016.7	15661.	15668.	15675.	15681.	15688.	15694.	15701.	15707.	15714.	15720.	660.
4016.8	15727.	15734.	15740.	15747.	15753.	15760.					

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4017.0	15858.	15865.	15872.	15879.	15885.	15892.	15899.	15905.	15912.	15919.	665.
4017.1	15925.	15932.	15939.	15946.	15953.	15959.	15966.	15973.	15980.	15986.	667.
4017.2	15993.	16000.	16007.	16013.	16020.	16027.	16033.	16040.	16047.	16054.	668.
4017.3	16060.	16067.	16074.	16081.	16087.	16094.	16101.	16108.	16114.	16121.	670.
4017.4	16127.	16135.	16141.	16148.	16155.	16161.	16168.	16175.	16182.	16188.	672.
4017.5	16195.	16202.	16209.	16215.	16222.	16229.	16236.	16242.	16249.	16256.	674.
4017.6	16262.	16269.	16276.	16283.	16289.	16296.	16303.	16310.	16316.	16323.	675.
4017.7	16329.	16337.	16343.	16350.	16357.	16364.	16370.	16377.	16384.	16391.	677.
4017.8	16397.	16404.	16411.	16417.	16424.	16431.	16438.	16444.	16451.	16458.	679.
4017.9	16464.	16471.	16478.	16485.	16492.	16498.	16505.	16512.	16519.	16525.	681.
4018.0	16532.	16539.	16546.	16553.	16560.	16567.	16574.	16580.	16587.	16594.	683.
4018.1	16601.	16608.	16615.	16622.	16629.	16636.	16643.	16650.	16657.	16663.	684.
4018.2	16670.	16677.	16684.	16691.	16698.	16705.	16712.	16719.	16726.	16733.	686.
4018.3	16739.	16746.	16753.	16760.	16767.	16774.	16781.	16788.	16795.	16802.	688.
4018.4	16808.	16816.	16823.	16829.	16836.	16843.	16850.	16857.	16864.	16871.	690.
4018.5	16877.	16885.	16892.	16899.	16906.	16912.	16919.	16926.	16933.	16940.	692.
4018.6	16947.	16954.	16961.	16968.	16975.	16982.	16989.	16995.	17002.	17009.	694.
4018.7	17016.	17023.	17030.	17037.	17044.	17051.	17058.	17065.	17072.	17078.	695.
4018.8	17085.	17092.	17099.	17106.	17113.	17120.	17127.	17134.	17141.	17148.	697.
4018.9	17154.	17161.	17168.	17175.	17182.	17189.	17196.	17203.	17210.	17217.	699.
4019.0	17223.	17231.	17238.	17245.	17252.	17259.	17266.	17273.	17281.	17288.	701.
4019.1	17294.	17302.	17309.	17316.	17323.	17330.	17337.	17344.	17352.	17359.	703.
4019.2	17365.	17373.	17380.	17387.	17394.	17401.	17408.	17415.	17423.	17430.	705.
4019.3	17436.	17444.	17451.	17458.	17465.	17472.	17479.	17487.	17494.	17501.	706.
4019.4	17507.	17515.	17522.	17529.	17536.	17543.	17550.	17558.	17565.	17572.	708.
4019.5	17578.	17586.	17593.	17600.	17607.	17614.	17621.	17629.	17636.	17643.	710.
4019.6	17649.	17657.	17664.	17671.	17678.	17685.	17692.	17700.	17707.	17714.	712.
4019.7	17720.	17728.	17735.	17742.	17749.	17756.	17764.	17771.	17778.	17785.	714.
4019.8	17791.	17799.	17806.	17813.	17820.	17827.	17835.	17842.	17849.	17856.	716.
4019.9	17862.	17870.	17877.	17884.	17891.	17898.	17906.	17913.	17920.	17927.	718.
4020.0	17933.	17941.	17949.	17956.	17963.	17970.	17978.	17985.	17992.	18000.	720.
4020.1	18006.	18014.	18021.	18029.	18036.	18043.	18051.	18058.	18065.	18073.	722.
4020.2	18079.	18087.	18094.	18102.	18109.	18116.	18124.	18131.	18138.	18145.	724.
4020.3	18152.	18160.	18167.	18175.	18182.	18189.	18197.	18204.	18211.	18218.	725.
4020.4	18225.	18233.	18240.	18248.	18255.	18262.	18269.	18277.	18284.	18291.	727.
4020.5	18298.	18306.	18313.	18321.	18328.	18335.	18342.	18350.	18357.	18364.	729.
4020.6	18371.	18379.	18386.	18393.	18401.	18408.	18415.	18423.	18430.	18437.	731.
4020.7	18444.	184[illegible].	18459.	18466.	18474.	18481.	18488.	18496.	18503.	18510.	733.
4020.8	18517.	185[illegible].	18532.	18539.	18547.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4021.0	18663.	18671.	18678.	18686.	18693.	18701.	18708.	18716.	18723.	18731.	739.
4021.1	18738.	18746.	18753.	18761.	18768.	18776.	18783.	18791.	18798.	18806.	741.
4021.2	18813.	18821.	18828.	18836.	18843.	18851.	18858.	18866.	18873.	18881.	743.
4021.3	18888.	18895.	18903.	18910.	18918.	18925.	18933.	18940.	18948.	18955.	745.
4021.4	18962.	18970.	18978.	18985.	18993.	19000.	19008.	19015.	19023.	19030.	747.
4021.5	19037.	19045.	19053.	19060.	19068.	19075.	19083.	19090.	19098.	19105.	749.
4021.6	19112.	19120.	19128.	19135.	19143.	19150.	19158.	19165.	19173.	19180.	751.
4021.7	19187.	19195.	19203.	19210.	19218.	19225.	19232.	19240.	19247.	19255.	753.
4021.8	19262.	19270.	19277.	19285.	19292.	19300.	19307.	19315.	19322.	19330.	755.
4021.9	19337.	19345.	19352.	19360.	19367.	19375.	19382.	19390.	19397.	19405.	757.
4022.0	19412.	19420.	19428.	19435.	19443.	19451.	19458.	19466.	19474.	19481.	759.
4022.1	19489.	19497.	19505.	19512.	19520.	19528.	19535.	19543.	19551.	19558.	761.
4022.2	19566.	19574.	19581.	19589.	19597.	19604.	19612.	19620.	19628.	19635.	763.
4022.3	19642.	19651.	19658.	19666.	19674.	19681.	19689.	19697.	19704.	19712.	765.
4022.4	19719.	19728.	19735.	19743.	19751.	19758.	19766.	19774.	19781.	19789.	767.
4022.5	19796.	19804.	19812.	19820.	19828.	19835.	19843.	19851.	19858.	19866.	769.
4022.6	19873.	19881.	19889.	19897.	19904.	19912.	19920.	19927.	19935.	19943.	771.
4022.7	19950.	19958.	19966.	19974.	19981.	19989.	19997.	20004.	20012.	20020.	773.
4022.8	20027.	20035.	20043.	20051.	20058.	20066.	20074.	20081.	20089.	20097.	775.
4022.9	20104.	20112.	20120.	20127.	20135.	20143.	20150.	20158.	20166.	20174.	777.
4023.0	20181.	20189.	20197.	20205.	20213.	20221.	20229.	20237.	20244.	20252.	779.
4023.1	20260.	20268.	20276.	20284.	20292.	20300.	20308.	20316.	20323.	20331.	781.
4023.2	20339.	20347.	20355.	20363.	20371.	20379.	20387.	20395.	20402.	20410.	784.
4023.3	20418.	20426.	20434.	20442.	20450.	20458.	20466.	20474.	20481.	20489.	786.
4023.4	20497.	20505.	20513.	20521.	20529.	20537.	20545.	20553.	20560.	20568.	788.
4023.5	20576.	20584.	20592.	20600.	20608.	20616.	20624.	20632.	20639.	20647.	790.
4023.6	20655.	20663.	20671.	20679.	20687.	20695.	20703.	20711.	20718.	20726.	792.
4023.7	20734.	20742.	20750.	20758.	20766.	20774.	20782.	20790.	20797.	20805.	794.
4023.8	20813.	20821.	20829.	20837.	20845.	20853.	20861.	20869.	20876.	20884.	796.
4023.9	20892.	20900.	20908.	20916.	20924.	20932.	20940.	20947.	20955.	20963.	799.
4024.0	20971.	20979.	20987.	20996.	21004.	21012.	21020.	21028.	21036.	21044.	801.
4024.1	21052.	21061.	21069.	21077.	21085.	21093.	21101.	21109.	21117.	21125.	803.
4024.2	21133.	21142.	21150.	21158.	21166.	21174.	21182.	21190.	21199.	21207.	805.
4024.3	21214.	21223.	21231.	21239.	21247.	21255.	21264.	21272.	21280.	21288.	807.
4024.4	21295.	21304.	21312.	21320.	21328.	21337.	21345.	21353.	21361.	21369.	810.
4024.5	21377.	21385.	21393.	21402.	21410.	21418.	21426.	21434.	21442.	21450.	812.
4024.6	21458.	21467.	21475.	21483.	21491.	21499.	21507.	21515.	21523.	21531.	814.
4024.7	21539.	21548.	21556.	21564.	21572.	21580.	21588.	21596.	21605.	21613.	817.
4024.8	21620.	21629.	21637.	21645.	21653.	21661.	21669.	21679.	21686.	21694.	819.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4025.0	21783.	21792.	21800.	21808.	21817.	21825.	21833.	21842.	21850.	21858.	823.
4025.1	21866.	21875.	21883.	21892.	21900.	21908.	21917.	21925.	21934.	21942.	826.
4025.2	21950.	21959.	21967.	21975.	21984.	21992.	22000.	22009.	22017.	22025.	828.
4025.3	22033.	22042.	22050.	22059.	22067.	22076.	22084.	22092.	22101.	22109.	831.
4025.4	22117.	22126.	22134.	22142.	22151.	22159.	22167.	22176.	22184.	22192.	833.
4025.5	22200.	22209.	22218.	22226.	22234.	22243.	22251.	22259.	22268.	22276.	835.
4025.6	22284.	22293.	22301.	22309.	22318.	22326.	22335.	22343.	22351.	22360.	838.
4025.7	22367.	22376.	22385.	22393.	22401.	22410.	22418.	22426.	22435.	22443.	840.
4025.8	22451.	22460.	22468.	22477.	22485.	22493.	22502.	22510.	22518.	22527.	843.
4025.9	22534.	22543.	22552.	22560.	22568.	22577.	22585.	22593.	22602.	22610.	845.
4026.0	22618.	22627.	22636.	22644.	22653.	22662.	22670.	22679.	22687.	22696.	847.
4026.1	22704.	22713.	22722.	22730.	22739.	22748.	22756.	22765.	22773.	22782.	850.
4026.2	22790.	22799.	22808.	22816.	22825.	22834.	22842.	22851.	22859.	22868.	853.
4026.3	22876.	22885.	22894.	22902.	22911.	22920.	22928.	22937.	22945.	22954.	855.
4026.4	22962.	22971.	22980.	22988.	22997.	23006.	23014.	23023.	23031.	23040.	858.
4026.5	23048.	23057.	23066.	23074.	23083.	23092.	23100.	23109.	23117.	23126.	860.
4026.6	23134.	23143.	23152.	23160.	23169.	23178.	23186.	23195.	23203.	23212.	863.
4026.7	23220.	23229.	23238.	23246.	23255.	23264.	23272.	23281.	23289.	23298.	865.
4026.8	23306.	23315.	23324.	23332.	23341.	23350.	23358.	23367.	23375.	23384.	868.
4026.9	23392.	23401.	23410.	23418.	23427.	23436.	23444.	23453.	23461.	23470.	870.
4027.0	23478.	23488.	23496.	23505.	23514.	23523.	23532.	23541.	23550.	23558.	873.
4027.1	23567.	23576.	23585.	23594.	23603.	23612.	23620.	23629.	23638.	23647.	875.
4027.2	23655.	23665.	23674.	23682.	23691.	23700.	23709.	23718.	23727.	23736.	878.
4027.3	23744.	23753.	23762.	23771.	23780.	23789.	23798.	23806.	23815.	23824.	881.
4027.4	23833.	23842.	23851.	23860.	23869.	23877.	23886.	23895.	23904.	23913.	883.
4027.5	23921.	23931.	23939.	23948.	23957.	23966.	23975.	23984.	23993.	24001.	886.
4027.6	24010.	24019.	24028.	24037.	24046.	24055.	24063.	24072.	24081.	24090.	889.
4027.7	24098.	24108.	24117.	24125.	24134.	24143.	24152.	24161.	24170.	24179.	891.
4027.8	24187.	24196.	24205.	24214.	24223.	24232.	24241.	24250.	24258.	24267.	894.
4027.9	24276.	24285.	24294.	24303.	24312.	24320.	24329.	24338.	24347.	24356.	897.
4028.0	24364.	24374.	24383.	24392.	24401.	24410.	24419.	24429.	24438.	24447.	899.
4028.1	24455.	24465.	24474.	24483.	24492.	24502.	24511.	24520.	24529.	24538.	902.
4028.2	24547.	24556.	24565.	24575.	24584.	24593.	24602.	24611.	24620.	24629.	905.
4028.3	24638.	24648.	24657.	24666.	24675.	24684.	24693.	24702.	24712.	24721.	907.
4028.4	24729.	24739.	24748.	24757.	24766.	24775.	24785.	24794.	24803.	24812.	910.
4028.5	24821.	24830.	24839.	24848.	24858.	24867.	24876.	24885.	24894.	24903.	913.
4028.6	24912.	24921.	24931.	24940.	24949.	24958.	24967.	24976.	24985.	24994.	915.
4028.7	25003.	25013.	25022.	25031.	25040.	25049.	25058.	25067.	25077.	25086.	918.
4028.8	25094.	25104.	25113.	25122.	25131.	25140.	25150.	25159.	25168.	25177.	921.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4029.0	25277.	25287.	25296.	25306.	25315.	25324.	25334.	25343.	25353.	25362.	926.
4029.1	25371.	25381.	25390.	25400.	25409.	25418.	25428.	25437.	25446.	25456.	929.
4029.2	25465.	25475.	25484.	25493.	25503.	25512.	25522.	25531.	25540.	25550.	932.
4029.3	25559.	25569.	25578.	25587.	25597.	25606.	25616.	25625.	25634.	25644.	934.
4029.4	25653.	25663.	25672.	25681.	25691.	25700.	25710.	25719.	25728.	25738.	937.
4029.5	25747.	25757.	25766.	25775.	25785.	25794.	25804.	25813.	25822.	25832.	940.
4029.6	25841.	25851.	25860.	25869.	25879.	25888.	25898.	25907.	25916.	25926.	942.
4029.7	25935.	25945.	25954.	25963.	25973.	25982.	25991.	26001.	26010.	26020.	945.
4029.8	26029.	26038.	26048.	26057.	26067.	26076.	26085.	26095.	26104.	26114.	948.
4029.9	26123.	26132.	26142.	26151.	26161.	26170.	26179.	26189.	26198.	26208.	950.
4030.0	26217.	26227.	26236.	26246.	26256.	26265.	26275.	26285.	26294.	26304.	953.
4030.1	26313.	26323.	26333.	26343.	26352.	26362.	26372.	26381.	26391.	26401.	956.
4030.2	26410.	26420.	26430.	26439.	26449.	26459.	26468.	26478.	26488.	26497.	959.
4030.3	26507.	26517.	26526.	26536.	26546.	26555.	26565.	26575.	26584.	26594.	961.
4030.4	26603.	26613.	26623.	26633.	26642.	26652.	26662.	26671.	26681.	26691.	964.
4030.5	26700.	26710.	26720.	26729.	26739.	26749.	26758.	26768.	26778.	26787.	967.
4030.6	26797.	26807.	26816.	26826.	26836.	26845.	26855.	26865.	26874.	26884.	969.
4030.7	26893.	26903.	26913.	26923.	26932.	26942.	26952.	26961.	26971.	26981.	972.
4030.8	26990.	27000.	27010.	27019.	27029.	27039.	27048.	27058.	27068.	27077.	975.
4030.9	27087.	27097.	27106.	27116.	27126.	27135.	27145.	27155.	27164.	27174.	978.
4031.0	27183.	27194.	27204.	27214.	27224.	27233.	27243.	27253.	27263.	27273.	980.
4031.1	27283.	27293.	27303.	27313.	27323.	27333.	27343.	27353.	27363.	27373.	983.
4031.2	27382.	27392.	27402.	27412.	27422.	27432.	27442.	27452.	27462.	27472.	986.
4031.3	27481.	27492.	27502.	27512.	27522.	27532.	27542.	27552.	27561.	27571.	988.
4031.4	27581.	27591.	27601.	27611.	27621.	27631.	27641.	27651.	27661.	27671.	991.
4031.5	27680.	27691.	27701.	27711.	27720.	27730.	27740.	27750.	27760.	27770.	994.
4031.6	27780.	27790.	27800.	27810.	27820.	27830.	27840.	27850.	27860.	27870.	997.
4031.7	27879.	27889.	27899.	27909.	27919.	27929.	27939.	27949.	27959.	27969.	999.
4031.8	27978.	27989.	27999.	28009.	28019.	28029.	28039.	28049.	28058.	28068.	1002.
4031.9	28078.	28088.	28098.	28108.	28118.	28128.	28138.	28148.	28158.	28168.	1005.
4032.0	28177.	28188.	28198.	28208.	28219.	28229.	28239.	28249.	28259.	28270.	1008.
4032.1	28279.	28290.	28300.	28311.	28321.	28331.	28341.	28351.	28362.	28372.	1010.
4032.2	28382.	28392.	28402.	28413.	28423.	28433.	28443.	28454.	28464.	28474.	1013.
4032.3	28484.	28494.	28505.	28515.	28525.	28535.	28545.	28556.	28566.	28576.	1016.
4032.4	28586.	28597.	28607.	28617.	28627.	28637.	28648.	28658.	28668.	28678.	1019.
4032.5	28688.	28699.	28709.	28719.	28729.	28740.	28750.	28760.	28770.	28780.	1022.
4032.6	28790.	28801.	28811.	28821.	28832.	28842.	28852.	28862.	28872.	28883.	1024.
4032.7	28892.	28903.	28913.	28923.	28934.	28944.	28954.	28964.	28975.	28985.	1027.
4032.8	28994.	29005.	29015.	29026.	29036.	29046.	29056.				

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4033.0	29199.	29210.	29220.	29231.	29241.	29252.	29262.	29273.	29283.	29294.	1035.
4033.1	29304.	29315.	29325.	29336.	29346.	29357.	29367.	29378.	29388.	29399.	1038.
4033.2	29409.	29420.	29430.	29441.	29451.	29462.	29472.	29483.	29493.	29504.	1041.
4033.3	29514.	29525.	29535.	29546.	29556.	29567.	29577.	29588.	29598.	29609.	1044.
4033.4	29619.	29630.	29640.	29651.	29661.	29672.	29682.	29693.	29703.	29714.	1047.
4033.5	29724.	29735.	29745.	29756.	29766.	29777.	29787.	29798.	29808.	29819.	1050.
4033.6	29829.	29840.	29850.	29861.	29871.	29882.	29892.	29903.	29913.	29924.	1053.
4033.7	29934.	29945.	29955.	29966.	29976.	29987.	29997.	30008.	30018.	30029.	1056.
4033.8	30039.	30050.	30060.	30071.	30081.	30092.	30102.	30113.	30123.	30134.	1058.
4033.9	30144.	30155.	30165.	30176.	30186.	30197.	30207.	30218.	30228.	30239.	1061.
4034.0	30249.	30260.	30271.	30281.	30292.	30303.	30314.	30325.	30335.	30346.	1064.
4034.1	30356.	30368.	30379.	30389.	30400.	30411.	30422.	30433.	30443.	30454.	1067.
4034.2	30464.	30476.	30486.	30497.	30508.	30519.	30530.	30540.	30551.	30562.	1070.
4034.3	30572.	30584.	30594.	30605.	30616.	30627.	30638.	30648.	30659.	30670.	1073.
4034.4	30680.	30691.	30702.	30713.	30724.	30735.	30745.	30756.	30767.	30778.	1076.
4034.5	30788.	30799.	30810.	30821.	30832.	30843.	30853.	30864.	30875.	30886.	1079.
4034.6	30896.	30907.	30918.	30929.	30940.	30950.	30961.	30972.	30983.	30994.	1082.
4034.7	31004.	31015.	31026.	31037.	31048.	31058.	31069.	31080.	31091.	31101.	1085.
4034.8	31112.	31123.	31134.	31145.	31155.	31166.	31177.	31188.	31199.	31209.	1088.
4034.9	31220.	31231.	31242.	31253.	31263.	31274.	31285.	31296.	31306.	31317.	1091.
4035.0	31328.	31339.	31350.	31361.	31372.	31384.	31395.	31406.	31417.	31428.	1094.
4035.1	31438.	31450.	31461.	31472.	31483.	31494.	31506.	31517.	31528.	31539.	1097.
4035.2	31549.	31561.	31572.	31583.	31594.	31605.	31616.	31628.	31639.	31650.	1100.
4035.3	31660.	31672.	31683.	31694.	31705.	31716.	31727.	31738.	31750.	31761.	1103.
4035.4	31771.	31783.	31794.	31805.	31816.	31827.	31838.	31849.	31860.	31872.	1106.
4035.5	31882.	31894.	31905.	31916.	31927.	31938.	31949.	31960.	31971.	31982.	1109.
4035.6	31993.	32005.	32016.	32027.	32038.	32049.	32060.	32071.	32082.	32093.	1112.
4035.7	32104.	32116.	32127.	32138.	32149.	32160.	32171.	32182.	32193.	32204.	1115.
4035.8	32215.	32226.	32238.	32249.	32260.	32271.	32282.	32293.	32304.	32315.	1118.
4035.9	32326.	32337.	32348.	32360.	32371.	32382.	32393.	32404.	32415.	32426.	1121.
4036.0	32437.	32449.	32460.	32471.	32483.	32494.	32506.	32517.	32528.	32540.	1125.
4036.1	32551.	32563.	32574.	32585.	32597.	32608.	32620.	32631.	32642.	32654.	1128.
4036.2	32665.	32677.	32688.	32700.	32711.	32722.	32734.	32745.	32757.	32768.	1131.
4036.3	32779.	32791.	32802.	32814.	32825.	32836.	32848.	32859.	32871.	32882.	1134.
4036.4	32893.	32905.	32916.	32928.	32939.	32950.	32962.	32973.	32985.	32996.	1137.
4036.5	33007.	33019.	33030.	33042.	33053.	33064.	33076.	33087.	33099.	33110.	1140.
4036.6	33121.	33133.	33144.	33156.	33167.	33178.	33190.	33201.	33213.	33224.	1143.
4036.7	33235.	33247.	33258.	33270.	33281.	33292.	33304.	33315.	33327.	33338.	1147.
4036.8	33349.	33361.	33372.	33384.	33395.	33407.					

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4037.0	33577.	33589.	33601.	33613.	33624.	33636.	33648.	33660.	33671.	33683.	1156.
4037.1	33694.	33707.	33718.	33730.	33742.	33753.	33765.	33777.	33789.	33800.	1159.
4037.2	33812.	33824.	33835.	33847.	33859.	33871.	33882.	33894.	33906.	33918.	1163.
4037.3	33929.	33941.	33953.	33964.	33976.	33988.	34000.	34011.	34023.	34035.	1166.
4037.4	34046.	34058.	34070.	34082.	34093.	34105.	34117.	34129.	34140.	34152.	1169.
4037.5	34163.	34175.	34187.	34199.	34211.	34222.	34234.	34246.	34258.	34269.	1172.
4037.6	34280.	34293.	34304.	34316.	34328.	34340.	34351.	34363.	34375.	34386.	1176.
4037.7	34398.	34410.	34422.	34433.	34445.	34457.	34469.	34480.	34492.	34504.	1179.
4037.8	34515.	34527.	34539.	34551.	34562.	34574.	34586.	34598.	34609.	34621.	1182.
4037.9	34632.	34644.	34656.	34668.	34680.	34691.	34703.	34715.	34726.	34738.	1185.
4038.0	34749.	34762.	34774.	34786.	34798.	34810.	34822.	34834.	34846.	34858.	1189.
4038.1	34870.	34883.	34895.	34907.	34919.	34931.	34943.	34955.	34967.	34979.	1192.
4038.2	34990.	35003.	35015.	35027.	35039.	35051.	35063.	35075.	35087.	35099.	1195.
4038.3	35111.	35124.	35136.	35148.	35160.	35172.	35184.	35196.	35208.	35220.	1199.
4038.4	35232.	35244.	35256.	35268.	35280.	35292.	35304.	35316.	35328.	35341.	1202.
4038.5	35352.	35365.	35377.	35389.	35401.	35413.	35425.	35437.	35449.	35461.	1205.
4038.6	35473.	35485.	35497.	35509.	35521.	35533.	35545.	35557.	35569.	35582.	1209.
4038.7	35593.	35606.	35618.	35630.	35642.	35654.	35666.	35678.	35690.	35702.	1212.
4038.8	35714.	35726.	35738.	35750.	35762.	35774.	35786.	35798.	35811.	35823.	1215.
4038.9	35834.	35847.	35859.	35871.	35883.	35895.	35907.	35919.	35931.	35943.	1219.
4039.0	35955.	35968.	35980.	35992.	36005.	36017.	36030.	36042.	36054.	36067.	1222.
4039.1	36079.	36091.	36104.	36116.	36129.	36141.	36153.	36166.	36178.	36191.	1225.
4039.2	36202.	36215.	36228.	36240.	36253.	36265.	36277.	36290.	36302.	36314.	1229.
4039.3	36326.	36339.	36352.	36364.	36376.	36389.	36401.	36414.	36426.	36438.	1232.
4039.4	36450.	36463.	36475.	36488.	36500.	36513.	36525.	36537.	36550.	36562.	1235.
4039.5	36574.	36587.	36599.	36612.	36624.	36637.	36649.	36661.	36674.	36686.	1239.
4039.6	36698.	36711.	36723.	36736.	36748.	36760.	36773.	36785.	36798.	36810.	1242.
4039.7	36822.	36835.	36847.	36860.	36872.	36884.	36897.	36909.	36921.	36934.	1246.
4039.8	36946.	36959.	36971.	36983.	36996.	37008.	37021.	37033.	37045.	37058.	1249.
4039.9	37070.	37083.	37095.	37107.	37120.	37132.	37144.	37157.	37169.	37182.	1252.
4040.0	37194.	37207.	37220.	37232.	37245.	37258.	37270.	37283.	37296.	37309.	1256.
4040.1	37321.	37334.	37347.	37360.	37372.	37385.	37398.	37411.	37423.	37436.	1259.
4040.2	37448.	37462.	37474.	37487.	37500.	37512.	37525.	37538.	37551.	37563.	1263.
4040.3	37576.	37589.	37602.	37614.	37627.	37640.	37653.	37665.	37678.	37691.	1267.
4040.4	37703.	37716.	37729.	37742.	37754.	37767.	37780.	37793.	37805.	37818.	1270.
4040.5	37830.	37844.	37856.	37869.	37882.	37895.	37907.	37920.	37933.	37946.	1274.
4040.6	37958.	37971.	37984.	37996.	38009.	38022.	38035.	38047.	38060.	38073.	1277.
4040.7	38085.	38098.	38111.	38124.	38137.	38149.	38162.	38175.	38187.	38200.	1281.
4040.8	38212.	38225.	38238.	38251.	38264.	38277.	38289.	38302.	38315.	38328.	1284.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4041.0	38467.	38481.	38494.	38507.	38520.	38533.	38546.	38559.	38572.	38586.	1291.
4041.1	38598.	38612.	38625.	38638.	38651.	38664.	38677.	38690.	38703.	38717.	1295.
4041.2	38729.	38743.	38756.	38769.	38782.	38795.	38808.	38821.	38834.	38848.	1299.
4041.3	38860.	38874.	38887.	38900.	38913.	38926.	38939.	38952.	38965.	38979.	1302.
4041.4	38991.	39005.	39018.	39031.	39044.	39057.	39070.	39083.	39096.	39110.	1306.
4041.5	39122.	39136.	39149.	39162.	39175.	39188.	39201.	39214.	39227.	39241.	1310.
4041.6	39253.	39267.	39280.	39293.	39306.	39319.	39332.	39345.	39358.	39372.	1314.
4041.7	39384.	39398.	39411.	39424.	39437.	39450.	39463.	39476.	39489.	39503.	1317.
4041.8	39515.	39529.	39542.	39555.	39568.	39581.	39594.	39607.	39620.	39634.	1321.
4041.9	39646.	39660.	39673.	39686.	39699.	39712.	39725.	39738.	39751.	39765.	1325.
4042.0	39777.	39791.	39805.	39818.	39831.	39845.	39858.	39872.	39885.	39899.	1328.
4042.1	39912.	39926.	39939.	39953.	39966.	39980.	39993.	40007.	40020.	40034.	1332.
4042.2	40047.	40060.	40074.	40087.	40101.	40114.	40128.	40141.	40155.	40168.	1336.
4042.3	40181.	40195.	40209.	40222.	40236.	40249.	40263.	40276.	40290.	40303.	1340.
4042.4	40316.	40330.	40343.	40357.	40370.	40384.	40397.	40411.	40424.	40438.	1343.
4042.5	40451.	40465.	40478.	40492.	40505.	40519.	40532.	40545.	40559.	40572.	1347.
4042.6	40585.	40599.	40613.	40626.	40640.	40653.	40667.	40680.	40694.	40707.	1351.
4042.7	40720.	40734.	40748.	40761.	40774.	40788.	40801.	40815.	40828.	40842.	1355.
4042.8	40855.	40869.	40882.	40896.	40909.	40923.	40936.	40950.	40963.	40977.	1358.
4042.9	40990.	41003.	41017.	41030.	41044.	41057.	41071.	41084.	41098.	41111.	1362.
4043.0	41124.	41139.	41152.	41166.	41180.	41194.	41208.	41222.	41235.	41249.	1366.
4043.1	41263.	41277.	41291.	41305.	41319.	41332.	41346.	41360.	41374.	41388.	1370.
4043.2	41401.	41415.	41429.	41443.	41457.	41471.	41485.	41498.	41512.	41526.	1373.
4043.3	41539.	41554.	41568.	41582.	41595.	41609.	41623.	41637.	41651.	41665.	1377.
4043.4	41678.	41692.	41706.	41720.	41734.	41748.	41761.	41775.	41789.	41803.	1381.
4043.5	41816.	41831.	41845.	41858.	41872.	41886.	41900.	41914.	41928.	41941.	1384.
4043.6	41955.	41969.	41983.	41997.	42011.	42024.	42038.	42052.	42066.	42080.	1388.
4043.7	42093.	42108.	42121.	42135.	42149.	42163.	42177.	42191.	42204.	42218.	1392.
4043.8	42232.	42246.	42260.	42274.	42287.	42301.	42315.	42329.	42343.	42357.	1395.
4043.9	42370.	42384.	42398.	42412.	42426.	42440.	42454.	42467.	42481.	42495.	1399.
4044.0	42508.	42523.	42537.	42552.	42566.	42580.	42594.	42608.	42623.	42637.	1403.
4044.1	42650.	42665.	42679.	42694.	42708.	42722.	42736.	42750.	42765.	42779.	1406.
4044.2	42792.	42807.	42821.	42836.	42850.	42864.	42878.	42892.	42907.	42921.	1410.
4044.3	42934.	42949.	42963.	42978.	42992.	43006.	43020.	43034.	43049.	43063.	1413.
4044.4	43077.	43091.	43105.	43120.	43134.	43148.	43162.	43176.	43191.	43205.	1417.
4044.5	43219.	43233.	43247.	43262.	43276.	43290.	43304.	43318.	43333.	43347.	1420.
4044.6	43361.	43375.	43389.	43404.	43418.	43432.	43446.	43460.	43475.	43489.	1424.
4044.7	43503.	43517.	43531.	43546.	43560.	43574.	43588.	43602.	43617.	43631.	1427.
4044.8	43645.	43659.	43673.	43688.	43702.						

TABLE 3
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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4045.0	43929.	43944.	43958.	43973.	43987.	44002.	44016.	44031.	44045.	44060.	1438.
4045.1	44074.	44089.	44104.	44118.	44133.	44147.	44162.	44176.	44191.	44205.	1441.
4045.2	44219.	44234.	44249.	44264.	44278.	44293.	44307.	44322.	44336.	44351.	1444.
4045.3	44365.	44380.	44394.	44409.	44424.	44438.	44453.	44467.	44482.	44496.	1448.
4045.4	44510.	44525.	44540.	44554.	44569.	44584.	44598.	44613.	44627.	44642.	1451.
4045.5	44656.	44671.	44685.	44700.	44714.	44729.	44743.	44758.	44773.	44787.	1454.
4045.6	44801.	44816.	44831.	44845.	44860.	44874.	44889.	44903.	44918.	44933.	1458.
4045.7	44947.	44962.	44976.	44991.	45005.	45020.	45034.	45049.	45063.	45078.	1461.
4045.8	45092.	45107.	45122.	45136.	45151.	45165.	45180.	45194.	45209.	45223.	1464.
4045.9	45237.	45252.	45267.	45282.	45296.	45311.	45325.	45340.	45354.	45369.	1468.
4046.0	45383.	45398.	45413.	45428.	45443.	45458.	45473.	45487.	45502.	45517.	1471.
4046.1	45532.	45547.	45562.	45577.	45592.	45606.	45621.	45636.	45651.	45666.	1474.
4046.2	45680.	45696.	45710.	45725.	45740.	45755.	45770.	45785.	45800.	45815.	1477.
4046.3	45829.	45844.	45859.	45874.	45889.	45904.	45919.	45933.	45948.	45963.	1480.
4046.4	45978.	45993.	46008.	46023.	46038.	46052.	46067.	46082.	46097.	46112.	1484.
4046.5	46126.	46142.	46157.	46171.	46186.	46201.	46216.	46231.	46246.	46261.	1487.
4046.6	46275.	46290.	46305.	46320.	46335.	46350.	46365.	46380.	46394.	46409.	1490.
4046.7	46424.	46439.	46454.	46469.	46484.	46498.	46513.	46528.	46543.	46558.	1493.
4046.8	46572.	46588.	46603.	46617.	46632.	46647.	46662.	46677.	46692.	46707.	1496.
4046.9	46721.	46736.	46751.	46766.	46781.	46796.	46811.	46826.	46840.	46855.	1500.
4047.0	46870.	46885.	46901.	46916.	46931.	46946.	46961.	46976.	46992.	47007.	1503.
4047.1	47022.	47037.	47052.	47068.	47083.	47098.	47113.	47128.	47143.	47159.	1506.
4047.2	47173.	47189.	47204.	47219.	47235.	47250.	47265.	47280.	47295.	47310.	1509.
4047.3	47325.	47341.	47356.	47371.	47386.	47402.	47417.	47432.	47447.	47462.	1512.
4047.4	47477.	47493.	47508.	47523.	47538.	47553.	47569.	47584.	47599.	47614.	1515.
4047.5	47629.	47644.	47660.	47675.	47690.	47705.	47720.	47736.	47751.	47766.	1518.
4047.6	47781.	47796.	47812.	47827.	47842.	47857.	47872.	47887.	47903.	47918.	1521.
4047.7	47932.	47948.	47963.	47979.	47994.	48009.	48024.	48039.	48054.	48070.	1524.
4047.8	48084.	48100.	48115.	48130.	48146.	48161.	48176.	48191.	48206.	48221.	1528.
4047.9	48236.	48252.	48267.	48282.	48297.	48313.	48328.	48343.	48358.	48373.	1531.
4048.0	48388.	48404.	48419.	48435.	48450.	48466.	48481.	48497.	48512.	48528.	1534.
4048.1	48543.	48559.	48574.	48590.	48605.	48621.	48636.	48652.	48667.	48683.	1537.
4048.2	48698.	48714.	48729.	48745.	48760.	48776.	48791.	48807.	48822.	48838.	1540.
4048.3	48853.	48869.	48884.	48900.	48915.	48931.	48946.	48962.	48977.	48993.	1543.
4048.4	49008.	49024.	49039.	49055.	49070.	49086.	49101.	49117.	49132.	49147.	1546.
4048.5	49162.	49178.	49194.	49209.	49225.	49240.	49256.	49271.	49287.	49302.	1549.
4048.6	49317.	49333.	49349.	49364.	49380.	49395.	49411.	49426.	49442.	49457.	1552.
4048.7	49472.	49488.	49504.	49519.	49535.	49550.	49566.	49581.	49597.	49612.	1555.
4048.8	49627.	49643.	49659.	49674.	49690.						

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET

MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4049.0	49937.	49953.	49969.	49985.	50001.	50016.	50032.	50048.	50064.	50080.	1564.
4049.1	50095.	50111.	50127.	50143.	50159.	50174.	50190.	50206.	50222.	50238.	1567.
4049.2	50253.	50269.	50285.	50301.	50317.	50332.	50348.	50364.	50380.	50396.	1570.
4049.3	50411.	50427.	50443.	50459.	50474.	50490.	50506.	50522.	50538.	50553.	1573.
4049.4	50569.	50585.	50601.	50617.	50632.	50648.	50664.	50680.	50696.	50711.	1576.
4049.5	50727.	50743.	50759.	50775.	50790.	50806.	50822.	50838.	50854.	50869.	1579.
4049.6	50885.	50901.	50917.	50933.	50948.	50964.	50980.	50996.	51011.	51027.	1582.
4049.7	51043.	51059.	51075.	51090.	51106.	51122.	51138.	51154.	51169.	51185.	1585.
4049.8	51201.	51217.	51233.	51248.	51264.	51280.	51296.	51312.	51327.	51343.	1588.
4049.9	51358.	51375.	51391.	51406.	51422.	51438.	51454.	51469.	51485.	51501.	1591.
4050.0	51516.	51533.	51549.	51565.	51581.	51597.	51613.	51630.	51646.	51662.	1595.
4050.1	51677.	51694.	51710.	51726.	51742.	51758.	51774.	51790.	51807.	51823.	1597.
4050.2	51838.	51855.	51871.	51887.	51903.	51919.	51935.	51951.	51968.	51984.	1600.
4050.3	51999.	52016.	52032.	52048.	52064.	52080.	52096.	52112.	52128.	52145.	1603.
4050.4	52160.	52177.	52193.	52209.	52225.	52241.	52257.	52273.	52289.	52305.	1606.
4050.5	52321.	52338.	52354.	52370.	52386.	52402.	52418.	52434.	52450.	52466.	1609.
4050.6	52482.	52499.	52515.	52531.	52547.	52563.	52579.	52595.	52611.	52627.	1612.
4050.7	52643.	52660.	52676.	52692.	52708.	52724.	52740.	52756.	52772.	52788.	1615.
4050.8	52804.	52821.	52837.	52853.	52869.	52885.	52901.	52917.	52933.	52949.	1618.
4050.9	52965.	52981.	52998.	53014.	53030.	53046.	53062.	53078.	53094.	53110.	1621.
4051.0	53126.	53143.	53159.	53175.	53192.	53208.	53225.	53241.	53257.	53274.	1624.
4051.1	53290.	53307.	53323.	53339.	53356.	53372.	53389.	53405.	53421.	53438.	1627.
4051.2	53454.	53470.	53487.	53503.	53520.	53536.	53552.	53569.	53585.	53602.	1630.
4051.3	53617.	53634.	53651.	53667.	53684.	53700.	53716.	53733.	53749.	53765.	1633.
4051.4	53781.	53798.	53815.	53831.	53847.	53864.	53880.	53897.	53913.	53929.	1636.
4051.5	53945.	53962.	53979.	53995.	54011.	54028.	54044.	54060.	54077.	54093.	1639.
4051.6	54109.	54126.	54142.	54159.	54175.	54192.	54208.	54224.	54241.	54257.	1642.
4051.7	54273.	54290.	54306.	54323.	54339.	54355.	54372.	54388.	54405.	54421.	1645.
4051.8	54437.	54454.	54470.	54487.	54503.	54519.	54536.	54552.	54569.	54585.	1648.
4051.9	54601.	54618.	54634.	54650.	54667.	54683.	54700.	54716.	54732.	54749.	1651.
4052.0	54765.	54782.	54799.	54815.	54832.	54849.	54865.	54882.	54899.	54915.	1654.
4052.1	54932.	54949.	54965.	54982.	54999.	55015.	55032.	55049.	55065.	55082.	1656.
4052.2	55098.	55115.	55132.	55149.	55166.	55182.	55199.	55216.	55232.	55249.	1659.
4052.3	55265.	55282.	55299.	55316.	55332.	55349.	55366.	55382.	55399.	55416.	1662.
4052.4	55432.	55449.	55466.	55482.	55499.	55516.	55532.	55549.	55566.	55582.	1665.
4052.5	55599.	55616.	55633.	55649.	55666.	55683.	55699.	55716.	55733.	55749.	1668.
4052.6	55765.	55783.	55799.	55816.	55833.	55849.	55866.	55883.	55899.	55916.	1671.
4052.7	55932.	55949.	55966.	55983.	55999.	56016.	56033.				

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET

MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4053.0	56433.	56450.	56467.	56484.	56501.	56518.	56535.	56552.	56569.	56586.	1682.
4053.1	56602.	56620.	56637.	56654.	56671.	56688.	56705.	56722.	56739.	56756.	1685.
4053.2	56772.	56789.	56806.	56823.	56840.	56857.	56874.	56891.	56908.	56925.	1688.
4053.3	56942.	56959.	56976.	56993.	57010.	57027.	57044.	57061.	57078.	57095.	1691.
4053.4	57111.	57129.	57146.	57163.	57180.	57197.	57214.	57231.	57248.	57265.	1694.
4053.5	57281.	57298.	57315.	57332.	57349.	57366.	57383.	57400.	57417.	57434.	1697.
4053.6	57451.	57468.	57485.	57502.	57519.	57536.	57553.	57570.	57587.	57604.	1700.
4053.7	57620.	57638.	57655.	57672.	57689.	57706.	57723.	57740.	57757.	57774.	1702.
4053.8	57790.	57807.	57824.	57841.	57858.	57875.	57892.	57909.	57926.	57943.	1705.
4053.9	57960.	57977.	57994.	58011.	58028.	58045.	58062.	58079.	58096.	58113.	1708.
4054.0	58129.	58147.	58164.	58182.	58199.	58216.	58233.	58251.	58268.	58285.	1711.
4054.1	58302.	58320.	58337.	58354.	58371.	58389.	58406.	58423.	58440.	58458.	1714.
4054.2	58474.	58492.	58509.	58527.	58544.	58561.	58578.	58596.	58613.	58630.	1717.
4054.3	58647.	58665.	58682.	58699.	58716.	58734.	58751.	58768.	58785.	58803.	1720.
4054.4	58819.	58837.	58854.	58872.	58889.	58906.	58924.	58941.	58958.	58975.	1723.
4054.5	58992.	59010.	59027.	59044.	59062.	59079.	59096.	59113.	59131.	59148.	1725.
4054.6	59165.	59182.	59200.	59217.	59234.	59251.	59269.	59286.	59303.	59320.	1728.
4054.7	59337.	59355.	59372.	59389.	59407.	59424.	59441.	59458.	59476.	59493.	1731.
4054.8	59510.	59527.	59545.	59562.	59579.	59596.	59614.	59631.	59648.	59665.	1734.
4054.9	59682.	59700.	59717.	59734.	59752.	59769.	59786.	59803.	59821.	59838.	1737.
4055.0	59855.	59873.	59890.	59908.	59925.	59943.	59960.	59978.	59996.	60013.	1740.
4055.1	60030.	60048.	60066.	60083.	60101.	60118.	60136.	60153.	60171.	60188.	1743.
4055.2	60206.	60224.	60241.	60259.	60276.	60294.	60311.	60329.	60346.	60364.	1745.
4055.3	60381.	60399.	60417.	60434.	60452.	60469.	60487.	60504.	60522.	60539.	1748.
4055.4	60556.	60574.	60592.	60609.	60627.	60645.	60662.	60680.	60697.	60715.	1751.
4055.5	60732.	60750.	60767.	60785.	60802.	60820.	60837.	60855.	60873.	60890.	1754.
4055.6	60907.	60925.	60943.	60960.	60978.	60995.	61013.	61030.	61048.	61066.	1757.
4055.7	61083.	61101.	61118.	61136.	61153.	61171.	61188.	61206.	61223.	61241.	1760.
4055.8	61258.	61276.	61294.	61311.	61329.	61346.	61364.	61381.	61399.	61416.	1763.
4055.9	61433.	61451.	61469.	61486.	61504.	61522.	61539.	61557.	61574.	61592.	1765.
4056.0	61609.	61627.	61645.	61663.	61681.	61698.	61716.	61734.	61752.	61770.	1768.
4056.1	61787.	61805.	61823.	61841.	61859.	61877.	61894.	61912.	61930.	61948.	1771.
4056.2	61965.	61984.	62001.	62019.	62037.	62055.	62073.	62090.	62108.	62126.	1774.
4056.3	62143.	62162.	62180.	62197.	62215.	62233.	62251.	62269.	62287.	62304.	1777.
4056.4	62322.	62340.	62358.	62376.	62393.	62411.	62429.	62447.	62465.	62483.	1779.
4056.5	62500.	62518.	62536.	62554.	62572.	62590.	62607.	62625.	62643.	62661.	1782.
4056.6	62678.	62696.	62714.	62732.	62750.	62768.	62786.	62803.	62821.	62839.	1785.
4056.7	62856.	62875.	62892.	62910.	62928.	62946.	62964.	62982.	62999.	63017.	1788.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4057.0	63391.	63410.	63428.	63446.	63464.	63482.	63500.	63518.	63536.	63554.	1796.
4057.1	63572.	63591.	63609.	63627.	63645.	63663.	63681.	63699.	63717.	63735.	1799.
4057.2	63753.	63772.	63790.	63808.	63826.	63844.	63862.	63880.	63898.	63917.	1802.
4057.3	63934.	63953.	63971.	63989.	64007.	64025.	64043.	64061.	64079.	64098.	1805.
4057.4	64115.	64134.	64152.	64170.	64188.	64206.	64224.	64242.	64260.	64279.	1808.
4057.5	64296.	64315.	64333.	64351.	64369.	64387.	64405.	64423.	64442.	64460.	1810.
4057.6	64477.	64496.	64514.	64532.	64550.	64568.	64586.	64604.	64623.	64641.	1813.
4057.7	64658.	64677.	64695.	64713.	64731.	64749.	64767.	64785.	64804.	64822.	1816.
4057.8	64839.	64858.	64876.	64894.	64912.	64930.	64948.	64967.	64985.	65003.	1819.
4057.9	65020.	65039.	65057.	65075.	65093.	65111.	65129.	65148.	65166.	65184.	1822.
4058.0	65201.	65220.	65239.	65257.	65275.	65294.	65312.	65331.	65349.	65367.	1824.
4058.1	65385.	65404.	65423.	65441.	65459.	65478.	65496.	65514.	65533.	65551.	1827.
4058.2	65569.	65588.	65606.	65625.	65643.	65662.	65680.	65698.	65717.	65735.	1830.
4058.3	65753.	65772.	65790.	65809.	65827.	65845.	65864.	65882.	65901.	65919.	1833.
4058.4	65937.	65956.	65974.	65993.	66011.	66029.	66048.	66066.	66085.	66103.	1836.
4058.5	66121.	66140.	66158.	66176.	66195.	66213.	66232.	66250.	66268.	66287.	1839.
4058.6	66305.	66324.	66342.	66360.	66379.	66397.	66416.	66434.	66452.	66471.	1842.
4058.7	66489.	66507.	66526.	66544.	66563.	66581.	66599.	66618.	66636.	66655.	1845.
4058.8	66672.	66691.	66710.	66728.	66746.	66765.	66783.	66802.	66820.	66838.	1848.
4058.9	66856.	66875.	66894.	66912.	66930.	66949.	66967.	66986.	67004.	67022.	1850.
4059.0	67040.	67059.	67078.	67097.	67115.	67134.	67153.	67172.	67190.	67209.	1853.
4059.1	67227.	67246.	67265.	67284.	67302.	67321.	67340.	67358.	67377.	67396.	1856.
4059.2	67414.	67433.	67452.	67470.	67489.	67508.	67526.	67545.	67564.	67583.	1859.
4059.3	67601.	67620.	67639.	67657.	67676.	67695.	67713.	67732.	67751.	67769.	1862.
4059.4	67788.	67807.	67825.	67844.	67863.	67881.	67900.	67919.	67938.	67956.	1865.
4059.5	67974.	67994.	68012.	68031.	68050.	68068.	68087.	68106.	68124.	68143.	1868.
4059.6	68161.	68180.	68199.	68218.	68236.	68255.	68274.	68293.	68311.	68330.	1871.
4059.7	68348.	68367.	68386.	68405.	68423.	68442.	68461.	68479.	68498.	68517.	1874.
4059.8	68535.	68554.	68573.	68591.	68610.	68629.	68648.	68666.	68685.	68704.	1877.
4059.9	68722.	68741.	68760.	68778.	68797.	68816.	68834.	68853.	68872.	68890.	1880.
4060.0	68909.	68928.	68947.	68966.	68985.	69004.	69023.	69042.	69061.	69080.	1884.
4060.1	69099.	69118.	69137.	69156.	69175.	69194.	69213.	69232.	69251.	69270.	1887.
4060.2	69289.	69308.	69327.	69346.	69365.	69384.	69403.	69422.	69441.	69460.	1890.
4060.3	69478.	69498.	69517.	69536.	69555.	69574.	69593.	69612.	69631.	69650.	1893.
4060.4	69668.	69688.	69707.	69726.	69745.	69764.	69783.	69802.	69821.	69840.	1896.
4060.5	69858.	69878.	69897.	69916.	69935.	69954.	69973.	69992.	70011.	70030.	1899.
4060.6	70048.	70068.	70087.	70106.	70125.	70144.	70163.	70182.	70201.	70220.	1903.
4060.7	70238.	70258.	70277.	70296.	70315.	70334.	70353.	70372.	70391.	70410.	1906.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4061.0	70808.	70828.	70847.	70867.	70886.	70905.	70924.	70944.	70963.	70982.	1915.
4061.1	71001.	71021.	71040.	71060.	71079.	71098.	71118.	71137.	71156.	71176.	1919.
4061.2	71194.	71214.	71234.	71253.	71272.	71292.	71311.	71330.	71350.	71369.	1922.
4061.3	71388.	71407.	71427.	71446.	71465.	71485.	71504.	71523.	71543.	71562.	1925.
4061.4	71581.	71601.	71620.	71639.	71659.	71678.	71697.	71717.	71736.	71755.	1929.
4061.5	71774.	71794.	71813.	71833.	71852.	71871.	71891.	71910.	71929.	71948.	1932.
4061.6	71967.	71987.	72006.	72026.	72045.	72064.	72084.	72103.	72122.	72142.	1935.
4061.7	72160.	72180.	72200.	72219.	72238.	72258.	72277.	72296.	72316.	72335.	1939.
4061.8	72354.	72374.	72393.	72412.	72431.	72451.	72470.	72489.	72509.	72528.	1942.
4061.9	72547.	72567.	72586.	72605.	72625.	72644.	72663.	72683.	72702.	72721.	1945.
4062.0	72740.	72760.	72780.	72800.	72819.	72839.	72859.	72878.	72898.	72918.	1949.
4062.1	72937.	72957.	72976.	72996.	73016.	73035.	73055.	73075.	73094.	73114.	1952.
4062.2	73133.	73153.	73173.	73193.	73212.	73232.	73252.	73271.	73291.	73311.	1955.
4062.3	73330.	73350.	73370.	73389.	73409.	73429.	73448.	73468.	73488.	73507.	1959.
4062.4	73526.	73547.	73566.	73586.	73606.	73625.	73645.	73664.	73684.	73704.	1962.
4062.5	73723.	73743.	73763.	73782.	73802.	73822.	73841.	73861.	73881.	73900.	1966.
4062.6	73920.	73940.	73959.	73979.	73999.	74018.	74038.	74058.	74077.	74097.	1969.
4062.7	74116.	74136.	74156.	74176.	74195.	74215.	74235.	74254.	74274.	74293.	1972.
4062.8	74313.	74333.	74352.	74372.	74392.	74411.	74431.	74451.	74470.	74490.	1976.
4062.9	74509.	74529.	74549.	74569.	74588.	74608.	74628.	74647.	74667.	74687.	1979.
4063.0	74706.	74726.	74746.	74766.	74786.	74806.	74826.	74846.	74866.	74886.	1983.
4063.1	74906.	74926.	74946.	74966.	74986.	75006.	75026.	75046.	75066.	75086.	1986.
4063.2	75106.	75126.	75146.	75166.	75186.	75206.	75226.	75246.	75266.	75286.	1990.
4063.3	75306.	75326.	75346.	75366.	75386.	75406.	75426.	75446.	75466.	75486.	1993.
4063.4	75506.	75526.	75546.	75566.	75586.	75606.	75626.	75646.	75666.	75686.	1996.
4063.5	75706.	75726.	75746.	75766.	75786.	75806.	75826.	75846.	75866.	75886.	2000.
4063.6	75906.	75926.	75946.	75966.	75986.	76006.	76026.	76046.	76066.	76086.	2003.
4063.7	76106.	76126.	76146.	76166.	76186.	76206.	76226.	76246.	76266.	76286.	2007.
4063.8	76306.	76326.	76346.	76366.	76386.	76406.	76426.	76446.	76466.	76486.	2010.
4063.9	76506.	76526.	76546.	76566.	76586.	76606.	76626.	76646.	76666.	76686.	2013.
4064.0	76706.	76726.	76747.	76767.	76787.	76808.	76828.	76848.	76869.	76889.	2017.
4064.1	76909.	76930.	76950.	76970.	76991.	77011.	77031.	77052.	77072.	77092.	2020.
4064.2	77112.	77133.	77153.	77174.	77194.	77214.	77235.	77255.	77275.	77296.	2024.
4064.3	77316.	77336.	77357.	77377.	77397.	77418.	77438.	77458.	77479.	77499.	2027.
4064.4	77519.	77540.	77560.	77580.	77601.	77621.	77641.	77662.	77682.	77702.	2030.
4064.5	77722.	77743.	77764.	77784.	77804.	77825.	77845.	77865.	77886.	77906.	2034.
4064.6	77926.	77947.	77967.	77987.	78008.	78028.	78048.	78069.	78089.	78109.	2037.
4064.7	78129.	78150.	78170.	78191.	78211.	78231.	78252.	78272.	78292.	78313.	2040.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET

MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4065.0	78739.	78760.	78781.	78802.	78822.	78843.	78864.	78884.	78905.	78926.	2051.
4065.1	78946.	78967.	78988.	79008.	79029.	79050.	79070.	79091.	79112.	79132.	2054.
4065.2	79153.	79174.	79194.	79215.	79236.	79256.	79277.	79298.	79318.	79339.	2057.
4065.3	79359.	79380.	79401.	79422.	79442.	79463.	79484.	79504.	79525.	79546.	2060.
4065.4	79566.	79587.	79608.	79628.	79649.	79670.	79690.	79711.	79732.	79752.	2064.
4065.5	79773.	79794.	79814.	79835.	79856.	79876.	79897.	79918.	79938.	79959.	2067.
4065.6	79979.	80000.	80021.	80042.	80063.	80083.	80104.	80125.	80145.	80166.	2070.
4065.7	80186.	80207.	80228.	80249.	80269.	80290.	80311.	80331.	80352.	80373.	2074.
4065.8	80393.	80414.	80435.	80455.	80476.	80497.	80517.	80538.	80559.	80579.	2077.
4065.9	80599.	80621.	80641.	80662.	80683.	80703.	80724.	80745.	80765.	80786.	2080.
4066.0	80806.	80828.	80849.	80870.	80891.	80912.	80933.	80954.	80975.	80996.	2083.
4066.1	81016.	81038.	81059.	81080.	81101.	81122.	81143.	81164.	81185.	81206.	2087.
4066.2	81226.	81248.	81269.	81290.	81311.	81332.	81353.	81374.	81395.	81415.	2090.
4066.3	81436.	81457.	81478.	81499.	81520.	81541.	81562.	81583.	81604.	81625.	2093.
4066.4	81646.	81667.	81688.	81709.	81730.	81751.	81772.	81793.	81814.	81835.	2096.
4066.5	81856.	81877.	81898.	81919.	81940.	81961.	81982.	82003.	82024.	82045.	2100.
4066.6	82066.	82087.	82108.	82129.	82150.	82171.	82192.	82213.	82234.	82255.	2103.
4066.7	82276.	82297.	82318.	82339.	82360.	82381.	82402.	82423.	82444.	82465.	2106.
4066.8	82486.	82507.	82528.	82549.	82570.	82591.	82612.	82633.	82654.	82675.	2109.
4066.9	82696.	82717.	82738.	82759.	82780.	82801.	82822.	82843.	82864.	82885.	2113.
4067.0	82906.	82928.	82949.	82970.	82992.	83013.	83034.	83056.	83077.	83098.	2116.
4067.1	83119.	83141.	83162.	83183.	83205.	83226.	83247.	83269.	83290.	83311.	2119.
4067.2	83332.	83354.	83375.	83397.	83418.	83439.	83461.	83482.	83503.	83525.	2122.
4067.3	83545.	83567.	83589.	83610.	83631.	83653.	83674.	83695.	83716.	83738.	2126.
4067.4	83759.	83780.	83802.	83823.	83844.	83866.	83887.	83908.	83930.	83951.	2129.
4067.5	83972.	83994.	84015.	84036.	84058.	84079.	84100.	84122.	84143.	84164.	2132.
4067.6	84185.	84207.	84228.	84250.	84271.	84292.	84314.	84335.	84356.	84377.	2135.
4067.7	84398.	84420.	84441.	84463.	84484.	84505.	84527.	84548.	84569.	84591.	2139.
4067.8	84612.	84633.	84655.	84676.	84697.	84719.	84740.	84761.	84783.	84804.	2142.
4067.9	84825.	84847.	84868.	84889.	84911.	84932.	84953.	84974.	84996.	85017.	2145.
4068.0	85038.	85060.	85082.	85103.	85125.	85147.	85168.	85190.	85212.	85233.	2149.
4068.1	85254.	85277.	85298.	85320.	85342.	85363.	85385.	85407.	85428.	85450.	2152.
4068.2	85471.	85493.	85515.	85536.	85558.	85580.	85601.	85623.	85645.	85666.	2155.
4068.3	85688.	85710.	85731.	85753.	85775.	85796.	85818.	85840.	85861.	85883.	2158.
4068.4	85904.	85926.	85948.	85969.	85991.	86013.	86034.	86056.	86078.	86099.	2162.
4068.5	86121.	86143.	86164.	86186.	86208.	86229.	86251.	86273.	86294.	86316.	2165.
4068.6	86337.	86359.	86381.	86403.	86424.	86446.	86467.	86489.	86511.	86532.	2168.

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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELEV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4069.0	87203.	87226.	87248.	87270.	87292.	87314.	87336.	87358.	87380.	87402.	2182.
4069.1	87423.	87445.	87467.	87489.	87511.	87533.	87555.	87577.	87599.	87621.	2185.
4069.2	87643.	87665.	87687.	87709.	87731.	87753.	87775.	87797.	87819.	87841.	2189.
4069.3	87863.	87885.	87907.	87929.	87951.	87973.	87995.	88017.	88039.	88061.	2192.
4069.4	88083.	88105.	88127.	88149.	88171.	88193.	88215.	88237.	88259.	88281.	2195.
4069.5	88303.	88325.	88347.	88369.	88391.	88413.	88435.	88457.	88479.	88501.	2199.
4069.6	88522.	88545.	88567.	88589.	88611.	88633.	88655.	88677.	88699.	88721.	2202.
4069.7	88742.	88765.	88787.	88809.	88831.	88853.	88875.	88897.	88919.	88941.	2206.
4069.8	88962.	88985.	89007.	89029.	89051.	89073.	89095.	89117.	89139.	89161.	2209.
4069.9	89182.	89205.	89227.	89249.	89271.	89293.	89315.	89337.	89359.	89381.	2213.
4070.0	89402.	89425.	89447.	89470.	89492.	89514.	89537.	89559.	89581.	89604.	2216.
4070.1	89626.	89648.	89671.	89693.	89715.	89738.	89760.	89782.	89805.	89827.	2220.
4070.2	89849.	89872.	89894.	89917.	89939.	89961.	89984.	90006.	90028.	90051.	2224.
4070.3	90072.	90095.	90118.	90140.	90162.	90185.	90207.	90229.	90252.	90274.	2227.
4070.4	90296.	90319.	90341.	90364.	90386.	90408.	90431.	90453.	90475.	90498.	2231.
4070.5	90519.	90542.	90565.	90587.	90609.	90632.	90654.	90676.	90699.	90721.	2235.
4070.6	90743.	90766.	90788.	90810.	90833.	90855.	90878.	90900.	90922.	90945.	2239.
4070.7	90966.	90989.	91012.	91034.	91056.	91079.	91101.	91123.	91146.	91168.	2242.
4070.8	91190.	91213.	91235.	91257.	91280.	91302.	91324.	91347.	91369.	91392.	2246.
4070.9	91413.	91436.	91459.	91481.	91503.	91526.	91548.	91570.	91593.	91615.	2250.
4071.0	91637.	91660.	91683.	91706.	91728.	91751.	91774.	91797.	91819.	91842.	2254.
4071.1	91864.	91888.	91910.	91933.	91956.	91978.	92001.	92024.	92047.	92069.	2258.
4071.2	92092.	92115.	92138.	92160.	92183.	92206.	92229.	92251.	92274.	92297.	2262.
4071.3	92319.	92342.	92365.	92388.	92410.	92433.	92456.	92479.	92501.	92524.	2266.
4071.4	92546.	92570.	92592.	92615.	92638.	92661.	92683.	92706.	92729.	92752.	2270.
4071.5	92774.	92797.	92820.	92843.	92865.	92888.	92911.	92933.	92956.	92979.	2274.
4071.6	93001.	93024.	93047.	93070.	93093.	93115.	93138.	93161.	93184.	93206.	2278.
4071.7	93229.	93252.	93275.	93297.	93320.	93343.	93365.	93388.	93411.	93434.	2282.
4071.8	93456.	93479.	93502.	93525.	93547.	93570.	93593.	93616.	93638.	93661.	2286.
4071.9	93683.	93707.	93729.	93752.	93775.	93798.	93820.	93843.	93866.	93888.	2290.
4072.0	93911.	93934.	93958.	93981.	94004.	94027.	94050.	94073.	94096.	94119.	2294.
4072.1	94142.	94166.	94189.	94212.	94235.	94258.	94281.	94305.	94328.	94351.	2298.
4072.2	94374.	94397.	94420.	94443.	94467.	94490.	94513.	94536.	94559.	94582.	2302.
4072.3	94605.	94629.	94652.	94675.	94698.	94721.	94744.	94767.	94791.	94814.	2306.
4072.4	94836.	94860.	94883.	94906.	94929.	94953.	94976.	94999.	95022.	95045.	2310.
4072.5	95068.	95091.	95115.	95138.	95161.	95184.	95207.	95230.	95253.	95277.	2314.
4072.6	95299.	95323.	95346.	95369.	95392.	95415.	95439.	95462.	95485.	95508.	2318.
4072.7	95531.	95554.	95577.	95601.	95624.	95647.	95670.	95693.	95716.	95739.	2322.

Capacity above spillway crest (elev. 4070.5) is surcharge capacity used only when passing

TABLE 3
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PHILLIPS LAKE
ACTIVE CAPACITY TABLE ACRE-FEET MARCH 1968

ELFV (FEET)	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	AREA (ACRES)
4073.0	96225.	96249.	96272.	96296.	96319.	96343.	96366.	96390.	96414.	96437.	2334.
4073.1	96460.	96484.	96508.	96531.	96555.	96578.	96602.	96625.	96649.	96672.	2338.
4073.2	96695.	96719.	96743.	96766.	96790.	96813.	96837.	96860.	96884.	96908.	2342.
4073.3	96931.	96955.	96978.	97002.	97025.	97049.	97072.	97096.	97119.	97143.	2345.
4073.4	97166.	97190.	97213.	97237.	97260.	97284.	97307.	97331.	97355.	97378.	2349.
4073.5	97401.	97425.	97449.	97472.	97496.	97519.	97543.	97566.	97590.	97613.	2353.
4073.6	97636.	97660.	97684.	97707.	97731.	97754.	97778.	97801.	97825.	97849.	2356.
4073.7	97872.	97896.	97919.	97943.	97966.	97990.	98013.	98037.	98060.	98084.	2360.
4073.8	98107.	98131.	98154.	98178.	98201.	98225.	98248.	98272.	98296.	98319.	2364.
4073.9	98342.	98366.	98390.	98413.	98437.	98460.	98484.	98507.	98531.	98554.	2367.
4074.0	98577.	98602.	98626.	98649.	98673.	98697.	98721.	98745.	98769.	98793.	2371.
4074.1	98816.	98840.	98864.	98888.	98912.	98936.	98960.	98983.	99007.	99031.	2374.
4074.2	99055.	99079.	99103.	99127.	99150.	99174.	99198.	99222.	99246.	99270.	2377.
4074.3	99293.	99317.	99341.	99365.	99389.	99413.	99437.	99461.	99484.	99508.	2380.
4074.4	99532.	99556.	99580.	99604.	99628.	99652.	99675.	99699.	99723.	99747.	2383.
4074.5	99770.	99795.	99819.	99842.	99866.	99890.	99914.	99938.	99962.	99986.	2386.
4074.6	100009.	100033.	100057.	100081.	100105.	100129.	100153.	100176.	100200.	100224.	2389.
4074.7	100248.	100272.	100296.	100320.	100343.	100367.	100391.	100415.	100439.	100463.	2392.
4074.8	100486.	100510.	100534.	100558.	100582.	100606.	100630.	100654.	100677.	100701.	2395.
4074.9	100725.	100749.	100773.	100797.	100821.	100845.	100868.	100892.	100916.	100940.	2398.
4075.0	100963.	100988.	101012.	101036.	101061.	101085.	101109.	101133.	101158.	101182.	2401.
4075.1	101206.	101230.	101254.	101279.	101303.	101327.	101351.	101376.	101400.	101424.	2405.
4075.2	101448.	101472.	101497.	101521.	101545.	101569.	101594.	101618.	101642.	101666.	2409.
4075.3	101690.	101715.	101739.	101763.	101787.	101811.	101836.	101860.	101884.	101908.	2414.
4075.4	101932.	101957.	101981.	102005.	102029.	102054.	102078.	102102.	102126.	102151.	2418.
4075.5	102174.	102199.	102223.	102247.	102272.	102296.	102320.	102344.	102369.	102393.	2422.
4075.6	102416.	102441.	102465.	102490.	102514.	102538.	102562.	102586.	102611.	102635.	2426.
4075.7	102659.	102683.	102708.	102732.	102756.	102780.	102804.	102829.	102853.	102877.	2430.
4075.8	102901.	102926.	102950.	102974.	102998.	103022.	103047.	103071.	103095.	103119.	2434.
4075.9	103143.	103168.	103192.	103216.	103240.	103265.	103289.	103313.	103337.	103361.	2439.
4076.0	103385.										

TABLE 3
Page 24 of 24

TABLE 4

Powder River near Baker, Oregon

Discharge Rating Table

Gage Ht.	Disch. cfs	Gage Ht.	Disch. cfs	Gage Ht.	Disch. cfs	Gage Ht.	Disch. cfs	Gage Ht.	Disch cfs	Gage Ht.	Disch. cfs
1.00		4.00	600								
.10	6	.10	630								
.20	10	.20	660								
.30	15	.30	690								
.40	24	.40	720								
.50	35	.50	750								
.60	47	.60	780								
.70	59	.70	810								
.80	72	.80	840								
.90	87	.90	870								
2.00	104	5.00	900								
.10	122	.10	930								
.20	140	.20	960								
.30	160	.30	995								
.40	180	.40	1030								
.50	200	.50	1065								
.60	222	.60	1100								
.70	245	.70	1140								
.80	268	.80	1180								
.90	292	.90	1220								
3.00	316	6.00	1260								
.10	340	.10	1300								
.20	365	.20	1340								
.30	390	.30									
.40	420	.40									
.50	450	.50									
.60	480	.60									
.70	510	.70									
.80	540	.80									
.90	570	.90									

9-218
(Rev. 2)

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY (WATER RESOURCES DIVISION)

Sta. No. 13-2[illegible]3.00

Rating table for Powder River near Sumpter, Oreg.

from May 5, 1966 to ..... , from ..... to ..... , from ..... to .....

Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference	Gage height	Discharge	Difference
Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs	Feet	Cfs	Cfs
.00			2.00	43	10	4.00	680	60	.00			9.00			11.00	1.77		13.00	6.0	
.10			.10	53	12	.10	740		.10			.10			.10	1.92		.10		
.20			.20	65	14	.20	800	60	.20			.20			.20	2.08		.20		
.30			.30	79	16	.30	860	70	.30			.30			.30	2.25		.30		
.40			.40	95	18	.40	930	70	.40			9.40	-0.10		.40	2.43		.40		
.50			.50	113	21	.50	1,000		.50			.50	.15		.50	2.63		.50		
.60			.60	134	24	.60			.60			.60	.21		.60	2.83		.60		
.70			.70	158	26	.70			.70			.70	.28		.70	3.03		.70		
.80			.80	184	28	.80			.80			.80	.36		.80	3.23		.80		
0.90	0.10		.90	212	30	.90			.90			.90	.45		.90	3.43		.90		
1.00	1	See Curve	3.00	242		.00			.00			1.00	.55		12.00	3.63		.00		
.10	1.77		.10	272	30	.10			.10			.10	.65		.10	3.83		.10		
.20	3.6		.20	302	33	.20			.20			.20	.75		.20	4.04		.20		
.30	6.0	3.1	.30	335	35	.30			.30			.30	.85		.30	4.26		.30		
.40	9.1	3.5	.40	370	40	.40			.40			.40	.96		.40	4.49		.40		
.50	12.6	4.4	.50	410	50	.50			.50			.50	1.08		.50	4.72		.50		
.60	17	5	.60	460		.60			.60			.60	1.20		.60	4.96		.60		
.70	22	6	.70	510	50	.70			.70			.70	1.34		.70	5.21		.70		
.80	28	7	.80	560	60	.80			.80			.80	1.48		.80	5.47		.80		
.90	35	8	.90	620	60	.90			.90			.90	1.62		.90	5.73		.90		

Extrapolated above this point

Extrapolated above this point

This table is applicable for open-channel conditions. It is based on ... discharge measurements ~~made during~~ 12-15, 17, 18

~~and is well defined between ... cfs and ... cfs.~~

Comp by DMG date 12/14

Ckd by VKP date 12/20

Table No. 2

TABLE 5

TABLE

EVAPORATION DATA IN INCHES

WARM SPRINGS RESERVOIR

Year	April	May	June	July	August	Sep.	October
1927		3.35	8.94	12.60	10.93	5.85	
1928		9.40	9.30	13.16	11.58	7.89	
1929		8.81	9.08	15.11	13.61	6.86	
1930	5.91	7.55	10.57	13.87	11.38	6.47	
1931	5.72	10.13	10.77	14.79	12.69	7.54	
1932	5.13	8.38	10.31	14.56	12.33	8.62	
1933	5.81	7.07	11.95	15.65	11.75	8.05	
1934	6.90	10.20	9.67	14.10	11.71	7.57	
1935	4.71	8.78	10.97	12.51	11.61	8.20	
1936	6.24	8.94	9.10	12.36	11.27	6.52	
1937	4.88	9.00	8.74	13.10	10.94	7.12	
1938	5.01	6.90	9.42	10.98	10.85		
1939	6.51	8.96	9.27	12.36	11.38	7.14	
1940	4.59	8.81	11.75	12.57	11.69	5.13	
1941	4.20	6.40	7.36	10.69	8.02	4.55	
1942	4.23	5.07	7.65	11.04	9.12		
1943	4.60	6.48	6.64	11.12	10.10	6.78	2.37
1944	4.42	8.35	6.87	10.81	10.02	6.04	
1945	5.15	5.50	7.94	12.21	10.28	6.40	
1946	5.16	7.35	8.39	10.62	9.89	5.69	
1947	4.97	8.49	6.93	10.40	9.18	5.43	2.36
1948			7.77	10.74	9.40	6.64	3.22
1949	6.44	7.51	10.21	12.65	9.68	7.20	
1950	5.57	8.05	7.74		9.26	5.70	3.68
1951		7.03	8.97	11.71	9.00	6.44	2.66
1952		6.00	6.66	8.84	9.60	5.84	4.00
1953	4.53	5.27	6.15	10.14	7.94	6.19	3.67
1954	6.11	8.76	7.64	12.60	8.70	7.16	4.22
1955		7.61	10.52	10.68	10.64	6.42	3.71
1956		6.47	8.68	11.20	8.80	6.39	
1957	4.56	4.79	8.44	11.99	10.16	7.37	2.50
1958		9.07	7.72	11.87	11.19	7.05	4.50
1959		6.22	10.12	13.48	10.94	5.64	
1960		6.45	10.60	13.78	10.41	8.11	
Mean	5.28	7.52	8.83	12.11	10.29	6.68	3.35
Std.Dev.	0.79	1.46	1.59	1.57	1.24	0.95	0.77
Maximum	6.90	10.20	11.95	15.65	12.69	8.62	4.50
Minimum	4.20	4.79	6.15	8.84	7.94	4.55	2.36

TABLE 6

Original in file for Malheur Manual

Powder River near Baker, Oregon

Monthly and yearly runoff, in acre-feet

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1904	-	-	-	[e]3,070	7,650	[e]8,920	59,200	40,800	25,700	5,230	1,770	1,020	-
1905	1,810	1,670	[e]1,460	[e]2,020	[e]2,020	11,000	12,000	12,400	9,760	1,660	815	321	[e]56,700
1906	1,420	[e]1,310	[e]1,350	[e]1,480	[e]2,070	[e]6,700	30,500	19,200	13,200	2,570	882	547	[e]81,000
1907	715	1,810	[e]2,800	[e]2,090	[e]3,200	14,900	30,700	32,600	13,100	4,030	1,610	916	[e]120,000
1908	1,130	1,460	[e]2,260	[e]1,890	[e]1,480	18,400	24,000	17,200	14,600	4,150	738	818	[e]84,100
1909	2,230	2,140	1,750	[e]3,480	3,470	[e]8,420	12,000	18,500	19,000	2,280	610	84	[e]75,800
1910	1,090	6,600	[e]2,430	[e]1,350	[e]1,390	41,300	38,200	20,500	4,970	430	307	512	[e]120,000
1911	1,080	3,100	[e]2,150	[e]1,230	[e]1,000	8,180	18,600	17,500	20,900	3,160	400	149	[e]77,400
1912	2,450	2,820	640	[e]3,070	[e]5,900	7,190	31,100	38,700	30,600	4,840	1,920	1,340	[e]129,000
1913	1,520	[e]2,220	[e]2,340	1,640	[e]1,850	[e]6,950	31,700	33,300	21,900	5,390	1,680	387	111,000
1914	1,880	2,180	1,840	[e]2,460	[e]3,890	[e]15,400	[e]29,300	24,700	11,200	2,870	-	-	-
1926	-	-	-	-	-	-	-	-	-	484	151	274	-
1927	609	1,260	3,170	2,260	3,730	11,300	23,000	24,000	23,200	2,020	959	946	97,300
1928	[e]2,200	4,750	3,520	[e]5,530	3,970	21,700	18,100	35,700	6,430	1,840	492	375	[e]105,000
1929	658	1,140	[e]1,040	4922	4666	[e]8,850	10,100	19,500	[e]1,800	1,240	[e]437	[e]292	[e]56,600
1930	474	[e]595	1,280	[e]922	3,710	5,250	[e]9,940	7,930	3,610	510	326	238	[e]34,800
1931	467	619	738	676	1,390	4,960	[e]11,600	10,900	2,110	238	31	28	[e]35,800
1932	276	533	1,230	922	1,730	12,500	25,600	33,300	14,300	1,760	417	181	92,700
1933	393	1,060	836	1,050	1,110	3,760	20,500	23,300	26,100	2,620	682	321	81,700
1934	482	791	2,080	3,430	3,140	6,730	7,540	3,170	1,310	472	64	15	29,220
1935	307	960	1,810	1,890	2,440	4,140	11,750	16,020	5,910	971	117	33	46,350
1936	117	334	684	1,020	1,210	5,090	27,680	17,620	5,200	915	219	124	60,210
1937	240	337	716	574	696	4,440	9,860	18,380	8,740	1,770	700	385	46,790
1938	765	1,320	4,890	3,510	4,010	14,500	25,880	26,750	13,940	2,800	777	401	99,540
1939	473	1,000	1,210	1,250	1,430	14,470	18,180	10,920	3,400	873	120	110	53,420
1940	313	[e]390	965	[e]1,740	3,600	15,900	20,710	16,590	5,140	924	343	472	[e]69,080
1941	1,450	2,610	2,810	3,030	3,560	17,050	18,070	25,010	14,260	4,110	1,820	2,470	96,250
1942	1,840	2,820	6,640	[e]4,430	4,200	8,290	31,550	22,900	14,810	4,160	1,060	642	[e]103,500
1943	765	1,620	3,270	4,520	5,570	14,440	37,150	20,530	18,260	7,580	1,560	859	116,100
1944	1,010	1,550	1,390	1,340	1,500	2,930	6,210	9,360	7,830	2,080	707	392	36,300
1945	433	950	916	1,580	2,560	4,360	12,380	24,310	13,920	2,550	783	[e]612	65,350
1946	940	1,330	2,160	2,460	1,980	11,710	29,780	29,250	12,070	3,750	908	698	97,030
1947	1,180	2,100	4,210	3,780	5,440	11,160	13,060	20,350	7,740	1,540	487	425	71,470
1948	1,060	1,810	2,810	3,620	3,120	4,760	15,840	28,740	27,260	4,390	1,510	821	95,740
1949	1,120	1,440	[e]1,410	[e]1,110	2,110	10,690	28,840	30,380	7,810	1,800	659	534	[e]87,900
1950	671	1,450	1,620	[e]1,170	[e]2,150	5,650	19,620	20,280	19,630	4,490	1,580	539	79,050
1951	976	2,110	3,080	2,540	5,430	10,430	32,640	25,660	8,480	1,990	702	371	94,460
1952	885	1,250	2,030	1,680	2,360	7,400	37,820	30,930	14,950	5,360	1,060	537	104,300
1953	491	485	801	5,280	5,160	9,720	20,290	25,980	34,160	9,660	1,980	946	115,000
1954	1,150	1,600	2,510	2,230	3,950	7,250	12,220	16,150	7,460	2,590	855	584	58,750
1955	607	651	745	879	956	1,730	5,240	11,550	12,520	2,810	444	563	38,680
1956	844	1,490	6,990	5,180	3,710	16,420	35,210	38,540	17,000	3,160	1,090	864	130,000
1957	908	1,460	2,920	1,670	3,930	10,610	20,140	32,080	16,400	2,220	815	444	93,600
1958	1,340	1,530	1,910	2,370	7,750	8,910	27,500	51,210	20,480	3,510	935	626	128,100
1959	871	2,080	3,910	4,050	3,300	5,670	15,970	16,400	12,330	2,500	464	854	68,400
1960	2,150	2,300	1,870	1,320	1,720	13,510	20,840	14,500	13,030	1,610	581	409	75,840
1961	425	778	1,230	1,240	4,620	6,680	10,900	14,030	12,690	1,570	330	241	55,650
1962	490	1,130	1,600	3,390	3,070	4,630	22,970	15,870	12,460	2,090	553	260	68,500
1963	1,680	3,020	4,260	2,330	7,520	5,580	9,420	21,280	11,260	2,250	690	484	69,770
1964	553	1,940	1,500	1,590	1,580	3,150	12,510	16,120	24,300	3,270	1,330	683	68,030
1965	622	979	6,410	9,870	11,820	13,440	32,280	30,320	23,170	5,450	3,000	1,580	138,941
1966	1,190	1,510	1,580	2,390	1,510	4,220	12,510	10,530	4,530	1,150	189	116	43,480
Max.	2,450	6,600	6,990	9,870	13,200	41,300	50,200	51,210	34,160	9,680	3,000	2,470	138,941
Mean	974	1,647	2,280	2,403	3,456	9,752	21,370	22,464	13,783	2,814	825	526	80,741
Min.	117	334	640	524	666	1,730	5,240	3,170	1,310	238	31	75	29,220

TABLE 7

PLATE 1
BASIN MAP

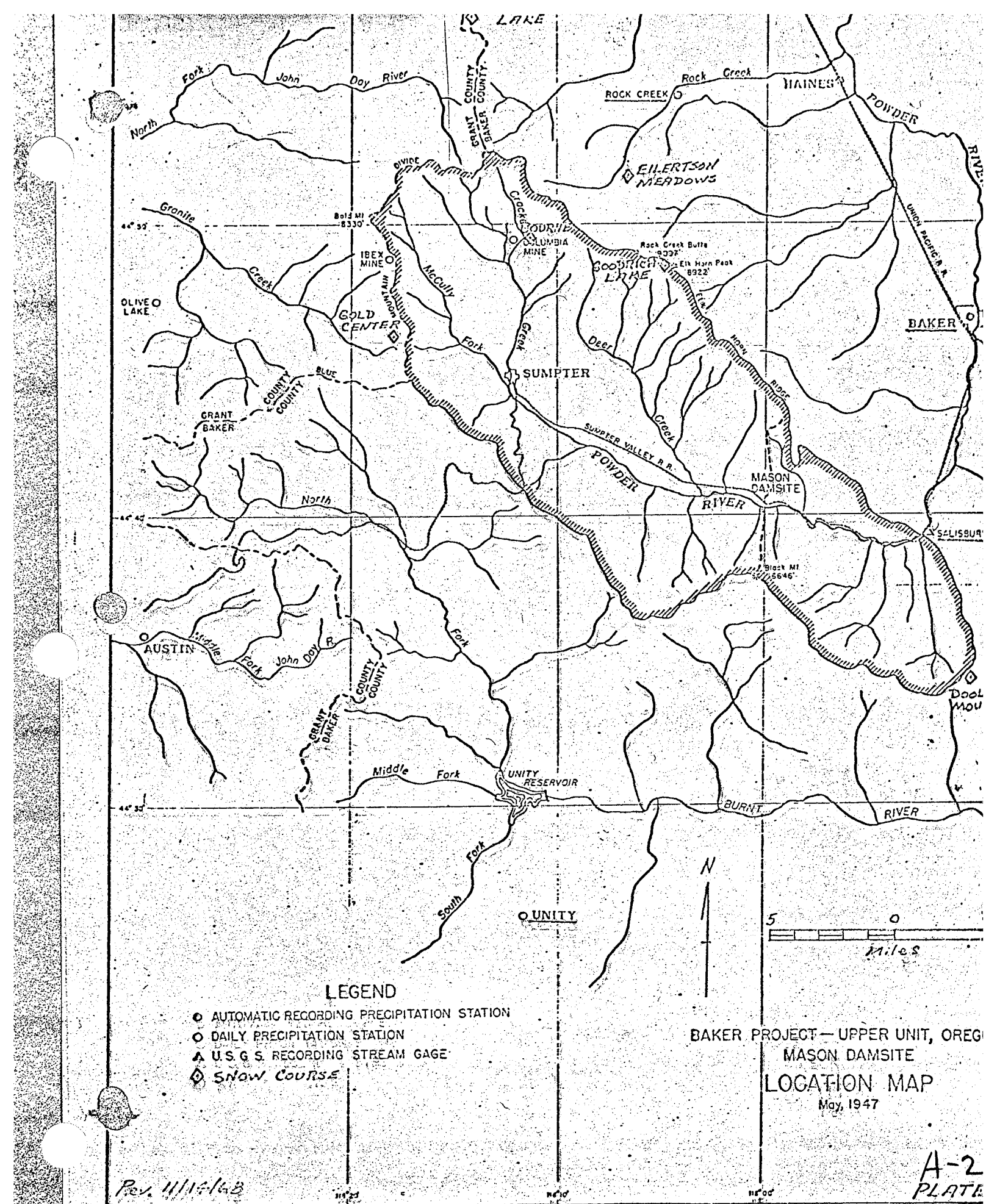
MASON RESERVOIR

POWDER RIVER, OREGON

PLATE 2
FLOOD PLAIN MAP

MASON RESERVOIR

POWDER RIVER, OREGON



LEGEND

- AUTOMATIC RECORDING PRECIPITATION STATION
- DAILY PRECIPITATION STATION
- U.S.G.S. RECORDING STREAM GAGE
- SNOW COURSE

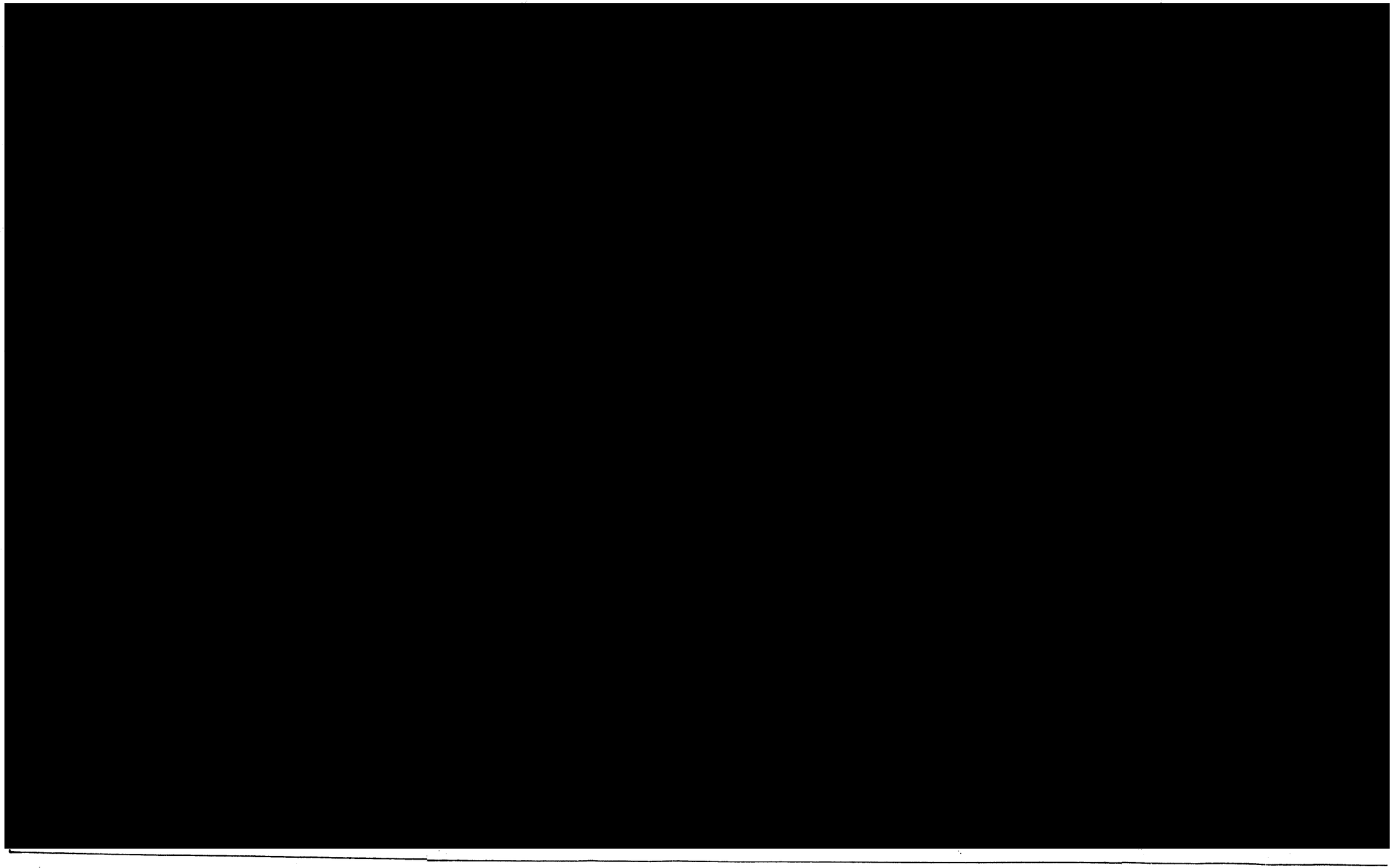
BAKER PROJECT — UPPER UNIT, OREG
MASON DAMSITE

LOCATION MAP

May, 1947

Rev. 11-1-48

A-2
PLATE



EXCEEDENCE FREQUENCY IN EVENTS PER HUNDRED YEARS

99.99 99.9 99.8 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.01

AVERAGE RECURRENCE INTERVAL IN YEARS

1.01 1.1 2 5 10 20 50 100 500

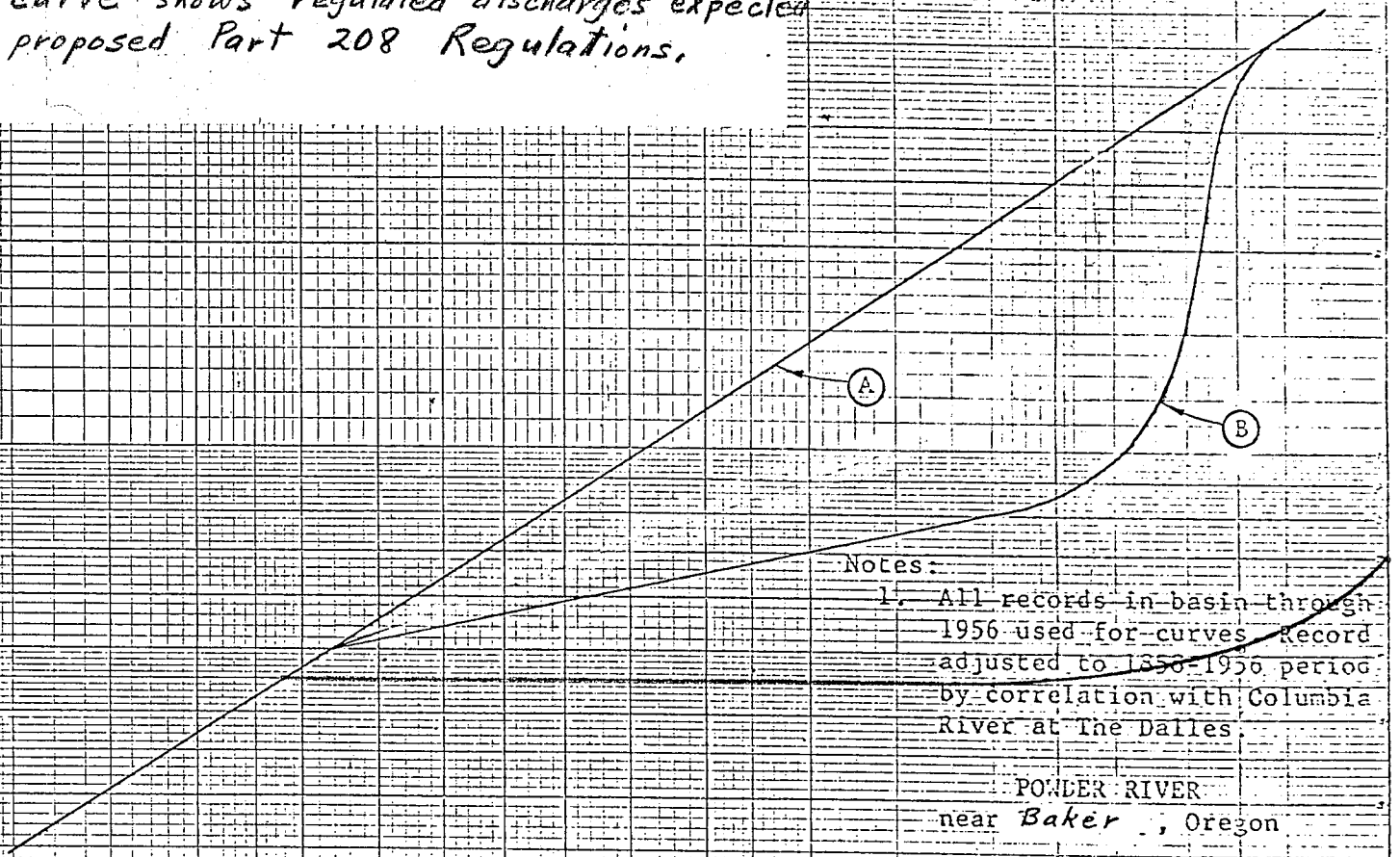
Curve (A) - Natural discharge frequency curve.

Curve (B) - Regulated frequency curve assuming 21,000 acre-feet of joint use storage and 17,000 acre-feet of exclusive storage for flood control in Mason Reservoir.

Red curve shows regulated discharges expected from proposed Part 208 Regulations.

DISCHARGE IN C.F.S.

4000
3000
2000
1000
800
600
400
200



Notes:

1. All records in basin through 1956 used for curves. Record adjusted to 1856-1956 period by correlation with Columbia River at The Dalles.

POWDER RIVER

near Baker, Oregon

Frequency Curves of Maximum Annual Discharges

14 May 58 Duncan

Plate 6

PRINTED IN U. S. A.

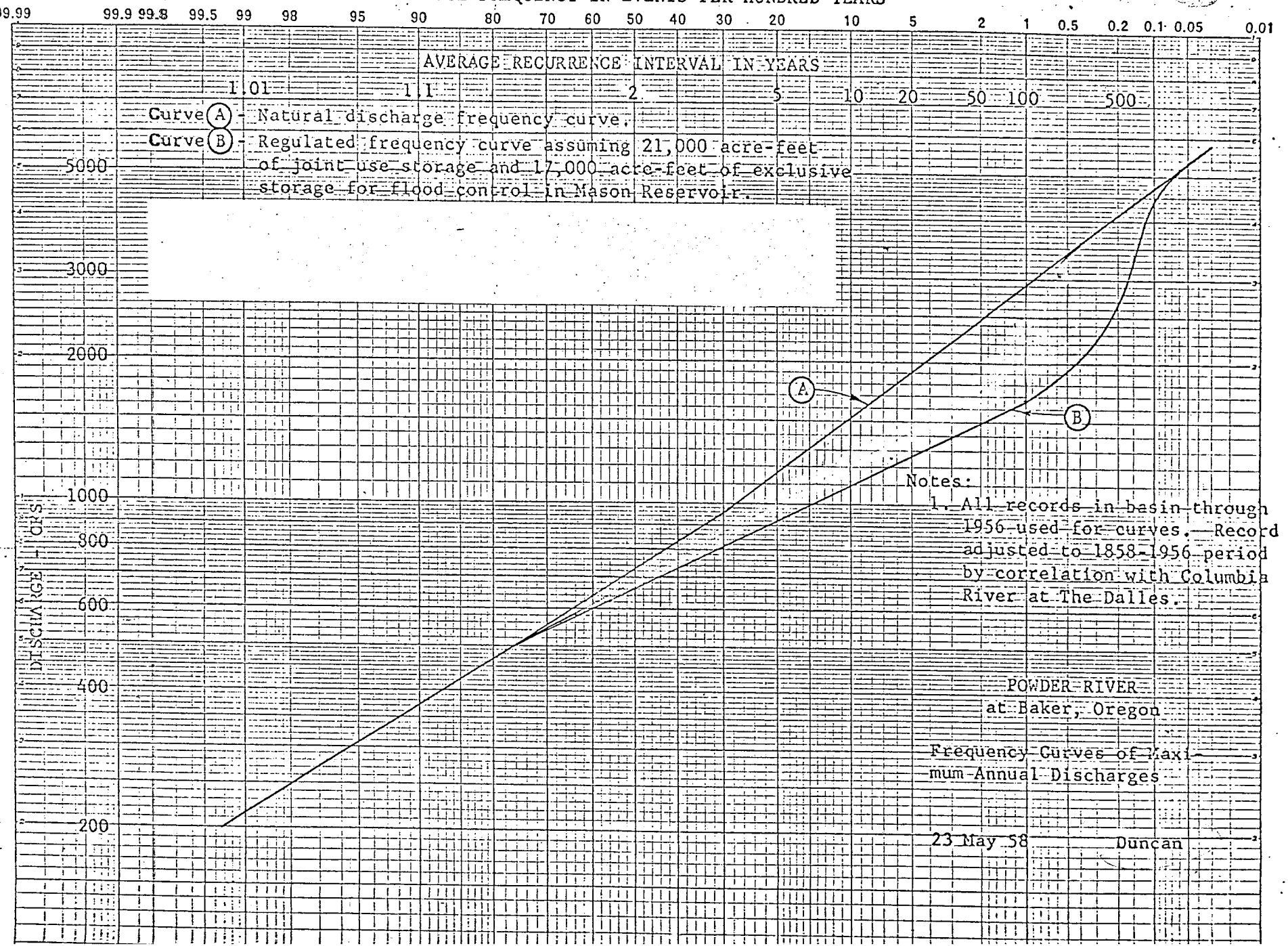


Plate 7

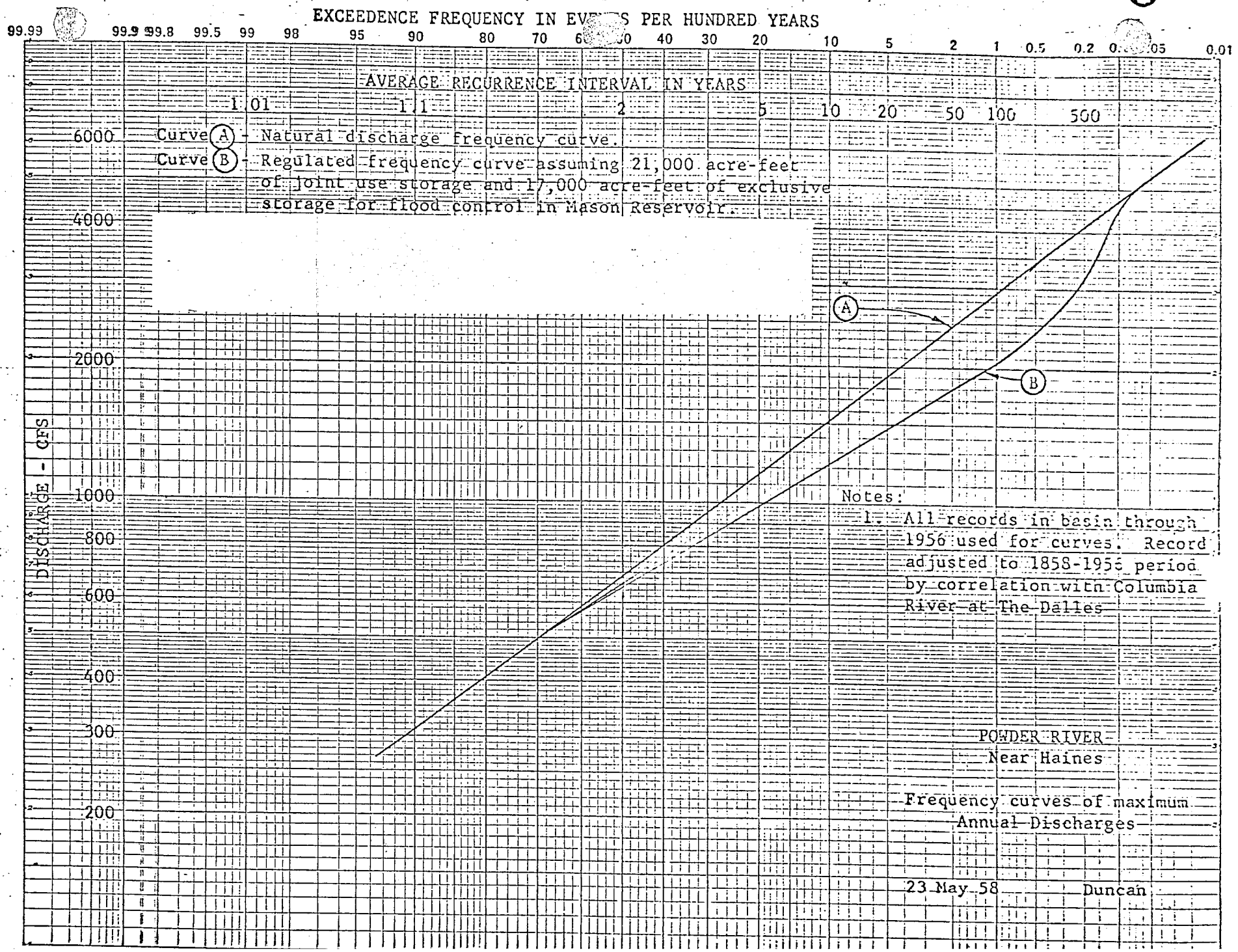
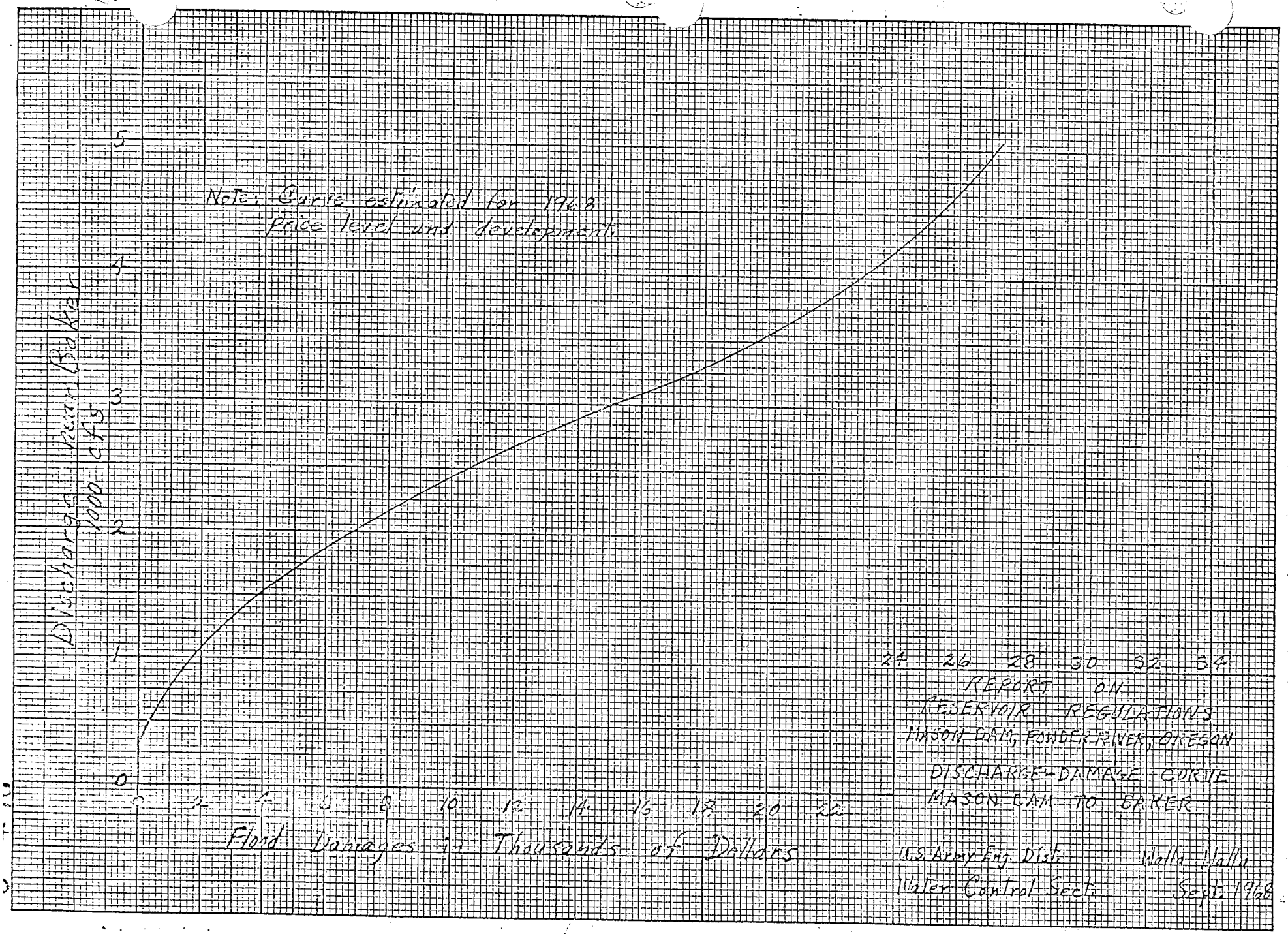
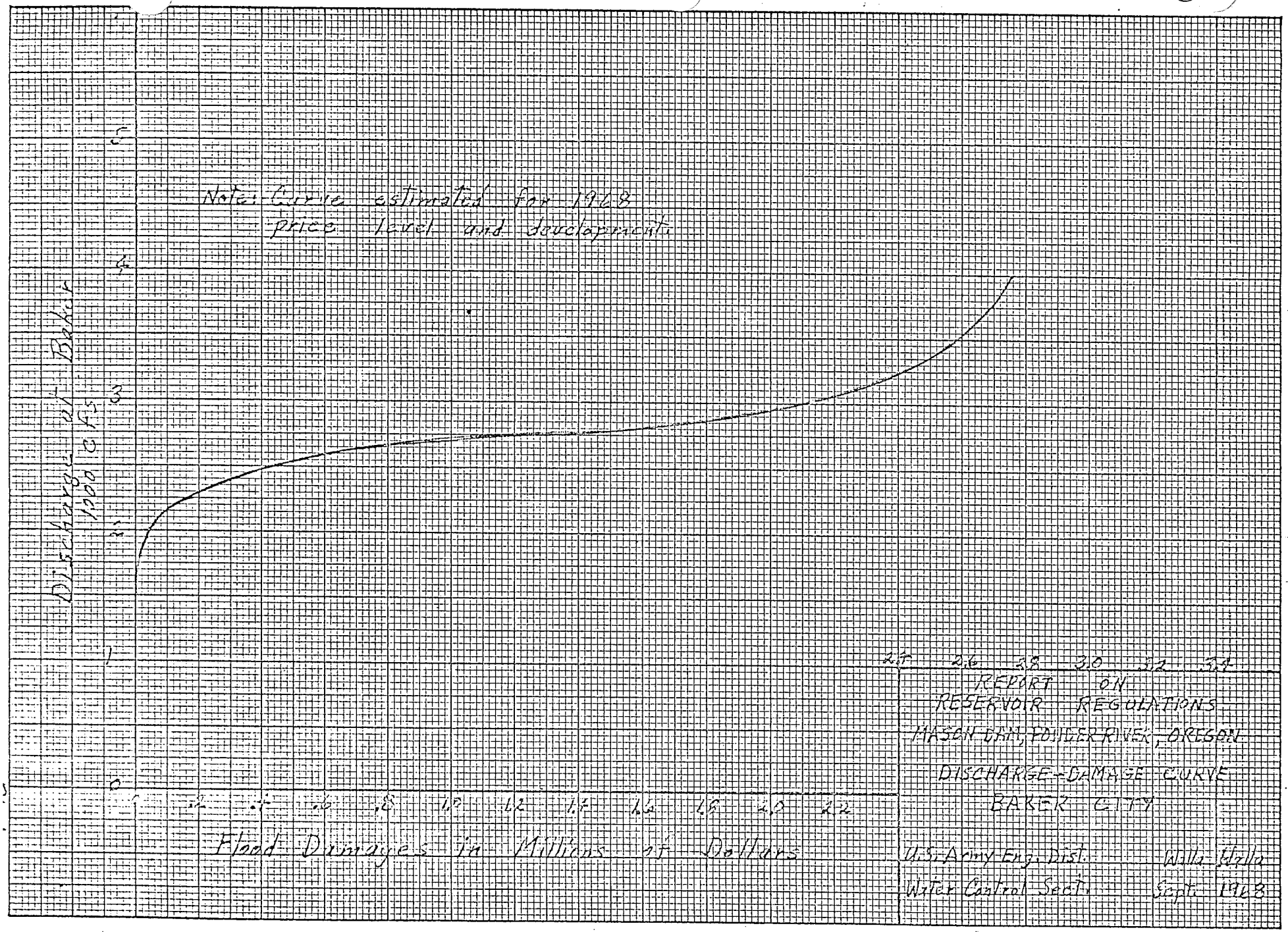
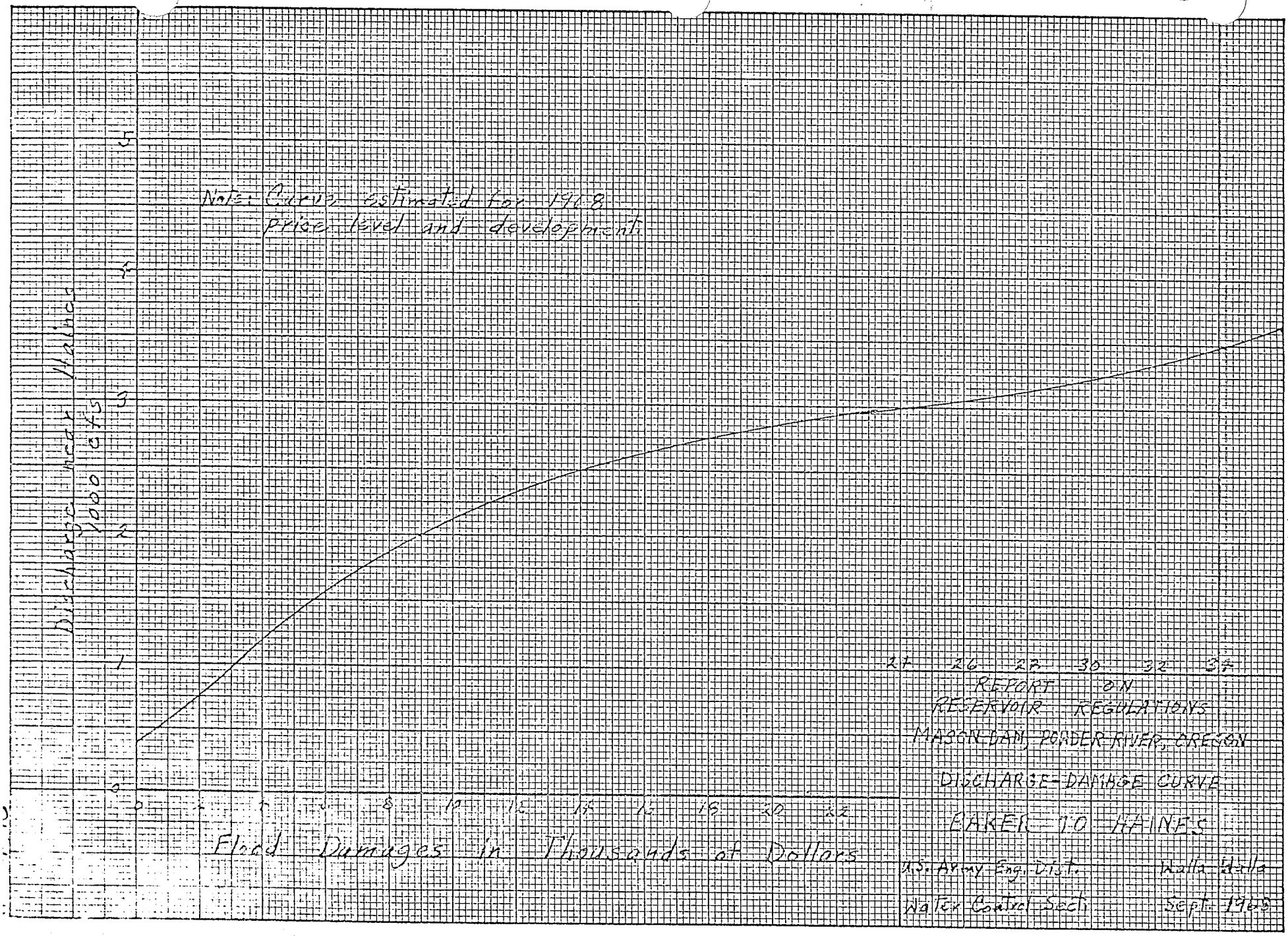
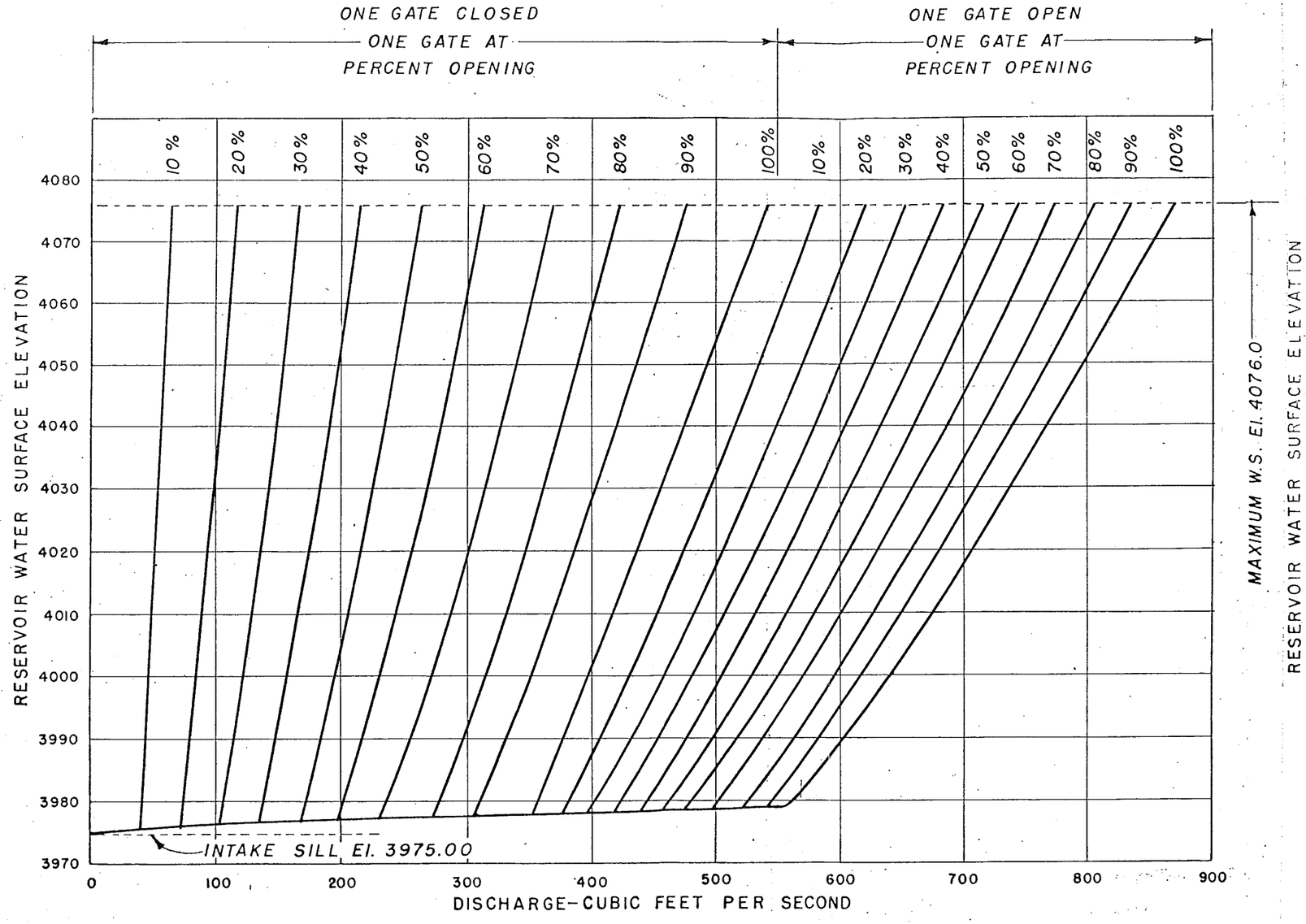

EXCEEDENCE FREQUENCY IN EVENTS PER HUNDRED YEARS
99.99
99.9
99.8
99.5
99
98
95
90
80
70
60
50
40
30
20
10
5
2
1
0.5
0.2
0.1
0.05
0.01
AVERAGE RECURRENCE INTERVAL IN YEARS
1.01
1.1
2
5
10
20
50
100
500
Curve (A) - Natural discharge frequency curve.
Curve (B) - Regulated frequency curve assuming 21,000 acre-feet of joint use storage and 17,000 acre-feet of exclusive storage for flood control in Mason Reservoir.
DISCHARGE - CFS
6000
4000
2000
1000
800
600
400
300
200
A
B
Notes:
1. All records in basin through 1956 used for curves. Record adjusted to 1858-1956 period by correlation with Columbia River at The Dalles
POWDER RIVER
Near Haines
Frequency curves of maximum Annual Discharges
23 May 58
Duncan

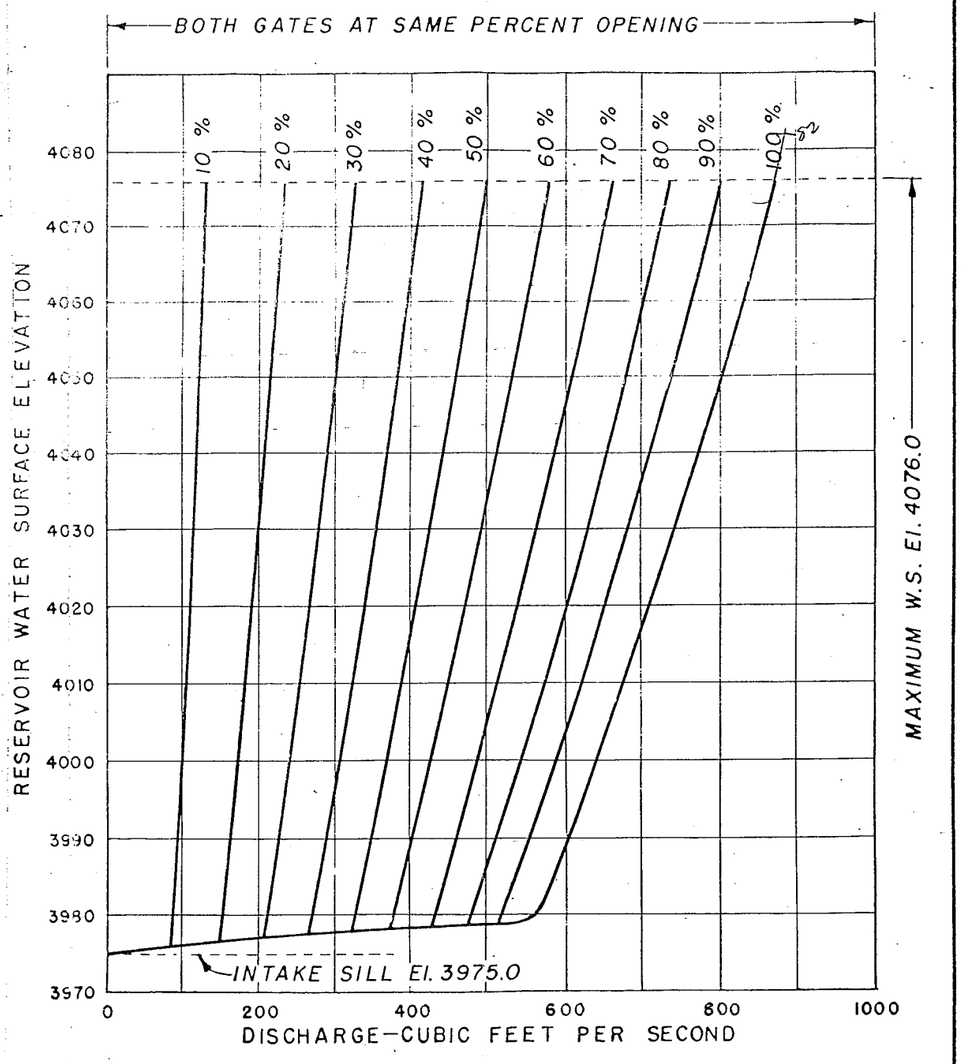
Plate 8


Note: Curve established for 1968 price level and development.
Discharge, Thousand CFS
0
1
2
3
4
5
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Flood Damages in Thousands of Dollars
REPORT ON
RESERVOIR REGULATIONS
MASON DAM, POWDER RIVER, OREGON
DISCHARGE-DAMAGE CURVE
MASON DAM TO BAKER
U.S. Army Eng. Dist. Walla Walla
Water Control Sect. Sept. 1968


Note: Curve estimated for 1968 price level and development.
Discharge at Baker in Kcfs
0
1
2
3
4
5
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
Flood Damages in Millions of Dollars
2.5
2.6
2.8
3.0
3.2
3.4
REPORT ON
RESERVOIR REGULATIONS
HAGEN DAM, POWDER RIVER, OREGON
DISCHARGE-DAMAGE CURVE
BAKER CITY
U.S. Army Eng. Dist.
Water Control Sect.
Walla Walla
Sept 1968


Note: Curve estimated for 1968 price level and development
Discharge near Haines 1000 cfs
0
2
4
0
4
8
12
16
20
24
26
28
30
32
34
Flood Damages in Thousands of Dollars
REPORT ON
RESERVOIR REGULATIONS
MASON DAM, POWDER RIVER, OREGON
DISCHARGE-DAMAGE CURVE
EAGLE TO HAINES
U.S. Army Eng. Dist. Walla Walla
Water Control Sect. Sept. 1968





NOTES

Regulating gates: 2-2'-9" x 2'-9" high pressure slide gates.
Any variation in discharge from these curves determined by measurements of flow downstream from the outlet works should be reported to the Chief Engineer.

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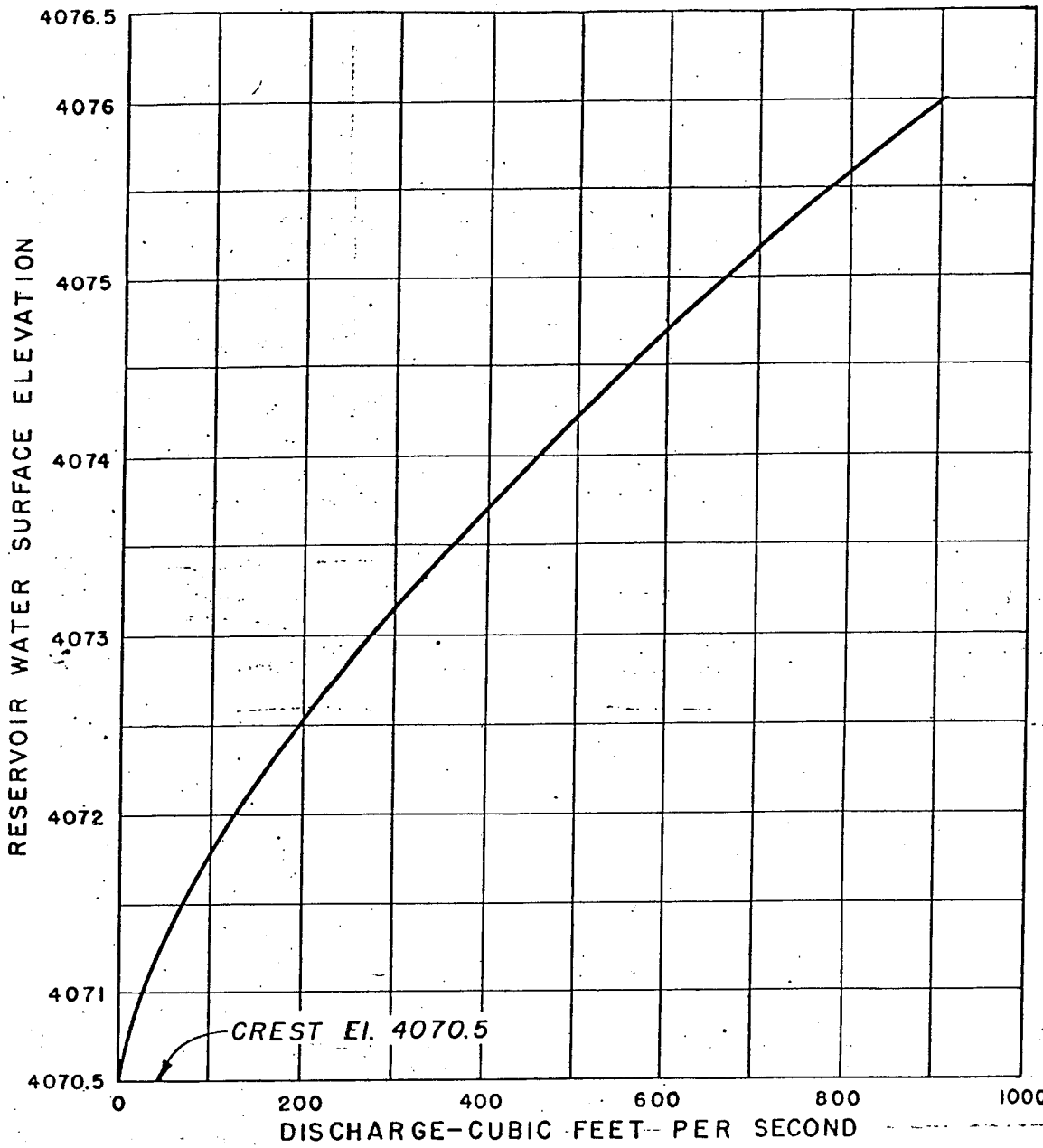
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BAKER PROJECT
UPPER DIVISION—OREGON

MASON DAM
OUTLET WORKS—DISCHARGE CURVES

DRAWN H.A.H. SUBMITTED M. A. Zabara
TRACED J.M.W. RECOMMENDED R. W. Hinrichs
CHECKED S.A.T. APPROVED R. J. Larsen
CHIEF, DAMS BRANCH

DENVER, COLORADO, DEC. 7, 1967 | 569-D-163

Plate 12



ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BAKER PROJECT
UPPER DIVISION—OREGON

MASON DAM
SPILLWAY—DISCHARGE CURVE

DRAWN	H.A.H.	SUBMITTED	M. A. Lacara
TRACED	J.M.W.	RECOMMENDED	R.W. Whinerah
CHECKED	G.A.B.	APPROVED	E. J. Larsen, CHIEF, DAMS BRANCH

DENVER, COLORADO, DEC. 7, 1967

569-D-162

Plate 13

JANUARY FEBRUARY MARCH APRIL MAY JUNE

5 10 15 20 25

Reservoir Storage 1000 A.F.

90 80 70 60 50 40

90,511 Spillway Crest

Exclusive Flood Control

73,536

Joint Use Flood Control and Irrig.

52,551

Active Conservation 52,551 A.F.

Reservoir Storage

Discharge C.F.S.

1250 1000 750 500 250 0

1892 - th peak

Natural flow at gage near Baker

Reservoir Outflow

Notes:

1. Outflow to reservoir assumed to be 85 percent of flow at gage near Baker.
2. Regulation of reservoir outflow to 25 cfs assumed to result in flows near 500 cfs at Baker.
3. Assumed regulation adjustments made every 5 days.

REPORT ON
RESERVOIR REGULATIONS
Mason Dam, Powder River, Oregon
Regulation of
1964 Flood
U.S. Army Engineer Walla Walla
Water Control Sect. Sept. 1965

Plate 14

JANUARY FEBRUARY MARCH APRIL MAY JUNE

5 10 15 20 25

Reservoir Storage 1,000 A.F.

90 — 90,519 - Spillway Crest

Exclusive Flood Control

80

73,526

70

Joint Use
Flood Control and Irrigation

60

52,531

50 — Active Conservation
52,531 A.F

40

Reservoir Storage

Discharge 1,000 c.f.s.

1,250

1,000

750

500

250

0

Natural flow at gage near Baker

Reservoir Outflow

NOTES:

1. Inflow to reservoir assumed to be 85 percent of flow at gage near Baker.
2. Regulation of reservoir outflows to 450 cfs assumed to result in flows near 500 cfs at Baker.
3. Assumed regulation adjustments made every 5 days.

REPORT ON
RESERVOIR REGULATIONS
MASON DAM, POWDER RIVER, OREGON

Regulation of
1910 Flood

U.S. Army Eng. Dist. Walla Walla
Water Control Sec. Aug. 1968

Plate 15

JANUARY 5 10 15 20 25 | FEBRUARY 5 10 15 20 25 | MARCH 5 10 15 20 25 | APRIL 5 10 15 20 25 | MAY 5 10 15 20 25 | JUNE 5 10 15 20 25

Reservoir Storage 1000 A.F.: 90, 80, 70, 60, 50, 40

90,519 = Spillway Crest

Exclusive Flood Control

73,526

Joint Use Flood Control and Irrig.

52,531

Active Conservation 52,531 A.F.

Reservoir Storage

Discharge - c.f.s.: 1500, 1250, 1000, 750, 500, 250, 0

1159 c.f.s. Peak

Natural Flow at gage near Baker

Reservoir Outflow

Notes:

1. Inflow to reservoir assumed to be 85 percent of flow at gage near Baker.
2. Regulation of reservoir outflows to 450 cfs assumed to result in flows near 500 cfs at Baker.
3. Assumed regulation adjustments made every 5 days.
4. Assumed January peak flow regulated to 10 cfs while filling the Joint Use space.

REPORT ON
RESERVOIR REGULATIONS
MASON DAM, FOUDER RIVER, OREGON

Regulation of
1965 Flood

U.S. Army Eng. Dist., Walla Walla
Water Control Sect. Aug. 1968

Plate 18

JANUARY FEBRUARY MARCH APRIL MAY JUNE

5 10 15 20 25

Reservoir Storage 1000 A.F.

90 80 70 60 50 40

90,519 = Spillway Crest

Exclusive Flood Control

73,526

Joint Use Flood Control and Irrig.

52,531

Active Conservation 52,531 A.F.

Reservoir Target

Discharge - cfs

1500 1250 1000 750 500 250 0

1400 cfs Peak

Natural Flow at Gage near Baker

Reservoir Outflow

Notes:

1. Inflow to reservoir assumed to be 85 percent of flow at gage near Baker.
2. Regulation of reservoir outflows to 450 cfs assumed to result in flows near 500 cfs at Baker.
3. Assumed regulation adjustments made every 5 days.

REPORT OF
RESERVOIR REGULATIONS
MASON DAM, PORTER RIV., OREGON

Regulation of
1958 Flood

U.S. Army Eng. Dist., Walla Walla
Water Control Sect. May 1962

Plate 17

JANUARY 5 10 15 20 25 | FEBRUARY 5 10 15 20 25 | MARCH 5 10 15 20 25 | APRIL 5 10 15 20 25 | MAY 5 10 15 20 25 | JUNE 5 10 15 20 25

Reservoir Storage - 1000 A.F.: 90, 80, 70, 60, 50, 40

90,519 = Spillway Crest

Exclusive Flood Control

73,526

Joint Use Flood Control and Irrig.

52,531

Active Conservation 52,531 A.F.

Reservoir Storage

Discharge - cfs: 1500, 1250, 1000, 750, 500, 250, 0

Natural Flow at gage near Baker

1340 cfs Peak

Reservoir Outflow

Notes:

1. Inflow to reservoir assumed to be 85 percent of flow at gage near Baker.
2. Regulation of reservoir outflows to 750 cfs assumed to result in flows near 500 cfs at Baker.
3. Assumed regulation adjustments made every 5 days.

REPORT ON RESERVOIR REGULATIONS
MASON DAM, POWDER RIVER, OREGON

Regulation of 1956 Flood

U.S. Army Eng. Dist., Walla Walla
Water Control Sect. Aug. 1969

Plate 16

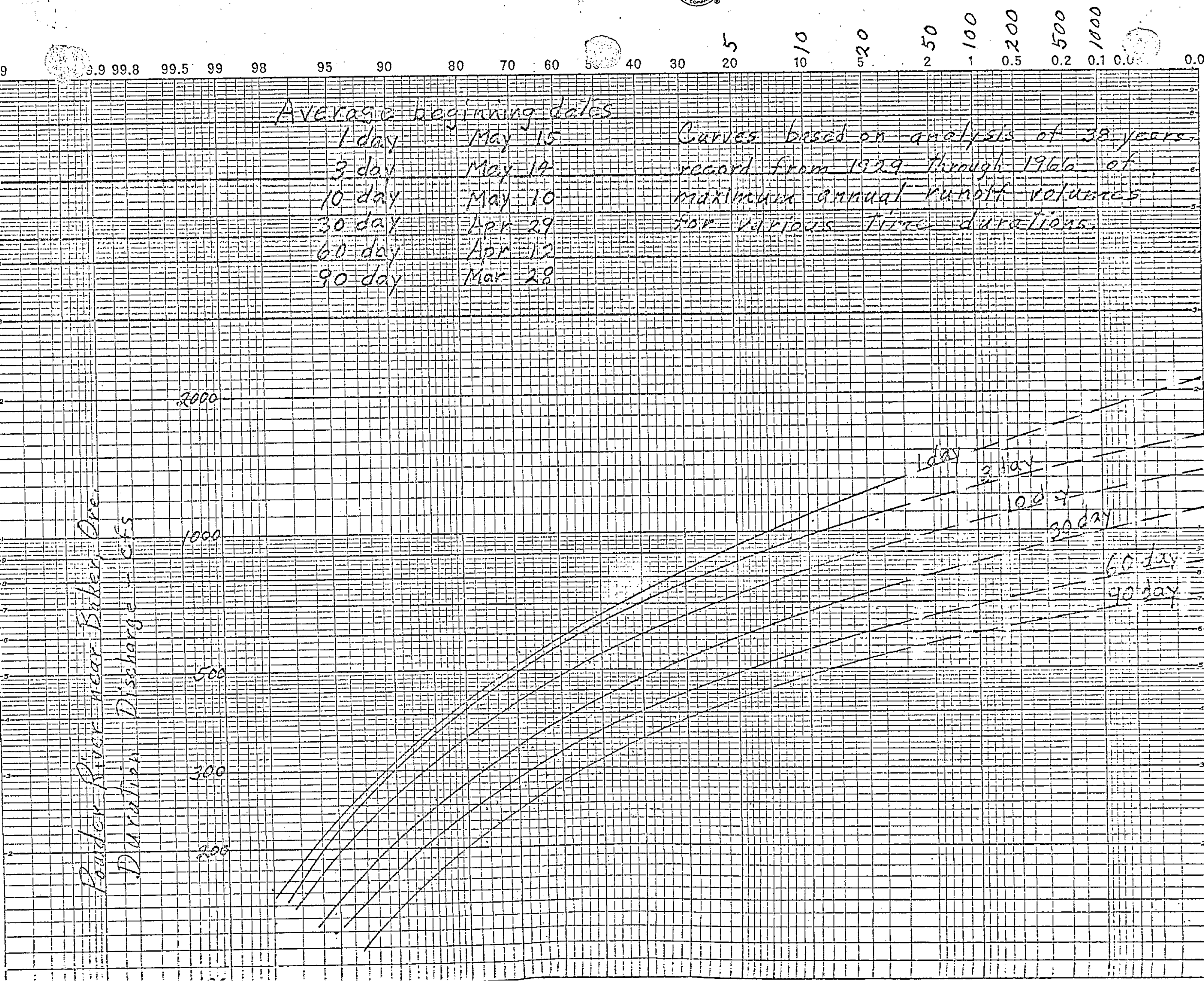
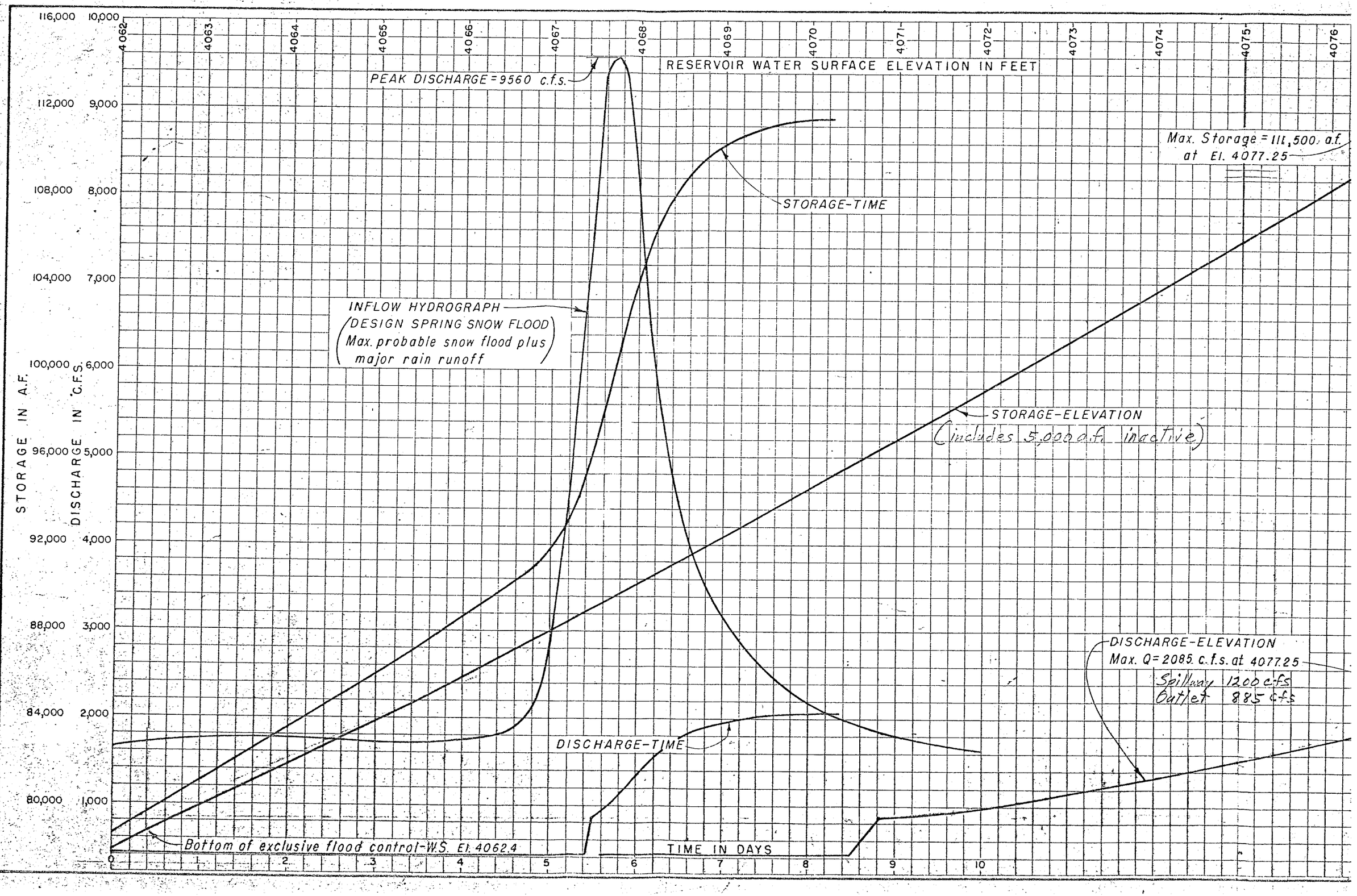

Average beginning dates
1 day May 15
3 day May 18
10 day May 10
30 day Apr 29
60 day Apr 12
90 day Mar 28
Curves based on analysis of 38 years record from 1929 through 1966 of maximum annual runoff volumes for various time durations.
Powder River near Baker, Ore.
Duration Discharge - cfs
2000
1000
500
300
200
1 day
3 day
10 day
30 day
60 day
90 day
99.99
99.9
99.8
99.5
99
98
95
90
80
70
60
40
30
20
10
5
2
1
0.5
0.2
0.1
0.01
5
10
20
50
100
200
500
1000

Plate 19


RESERVOIR WATER SURFACE ELEVATION IN FEET
4062
4063
4064
4065
4066
4067
4068
4069
4070
4071
4072
4073
4074
4075
4076
STORAGE IN A.F.
DISCHARGE IN C.F.S.
116,000
112,000
108,000
104,000
100,000
96,000
92,000
88,000
84,000
80,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
PEAK DISCHARGE = 9560 c.f.s.
INFLOW HYDROGRAPH
(DESIGN SPRING SNOW FLOOD
Max. probable snow flood plus
major rain runoff)
STORAGE-TIME
Max. Storage = 111,500 a.f.
at El. 4077.25
STORAGE-ELEVATION
(includes 5,000 a.f. inactive)
DISCHARGE-ELEVATION
Max. Q = 2085 c.f.s. at 4077.25
Spillway 1200 c.f.s
Outlet 885 c.f.s
DISCHARGE-TIME
Bottom of exclusive flood control-W.S. El. 4062.4
TIME IN DAYS
0
1
2
3
4
5
6
7
8
9
10

RESERVOIR WATER SURFACE ELEVATION IN FEET

4065 4066 4067 4068 4069 4070 4071 4072 4073 4074 4075 4076 4077

PEAK DISCHARGE = 9560 c.f.s.

Max. Storage = 111,500 a.f.
at El. 4077.25

STORAGE-TIME

INFLOW HYDROGRAPH
DESIGN SPRING SNOW FLOOD
Max. probable snow flood plus
major rain runoff

STORAGE-ELEVATION
(includes 5,000 a.f. inactive)

DISCHARGE-ELEVATION
Max. Q = 2085 c.f.s. at 4077.25
Spillway 1200 c.f.s
Outlet 885 c.f.s

DISCHARGE-TIME

d control-W.S. El. 4062.4

TIME IN DAYS

3 4 5 6 7 8 9 10

NOTES

This flood routing was made using the design spring snow flood, the area-capacity table dated Jan. 1968, Reservoir capacity allocations dated Feb. 7, 1968, and the combined spillway and outlet works capacity, except releases restricted to 450 c.f.s. when water surface is below El. 4070.5.

Max. water surface elevation 4076.0 shown on other documents was based on previous data.

ALWAYS THINK SAFETY

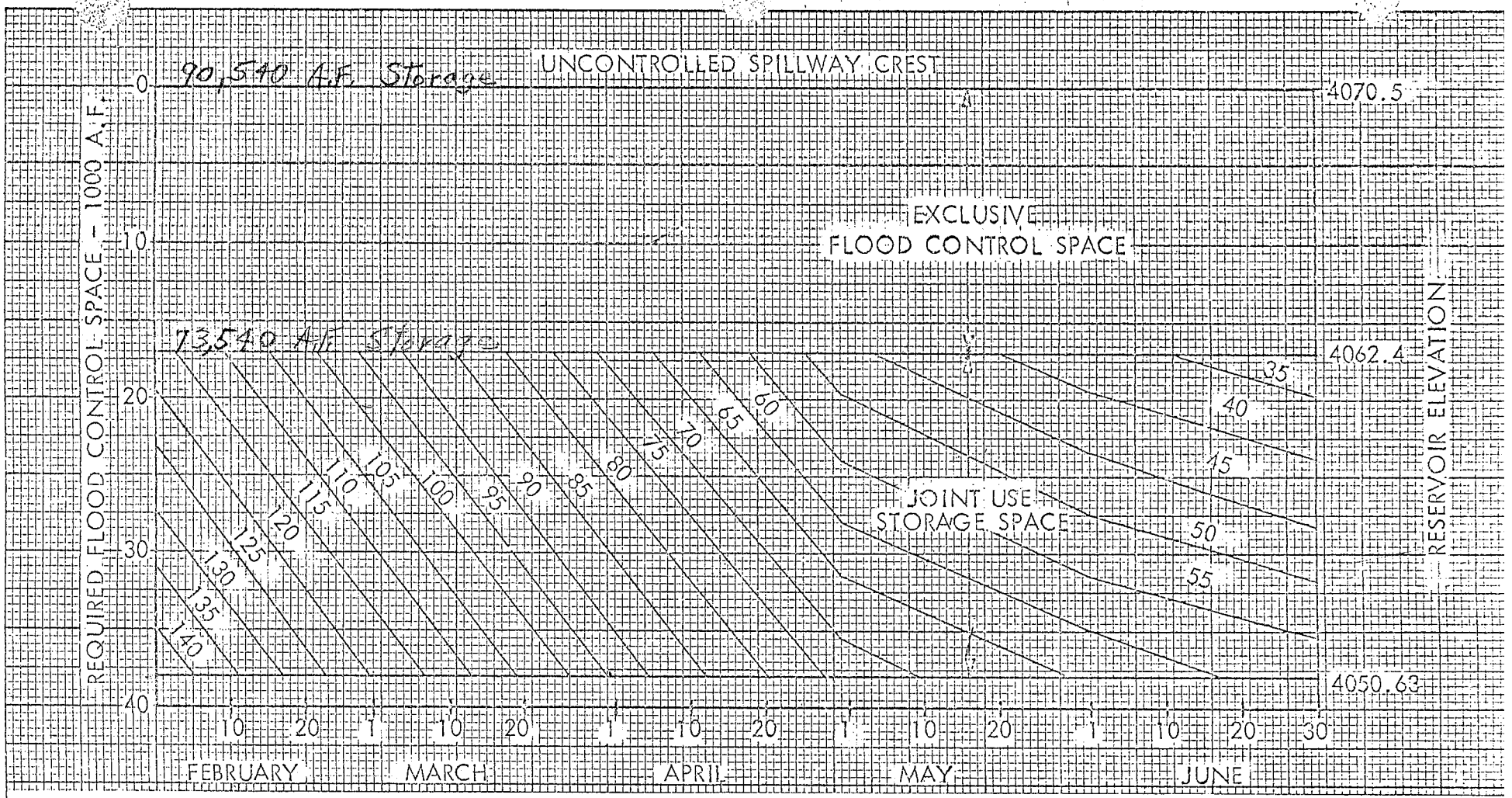
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BAKER PROJECT
UPPER DIVISION - OREGON

MASON DAM
FLOOD ROUTING

DRAWN G.H.T. SUBMITTED M. A. Jasora
TRACED F.M.K. RECOMMENDED R. W. Whinnery
CHECKED C.C.R. APPROVED Paul C. Walker
ACTING CHIEF, DAMS BRANCH

DENVER, COLO. SEPT. 12, 1968 | 569-D-165

[redacted]



NOTE:

Parameters are forecasted runoff of Powder River in thousands of acre-feet as measured at gaging station near Baker, Oregon. from date through 31 July.

Prepared Pursuant to Flood Control Regulations for Mason Dam and Reservoir (33 C.F.R. 208)

Approved _____
Commissioner of Reclamation

Approved _____
Lt. Gen., Chief of Engineers

MASON DAM AND RESERVOIR
PHILLIPS LAKE
Powder River, Oregon

FLOOD CONTROL STORAGE RESERVATION DIAGRAM

File No. PW-123-2/2

Effective Date _____

Plate 1.

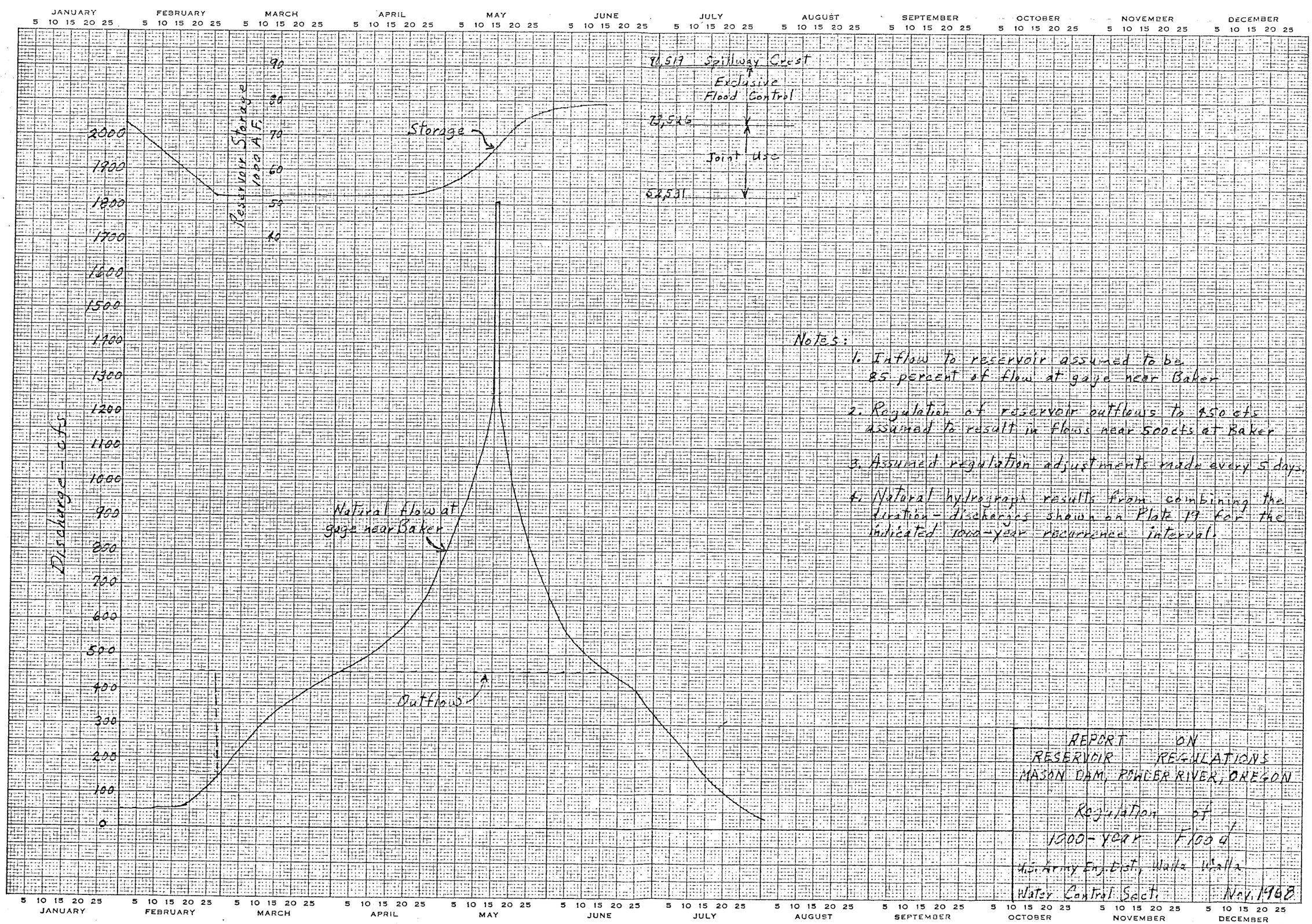


Plate 23

PRECIPITATION OR SNOWMELT - INCHES

PROBABLE MAXIMUM PRECIPITATION PLUS SNOWMELT

RESERVOIR STORAGE - ACRE-FEET - 1000's

INFLOW AND DISCHARGE - 1000 cfs

Pool overtops dam crest

Pool surface 6 feet higher than top of dam

Pool exceeds spillway crest

Reservoir Storage

Reservoir Inflow

1 hour unit hydrograph

Reservoir outflow

Probable maximum flood

Assumptions:

1. Storage at min. flood control pool at beginning of probable maximum precipitation.
2. All discharge facilities operating at full capacity.

TIME AFTER BEGINNING OF PROBABLE MAXIMUM PRECIPITATION

Time in Hours

Notes:

1. PMP and snowmelt based on criteria in USWB HMR 43 and addenda. PMP amounts derived: 4.29 inches for 6 hours; 21.35 inches in 72 hours. Snowmelt derived: 1.72 inches in 6 hours; 10.03 inches in 72 hours.
2. Losses taken as 50 percent of PMP plus snowmelt amounts.
3. Snowmelt runoff for 72-hour period prior to beginning of probable maximum precipitation used for base flow.
4. Synthetic unit hydrograph used for collection of excesses. Unit hydrograph characteristics are: C_t = 1.0, 640 C_p = 500.
5. Probable maximum flood peak 52,200 cfs or 299 c.s.m. Probable maximum flood volume 15.7 inches or 146,000 acre-feet.

MASON DAM, POWDER RIVER, OREGON

PROBABLE MAXIMUM FLOOD

Development and Routing Through Existing Dam

U.S. Army Eng. Dist., Walla Walla

CRE + RHC 1/16/62

Plate 24

MASON DAM

APPENDIX A

PERTINENT CORRESPONDENCE

COPY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

P.O. Box 718
Walla Walla, Washington
July 28, 1949

Col. Wm. Whipple, District Engineer
Corps of Engineers, Department of the Army
19 East Poplar Street
Walla Walla, Washington

Re: Powder River, Oregon

Dear Colonel Whipple:

This office is presently engaged in completing a study and report on the irrigation possibilities on the Powder River near Baker, Oregon. We desire to incorporate in our report the views of the Corps of Engineers on flood control and major drainage.

The plan of irrigation now under consideration contemplates a storage reservoir of 60,000 acre-feet capacity at the Mason site on Powder River and the sale of stored water to water-right lands in Baker Valley. Irrigation will require 45,000 acre-feet of the total capacity and it is proposed to have a conservation pool of 2,000 acre-feet. This will leave 13,000 acre-feet available for joint use of flood control and irrigation to be filled during the last of the snow-melt flood. The attached sheet shows the reservoir operation in a low run-off year.

Preliminary designs for the Mason Dam, made in 1934, provided for an outlet capacity of 800 second-feet and a spillway capacity of 7,500 second-feet. Your office has been supplied a copy of our "Spillway Design Flood Study" for the Mason Reservoir and it is requested that this study be reviewed and your comments on the adequacy of the spillway be forwarded to our office at as early a date as is convenient so that we may request our Chief Engineer's Office for a review of the earlier design and cost estimate.

We also desire from your office a statement of potential flood damages along Powder River and the probable reduction in such damages which would be attributable to the operation of Mason Reservoir. This information is desired by October 1 or as soon thereafter as it can be made available.

We also desire from your office a statement of damages resulting from the high water table in Baker Valley, your plans for alleviating this condition and the potential benefits to be derived from the lowering of the water table. These damages and benefits should not include damages resulting from floods or benefits which might accrue to Mason Reservoir. This statement is also needed by October 1 or as soon thereafter as possible.

Sincerely yours,

M. Boyd Austin
Planning Engineer

cc-Regional Director, Boise, Idaho
Attn: 1-760

A-1

PRELIMINARY MASON RESERVOIR OPERATION STUDY
BAKER PROJECT - UPPER UNIT, OREGON

Capacity: 60,000 Acre-feet Unit: 1000 Acre-feet

	Month	Flow at Salisbury	Computed Flow at Bowen	Computed Flow at Mason	Non-storable Natural Flow	Water Supplied to Water Right Holders on Non-arable Land	Water Supplied to Smith Ditch	Water Released to Project Lands	Total Water Supplied and Released	Storable Water	Reservoir Release	Reservoir Evaporation	Reservoir Spill	End of Month Reservoir Content
1933	Nov.	0.79	0.87	0.67	0.20	-	-	-	-	0.67	-	-	-	*34.74
	Dec.	2.08	2.29	1.77	0.52	-	-	-	-	1.77	-	-	-	35.41
														37.18
1934	Jan.	3.43	3.77	2.92	0.85	-	-	-	-	2.92	-	-	-	40.10
	Feb.	3.14	3.46	2.67	0.79	-	-	-	-	2.67	-	-	-	42.77
	Mar.	6.73	7.40	5.72	1.68	-	-	-	-	5.72	-	-	-	48.49
	Apr.	7.54	8.29	6.41	1.88	3.00	-	3.16	6.16	2.13	4.28	0.20	-	50.42
	May	3.17	3.49	2.69	0.80	3.49	-	4.73	8.22	-	7.42	0.31	-	45.38
	June	1.31	1.44	1.11	0.33	1.44	-	7.52	8.96	-	8.63	0.31	-	37.55
	July	0.47	0.52	0.40	0.12	0.52	-	9.47	9.99	-	9.67	0.32	-	27.76
	Aug.	0.06	0.07	0.05	0.02	0.07	-	7.89	7.96	-	7.94	0.23	-	19.64
	Sept.	0.02	0.02	0.02	-	0.02	-	4.37	4.39	-	4.39	0.11	-	15.16
	Oct.	0.31	0.34	0.26	0.08	0.34	-	2.30	2.64	-	2.56	0.04	-	12.82
Total		$29.05	31.96	24.69	7.27			39.44		$15.88		1.52		

*Holdover storage

A-1

NHS 600.236 (Powder River)-1/1

COPY

LEWIS

COPY

NPWGP

August 22, 1949

M. Boyd Austin
Planning Engineer
U. S. Bureau of Reclamation
P. O. Box 718
Walla Walla, Washington

Dear Mr. Austin:

Reference is made to the third paragraph of your letter of July 28, 1949, in which you request comments by this office on the adequacy of a 7,500 second-feet spillway capacity for Mason Damsite on Powder River, Oregon.

From results of studies in 1941 the Corps of Engineers proposed a spillway capacity of 8,500 second-feet for this site. The Corps of Engineers' derivation was based on a two-day storm with one inch of run-off the first day and two inches the second day, applied to a unit graph similar to that used by your office. Analysis of stream-flow in Powder River indicates that large floods are more likely to result from rapid snow-melt augmented by rainfall as your 1947 studies show.

For spillway design floods, the Office, Chief of Engineers recommends use of 0.05 inches of water melted from snow per day degree of heat supply. For most basins use of that rate of snow-melt and minimum losses consitent with observed basin values would result in a somewhat higher rate of run-off than the 0.014 inches of run-off per day degree of heat supply used in studies by Mr. Gay of your office. Also, the Corps of Engineers favors superimposing the rain flood directly on the peak of the snow-melt flood, a more critical combining of these components of the spillway design flood than used in studies by your office.

Because of shortage of time and personnel this office has not made a detailed analysis of the spillway capacity requirement for Mason Damsite. However, in accordance with comments in the preceding paragraphs, it is believed that an analysis by this office would result in a spillway design flood peak exceeding 7,500 second-feet and probably equalling or exceeding the 8,500 second-feet peak discharge derived earlier by the Corps of Engineers. Until a detailed analysis can be made this office favors the use of 8,500 second-feet for the

A-2

Austin, M. Boyd

spillway design flood.

Although you do not request comments on the outlet capacity, it appears from a brief review that the capacity of 800 second-feet would be adequate for flood operations of the reservoir.

Very truly yours,

WM. WHIPPLE,
Colonel, Corps of Engineers
District Engineer

COPY

RHC/md
JMO
LER
JER
RDW
SGN
WW
M&R

A-2

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
P. O. Box 718
Walla Walla, Washington

March 9, 1950

Colonel William Whipple
District Engineer
Walla Walla District
Corps of Engineers
19 East Poplar Street
Walla Walla, Washington

Re: Powder River

Dear Colonel Whipple:

On July 28, 1949 we requested certain information from your office concerning benefits to be derived from control of floods through storage in a reservoir at the Mason site on Powder River. There appears now to be some question whether the dam if constructed would be at the Mason site or the Bowen site which is located on Powder River a short distance above the town of Baker. The data previously furnished for the Mason Reservoir would also apply to the Bowen Reservoir so it is requested that in addition to the information requested in our July 28 letter you also furnish us with similar information on flood control attributable to a reservoir at the Bowen site.

It has also occurred to us that while you are working on the Powder River you might also wish to furnish us information as to the potential value of a reservoir on Wolf Creek, a tributary entering the Powder River below North Powder. The contemplated reservoir would have a capacity of 8,300 acre-feet and would be operated in the interest of irrigation on a forecast basis. The dam site is in the southeast quarter of Section 11, township 6 south, Range 38 east.

Our report on the Wolf Creek Division is not scheduled until the fall of 1952 so our need for information on the Wolf Creek Reservoir is not urgent but we thought that it might entail less work for you if the flood control values for this reservoir were determined at the time you are working on the determination of the values for the Mason and Bowen reservoirs.

Sincerely yours,

/S/ M. Boyd Austin

M. Boyd Austin
Planning Engineer

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UNITED STATES
DEPARTMENT OF THE INTERIOR
P.O. Box 718
Walla Walla, Washington

June 29, 1950

Colonel William Whipple
District Engineer
Corps of Engineers
Department of the Army
19 East Poplar Street
Walla Walla, Washington

Re: Powder River, Oregon

Dear Colonel Whipple:

Reference is made to our letters of July 28, 1949 and March 9, 1950 with regard to the Powder River, in Oregon.

not in file - has no bearing on Falls

It has now been determined that the Mason dam and reservoir site will be the favored site forpurposes of our report. The request for flood control information on the Bowen site contained in our March 9, 1950 letter may now be disregarded.

Further refinements in our reservoir operation studies have lead to the conclusion that we could not justify irrigation storage at the Mason site in excess of 45,000 acre-feet. Theoperation table supplied with our letter of July 28, 1949 should therefore be corrected to show carryover storage of 20.10 instead of 34.74 and revising theother figures shown in the last column accordingly.

A portion of the 45,000 acre-feet of irrigation storage capacity may be used jointly for flood control. The following tabulation shows the amount of storage space which would have been available at the first of the month for storage of flood flows if the irrigation capacity were to be completed filled by June 1 which is usually the end of the storage period.

First day of month	Capacity available for flood control
November	24,900
December	24,000
January	22,000
February	19,000
March	17,000
April	11,000
May	3,000
June	0

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The value of the indicated amounts of storage capacity should be determined in terms of ability to control floods. This will give us a figure to use for the value of the irrigation reservoir for incidental flood control.

We also wish you to evaluate for us various amounts of storage over and above the 45,000 acre-feet of irrigation storage which would be reserved exclusively for flood control. It is presumed that with additional exclusive flood control capacity that the entire 25,000 acre-feet of joint use capacity could be operated on a snow-melt forecast basis rather than on the filling schedule previously shown.

Conversations with engineers of your office have indicated that optimum flood benefits would occur with exclusive flood control capacity of somewhere between 8,000 and 17,000 acre-feet. It is suggested that evaluations be made for flood control capacities of 8,000, 13,000 and 17,000 acre-feet.

We also understand that engineers of your office are doubtful whether drainage works in the Baker Valley are desired or if they would be beneficial. We would like to have a definite statement of the view of the Corps with regard to this problem as well as your evaluation of flood damages and benefits.

Our report schedule is such that the information desired from your office should reach us not later than January 1, 1951.

Sincerely yours,

/s/

M. Boyd Austin
Planning Engineer

in Duplicate

COPY

NPNGP

May 11, 1951

Mr. M. Boyd Austin
Bureau of Reclamation
P.O. Box 718
Walla Walla, Washington

Dear Mr. Austin:

Reference is made to your letter to this office of June 29, 1950, together with previous letters and subsequent discussions concerning benefits allocable to the proposed Mason dam on Powder River, Oregon. It is our understanding that current plans call for a reservoir of 100,000 acre feet capacity, a portion of which will be available for flood control.

Flood damages in the basin occur primarily in Bowen Valley, through the city of Baker, Baker Valley, lower Powder Valley situated downstream from Thief Valley Reservoir, and in the vicinity of the mouth of Eagle Creek. The river meanders through the agricultural areas of these reaches and little attempt is made to control overbank flooding. Numerous check dams tend to raise the water surface profile during flood stage. Existing channel capacities in some reaches of the river are estimated at less than 500 c.f.s. The river channel through the city of Baker has been extensively improved and is capable of handling the more frequent floods up to about 1,500 c.f.s. Reservoir regulation will make this improved channel very effective through the urban area.

Flood damages under existing conditions of development and current prices have been estimated and average annual damages computed based on anticipated frequency of occurrence. Due to the type of floods experienced, it is felt that for any major allocation of benefits, some exclusive flood control space will be required. For study purposes benefits have been computed based on a series of flood control storage capacities. Subsequent study and agreement will be required concerning the portion of these capacities that can be considered joint use storage and the portion required for exclusive flood control. The following table shows the flood control benefits creditable to Mason Reservoir under existing conditions depending on the space assigned thereto. Earnings as shown are based on optimum regulation of assigned space with controlled releases scheduled to 500 c.f.s. at the dam site.

Flood Control Storage (Acre Feet)	Annual Benefits
Plan 1	$ 10,000
8,000	16,000
13,000	21,000
17,000	30,000
25,000	38,000
33,000	41,000
38,000	43,000

Note: Plan 1 is scheduled use of unfilled irrigation storage space thru which incidental flood control regulation is accomplished.

From an examination of the stream flow regulation upon which the above tabulated benefits were based, it is evident that for any storage of less than 25,000 a.f., the remaining damages and frequency of flooding, especially below the town of Baker, will no doubt justify some channel rectification coordinated with upstream storage. In that event future joint allocation of benefits between storage and channel improvement may be necessary. However, any definite plans along these lines can be determined only by a comprehensive study of the area, as contemplated in our pending report on the flood and drainage problems of the Basin. Completion of this report is at least a year in the future, dependent on availability of funds.

Your letters and our discussions have also covered the problem of land drainage in Baker Valley. As you know this subject is somewhat controversial through the valley depending on the land usage. Drainage improvements must of necessity be coordinated with land management practices and this entire subject is one of considerable magnitude requiring careful study. This office has had neither funds nor personnel available to study the problem at the present time and therefore cannot furnish you an evaluation of the effect of your proposed storage development on the drainage problems of the valley.

Very truly yours,

W. H. MILLS
Colonel, Corps of Engineers
District Engineer

HAP/o
LER
JER
VB
RNA
WHM
M & R

A-5

Planning Branch Files

10 July 1952

THRU: Chief, Planning & Reports Branch
Chief, Reports Section

Powder River Investigations

1. Messrs. Boyd Austin and John Mangan of the U.S.B.R. Area Planning Office in Spokane were in this office 7 July 1952 for coordination of their reports on Umatilla River and Powder River with work of this office. Corps of Engineer personnel present included Mr. Rydell, part time, Messrs. Lewis, Preston, Schultz, Conway and Bruce. A separate memorandum has been prepared on Umatilla River.

2. Principal purpose of discussion relative to Powder River was to determine the hydrologic feasibility of using joint storage at the Bureau's proposed Mason Dam and the benefits creditable thereto. Mr. Austin, in accordance with previous discussion with this office, is proposing to use 17,000 acre-feet of exclusive flood control storage yielding a flood control benefit of $30,000 in accordance with our letter of May 1951. In addition to this exclusive storage he is analyzing the economic feasibility of providing 21,000 acre-feet of joint use storage for which a benefit of $13,000 annually would be possible under optimum conditions in accordance with our referenced letter. He was advised that it was the preliminary opinion of this office that joint use storage on Powder River was practicable but that, because of possible inaccuracies in forecast, the $13,000 benefit cited above should be scaled down to $10,000, and that it should be reduced further by the annual charges of the hydrologic stations required to permit forecasting. Mr. Conway is to estimate the capital cost of the additional hydrologic stations required and their annual cost, and to forward this information to Mr. Austin within the next month.

3. Mr. Austin was informed that, because of lack of funds, we planned no work in the immediate future toward refining the preliminary storage benefits previously furnished him, and that the preliminary benefits as furnished reserve some relatively small amounts for channel rectification which this office considers a necessary adjunct of storage in order to provide satisfactory flood control. It may be possible, however, in line with teletype dated 9 July 1952 OCE to NPD, relating to availability of more P.E.&S. funds for FY 1953 than anticipated, to schedule some work on Powder River in the near future. In this event Mr. Austin should be notified accordingly.

BRUCE

cc: Mr. Lewis
Mr. Preston
Mr. Conway

A-6

NPWGP July 23, 1952

Mr. Boyd Austin
U. S. Bureau of Reclamation
Spokane Area Planning Office
N. 1207 Division Street
Spokane 2, Washington

Dear Mr. Austin:

In accordance with your request of July 7, an estimate has been prepared of hydrologic network requirements and costs considered necessary for operation of Mason reservoir on Powder River. The network would consist of 4 precipitation gages and 5 snow survey courses with semi-monthly reports of precipitation and snow generally during the flood season and a few daily reports from accessible precipitation gages during occasional periods of intense rainfall.

The following tabulation summarizes existing and proposed network stations, reports required and estimated costs:

Gage or Course	Reports required	Costs: Initial (Construction)	Costs: Annual (O&M)
Precipitation gages			
Baker, recorder 1/	Semi-monthly, some daily	$ 0	$ 0
Bourne, storage 2/	Semi-monthly 3/	1,500	180
Goodrich Lake 2/	Semi-monthly 3/	1,500	180
Sumpter power plant 2/	Semi-monthly, some daily	100	180
Snow courses			
Bourne 1/	Semi-monthly 4/	0	380
Eilertson Meadows 1/	Monthly	0	0
Goodrich Lake 1/	Semi-monthly 4/	0	380
Dooley Mountain 1/	Semi-monthly 4/	0	380
Cold Center 1/	Semi-monthly 4/	0	380
Sub-totals		$3,100	$1,860
Contingencies		310	190
TOTALS		$3,410	$2,050
Rounded Costs		$3,400	$2,100

1/ Existing facilities. 2/ Proposed new construction.
3/ Coincident with snow surveys at these locations.
4/ Eight reports per year: Jan. 1, Feb. 1, Mar. 1 and 15, Apr. 1 and 15, May 1 and 15. Four at no cost to project.

Austin, Boyd July 23, 1952

Reservoir pool and discharge gages would be required for operation of the reservoir for irrigation. Costs of these gages are not included in the estimate which is for additional costs chargeable to flood control.

FOR THE DISTRICT ENGINEER:

RHC,
MJO
LER
ECF,
M&R

Very truly yours,

E. C. FRANZEN
Chief, Engineering Division

A-7

NPDGP

27 August 1953

Mr. H. T. Nelson
Regional Director
Bureau of Reclamation
Box 937
Boise, Idaho

Dear Mr. Nelson:

Reference is made to your letter of 15 April 1953, file number 730, furnishing for review and comment your proposed report on the Baker Project, Oregon, Upper Division, dated March 1953.

Your report recommends construction of Mason Dam with a reservoir of 100,000 acre-feet capacity, of which 54,000 acre-feet would be exclusively for irrigation; 17,000 acre-feet exclusively for flood control; 21,000 acre-feet for joint use of flood control and irrigation; and 8,000 acre-feet for sediment deposition and recreation. Construction cost of the project is estimated at $4,925,000 of which $1,387,800 has been allocated to flood control, derived by capitalizing the annual net flood control benefit at two and one-half percent interest over a 100-year period.

As you know, a report on the Powder River Basin is currently under preparation by our Walla Walla District office and it will give primary consideration to flood control problems, including the necessity for supplementary channel and major drainage improvements downstream from the proposed storage reservoir. Flood control benefits to be derived from such works would be additional to those assigned to the reservoir.

Colonel Tandy, District Engineer, Walla Walla, has already furnished comments in review of your report by letter of 10 July 1953. I note that your reply to him states that the method of allocating costs to flood control will be further considered upon completion of review of allocation procedures now underway in the Department of Interior.

The opportunity to review your report is appreciated.

Sincerely yours,

E. C. ITSCHNER
Brigadier General, USA
Division Engineer

cc: NPW

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A-8

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Upper Columbia Development Office
W. 1323 Nth Avenue
Spokane 1, Washington

March 28, 1958

District Engineer
Corps of Engineers
Walla Walla District
City County Airport
Walla Walla, Washington

Dear Sir:

For some time we have been cooperating with your Planning Branch in the preparation of our respective planning reports on the Upper Powder River in Baker Valley near Baker, Oregon. Recently Mr. Edward Preston met with individuals of this office for an informal discussion of our mutual problems. Since that time we have met with our Regional office personnel and have reached a decision as to the type of report that this office will prepare. It was concluded in our Regional office conference that our report should be in our Regional office prior to the end of this fiscal year.

For the information of your planning people we propose to prepare a revised Baker Project report on the basis of Mason Dam and Reservoir on the Upper Powder River constructed to a capacity of about 100,000 acre-feet.

We have established an arable land area of approximately 17,800 acres in Baker Valley that would be served by this reservoir.

Our plan for the distribution system of the Baker Valley is substantially the same as it was in our 1954 report. In this report, of which you have a copy, we assumed that the water would be distributed through the existing lateral system in the valley. In our report we will assume that the irrigation district will make such minor improvements to the existing works as are found to be necessary to make delivery of water. These improvements would be made by the district with their own forces during a development period tentatively set as five years.

On the subject of drainage, it was concluded that we would cooperate with your office in the opening of Powder River, Old Settler Slough and Baldock Slough to the extent that your office can justify

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this work on the basis of flood control. At this time we do not intend to include a Bureau constructed system of intercepter drains in our project plan. We will expect the irrigation district to build such works along with improving their distribution systems during the development period.

In general the plan we propose to use is quite similar to that in the 1954 report with the exception that we will provide a pumping plant near the north end of the valley in NE1/4 sec. 11, T. 8 S., R. 39 E., to serve up to 3,000 acres above the river bottom.

In connection with our studies we would like to have a new evaluation of flood control benefits for the following conditions:

1. Joint use for flood control and irrigation of 30,000 to 40,000 acre-feet of space to be filled on a forecast basis.

2. The required exclusive flood control space in Mason Reservoir for floods which can not be forecast and the benefits associated with this space in addition to those determined for item 1. The inclusion of this space in the plan of development would depend on incremental benefit-cost analysis.

We would also appreciate your review of the installation, operation, and maintenance costs of additional snow courses and other hydrometeorological stations that would be required to supplement the basic over-all flood control forecasting system in the area. These data were previously furnished this office by letter of July 23, 1952.

Some of my staff will be available to meet with your staff at an early date, possibly during the week of April 7, to discuss problems of mutual interest on this project. If you will suggest a date suitable to you we will plan accordingly.

Very truly yours,

Charles S. Hazen
Area Engineer

cc: Regional Director, Boise, Idaho--Attn: 700

A-9

NPWCW

1 April 1958

X 634.03 Annuities

Mr. Charles S. Hazen
U.S. Department of the Interior
Bureau of Reclamation
Upper Columbia Development Office
W. 1323 Ida Avenue
Spokane 1, Washington

Dear Mr. Hazen:

Reference is made to your two letters of 28 March 1958, concerning your current investigations on Powder and Umatilla Rivers and the need for flood control benefits for the storage reservoirs under study.

As suggested in your letter, I believe it will be to the advantage of both our offices to have a meeting on these two projects and review the available data on hand in our office and the additional details needed. I would like to propose that such a meeting be held the afternoon of Wednesday, 9 April 1958, in line with the informal discussions between Mr. Mangan and Mr. Preston. Unless we hear to the contrary, we will expect you that date.

Inclosed herewith are two copies of the topography at the Mission Dam site as requested by Mr. Mangan.

HAP/mf
LER
ECF
MSR

Sincerely yours,

1 Incl (in dupe)
Topo

E.C. FRANZEN
Chief, Engineering Division

A-10

NPWCW
Water Control Files

Conference with Bureau of Reclamation on Powder River and Umatilla River
Melvin J. Ord. 14 Apr 58
Ord/cm

1. On April 1958, Mr. John Mangun, in company with three other engineers from the Spokane office, Bureau of Reclamation, visited the Planning Branch to discuss investigations on the Powder River and Umatilla River. Messrs. Rydell, Preston (part time), Mould and Ord intered into discussion with these representatives.

2. Mr. Mangun reiterated the statement that he had made previously with regard to the Powder River project in that the Spokane Office of the Bureau is obligated to submit their report to higher authority no later than the 30th of June. This puts them under a rather sever time limit and they are especially interested in obtaining from the Corps of Engineers some estimates of flood control benefits that would accrue to Mason Dam on the Powder River. They were also interested in any plan of the Corps for drainage within the Baker Valley, because if the Corps would recommend a plan for drainage such channels would enhance irrigation by providing channels for irrigation waste water. Mr. Rydell indicated that it would be impossible for this office to arrive at any recommendations for drainage by 30 June. The Corps has not scheduled such an investigation to be completed within the next year, therefore, figures for drainage would not be available for the Bureau's report.

3. With regard to flood control benefits the Bureau representatives were informed that this office is currently reviewing the flood frequency curves and the preliminary operating plans that were used in the 1954 report. Also, a field investigation has been made of flood damages. The objective of these studies is to obtain information to furnish the Bureau of Reclamation requested flood control benefits accruing to the Mason Dam. In this connection the Bureau of Reclamation was asked to furnish this office a copy of their water supply study and operation plan for Mason Dam. The Bureau indicated this information would be furnished within two weeks. They are particularly concerned about the justification for exclusive flood control storage space in Mason Dam and they would like us to furnish our benefits based on use of joint use of space only as well as with a plan with any necessary exclusive flood control space.

4. The Bureau indicated that their plan will not include any lateral distribution system in the valley and that this feature would be left as a local contribution. They also indicated that their report would include recommendation of a pumping plant near Hanes to raise water about 125 feet for irrigation.

5. With regard to Umatilla River, the Bureau of Reclamation report is due 1 September 1958, and they will need information from us on flood control benefits by the 1st of August 1958. In general, their report will include only two plans. One including Ryan Creek as a reservoir and the other, as an alternate plan, using Mission Reservoir. As in the case of Powder River, they would like our benefits both for the use of the space on a joint-use basis as well as providing for exclusive flood control space. It was indicated to the Bureau of Representatives that this office would not be able to start on any studies in Umatilla River before 1 July 1958, however, because

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NE SUBJECT Conference with Bureau of Reclamation on Powder River & Umatilla
TO Water Control Files FROM Melvin J. Crd DATE 14 Apr 58 Comment No. 1
Crd/cm

the Bureau were particularly interested in getting a preliminary figure of joint use flood control benefits in about six weeks, it was indicated that if possible such a figure would be furnished. Further, it was indicated to them that we did not expect our flood control operations and benefits to differ greatly from that given in our report that was previously furnished to them in about 1952 for their previous report. They were furnished a copy of our report on the Umatilla River dated 1955.

MELVIN J. CRD
Chief, Water Control Section

cc: Hould
Preston
Rydell

17,000 F & C
21,000 J. U.
38,000 total for F. C.
Assume all needed as available.
for large floods which

A-11

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Upper Columbia Development Office
W. 1323 Ide Avenue
Spokane 1, Washington

July 7, 1958

Colonel Paul H. Symbol
District Engineer
Corps of Engineers
Walla Walla, Washington

Dear Colonel Symbol:

In accordance with discussions we have had with Mr. Ord of your office we are furnishing a preliminary copy of our water supply study for Mason Reservoir, Baker Project, Oregon to aid in your evaluation of the flood control aspects. The basic study (columns 1-14) shows the reservoir operated for irrigation on a fill-spill basis. The supplemental study for the years 1936-1957 (columns 15-20) shows how the reservoir operation would be modified for flood control based on a tentative forecasting procedure we have developed. A discussion of the forecasting procedure adopted for this study is shown below.

The forecast equation: No. 6-58A $Y = 3.04 X_1 + 4.58 X_2 + 7.80 X_3 + .07 X_4 - 60.39$ was developed from 22 years of record. The following terms (independent variables X_1 through X_4) which are the major factors effecting runoff are described as follows:

X_1 - "Basin Snow Water Index," which is intended to be a measure of the moisture accumulated in the snow pack as of April 1 and available for release upon melting. Since snow courses are samples of snow water conditions at particular locations it becomes necessary by correlation to weight and average the individual courses to produce representative over-all basin conditions. The basin snow index term is measured by the average April 1 snow water content taken at Anthony Lake, Bourne, Dooley Mountain, Eilertson Meadow, Gold Center and Goodrich Lake. (Measured in inches.)

X_2 - "Winter Precipitation Index." This term is a combination of fall and winter precipitation and is intended to be an index of the effect of winter precipitation that remains on April 1. This index is measured by the total monthly precipitation October-March, the average of stations Rock Creek, Baker and Unity. The precipitation stations are all outside the watershed; however, when correlated against runoff and then combined with snow they appear to be representative of winter precipitation conditions effecting runoff. (Measured in inches.)

X_3 - "Spring Precipitation Index." This term expresses the runoff producing effect of precipitation after April 1. Reliability of precipitation stations has been established in the analysis of term X_2; therefore, this index is measured by the average of the same stations: Baker, Rock Creek and Unity weighted, April + 2/3 May + 1/3 June. (Measured in inches.)

X_4 - "Index of Basin Antecedent Conditions." This term is the measure of ground-water storage that must be filled each year before runoff may occur. This index describes that portion of ground water contributed by carryover from previous years and is therefore measured by antecedent April-July runoff. (Measured in 1,000 A.F.).

Y - "Forecast of Runoff." April-July in 1,000 acre-feet, of the Powder River near Baker, Oregon (dependent variable).

The following relationship adjusts an "April-July" forecast to an "April-September" forecast - "Forecast April-September = 1.02491 (April-July Forecast)."

Following is a summary of results; The April 1 forecast assumes average conditions for spring precipitation, April, May and June; for the July 1 forecast all data are in.

Summary of Forecast Results

	Actual Apr.-July Runoff 1,000 A.F.	July 1 Forecast Computed Apr.-July Forecast 1,000 A.F.	July 1 Forecast Computed Apr.-July Deviations 1,000 A.F.	April 1 Forecast Computed Apr.-July Forecast 1,000 A.F.	April 1 Forecast Computed Apr.-July Deviations 1,000 A.F.
1957	70.84	66.20	-4.64	60.90	-9.94
1956	93.91	91.33	-2.58	86.03	-7.88
1955	32.12	30.97	-1.15	32.92	.80
1954	38.42	45.95	7.53	50.08	11.66
1953	90.11	84.66	-5.45	71.72	-18.39
1952	87.06	87.32	.26	83.11	-3.95
1951	68.78	57.79	-10.99	67.62	-1.16
1950	64.02	63.38	-.64	69.32	5.30
1949	68.83	70.37	1.54	74.35	5.52
1948	76.23	74.78	-1.45	62.93	-13.30
1947	42.69	43.20	.51	42.50	-.19
1946	74.85	75.97	1.12	75.82	.97
1945	53.16	53.44	.28	52.51	-.65
1944	25.48	28.84	3.36	27.98	2.50
1943	83.52	91.45	7.93	88.41	4.89
1942	73.42	68.49	-4.93	57.57	-15.85
1941	61.45	67.03	5.58	55.80	-5.65
1940	45.36	41.69	-3.67	48.24	2.88
1939	33.37	33.46	.09	43.98	10.61
1938	69.37	72.10	2.73	79.59	10.22
1937	38.75	36.34	-2.41	40.71	1.96
1936	51.42	58.11	6.69	58.35	6.93

Operation of the reservoir for irrigation in the summer months will assure that at least 20,000 acre-feet of space will be available on November 1 and 18,000 acre-feet on January 1 of each year. While no forecast has been developed for February 1 and March 1, it has been assumed that they could be developed with essentially the same degree of accuracy as in the April 1 forecast enclosed. Forecasts for February 1 and March 1 as shown in the supplemental study were computed by adjusting the April 1 forecast by the measured flow of the Powder River near Baker for these months.

The flood control space allocations in the study were determined from the following tentative rules:

November 1.-- 20,000 acre-feet minimum

January 1.-- 18,000 acre-feet minimum

February 1.-- 50 percent of forecast flow of Powder River near Baker, Oregon for period February 1 through July 31 in excess of 35,000 acre-feet.

March 1.-- 50 percent of forecast flow of Powder River near Baker, Oregon for period March 1 through July 31 in excess of 35,000 acre-feet.

April 1.-- 50 percent of forecast flow of Powder River near Baker, Oregon for period of April 1 through July 31 in excess of 35,000 acre-feet.

May 1.-- None

The required releases for flood control are generally relatively small in comparison to outlet capacity which will be in the neighborhood of 800 cubic feet per second at minimum pool and considerably more in the elevations of flood control operations. This should permit adjustments in the flood control space reservations in a relatively short time.

Please provide your appraisal of the flood control aspects of Mason Reservoir which would include benefits from operating on a forecast basis as outlined in this letter. Also the required exclusive space, if any, for floods which cannot be forecast and additional flood control benefits from this space. If any additional data are required for your evaluation please do not hesitate to contact this office.

Very truly yours,

Charles S. Hazen
Area Engineer

Encls.

cc to Regional Director, Boise, Idaho
Attention: 760, w/encl.

A-12

NPHCW

19 August 1958

Mr. Charles S. Hazen
Area Engineer
Upper Columbia Development Office
Bureau of Reclamation
U. S. Department of the Interior
W. 1323 Ida Avenue
Spokane 1, Washington

Dear Mr. Hazen:

Reference is made to your letter of 28 March 1958 requesting our re-evaluation of flood control benefits under two described sets of conditions for the Mason Dam and Reservoir project on Powder River.

We have recently completed a field study and review of the flood damages on Powder River and the evaluation of benefits associated with reservoir storage. From these investigations it is apparent that no increase can be made over the $40,000 average annual flood control benefits previously cited as creditable to Mason Reservoir. For condition No. 1, our evaluation has been based upon 38,000 acre-feet of joint use storage space for which the average annual flood control benefits are estimated to be $20,000. For condition No. 2 in your letter, our evaluation has been based upon 21,000 acre-feet of joint use space and 17,000 acre-feet of exclusive flood control space. Average annual flood control benefits creditable to the reservoir under this plan are estimated at $40,000.

We recognize that substantial increases in economic development have taken place in the Baker urban area since our 1952 study. Increased earnings attributable to this development have been incorporated in our current studies. Offsetting such increases, however, are decreases in flood damages and possible benefits in the Baker Valley area. Our former estimates were based upon then indicated trends toward higher land use. Our recent study, however, indicates that significant areas formerly being converted from low-intensity, salt tolerant pasture grasses, to production of higher-quality pastures and other more intensive land uses are now reverting to the former salt tolerant species.

From preliminary analyses of Powder River floods another important factor is apparent, i.e.; that Mason Reservoir cannot completely eliminate flood damages because large floods can originate downstream from the reservoir. The February 1957 flood had estimated peak discharge of 500 cfs at the gage near Salisbury, 2,350 cfs at Baker, 1,100 cfs near Haines, and

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probably not more than about 400 cfs contribution from above Mason dam site. Because of the flashy nature of the flood it might not be practical to eliminate or even diminish the contribution from above the dam site for such a flood. Standard project floods for the area have not been developed but would no doubt indicate potential for flows of 5,000 cfs or more to originate from the area between the dam site and Baker. Hence, channel improvements would be required for adequate protection against floods and to accommodate releases from Mason Reservoir operated for planned flood control.

In the valley below Baker such channel improvements would pose some additional problems because of the large capacity required to replace existing valley storage in conveying floods to Thief Valley reservoir, and because of attendant difficulties in maintaining ground water table at desirable levels along such a channel. From the February 1957 flood it appears that elimination of valley storage below Baker would require a channel capacity in excess of 2,500 cfs.

Review of the hydrometeorological network required for operation based on runoff forecasts indicates that stations outlined in our letter of 23 July 1952 probably would be adequate. However, costs should be adjusted to 1953 price levels, an estimated increase of about 20 percent. Costs previously given were $3,400 for initial installation, $2,100 annually for operation and maintenance and $2,000 annually for analyses of data and preparation of forecasts, the latter from a letter of 10 July 1953. On 1953 price levels these costs are estimated to be:

BCC/J
GFH
MJO
HAP
LER
ECF
VB
WJH
PHS
MLR

Initial costs.

Installation	$4,100

Annual Costs.

Installation	$ 300	
Operation and Maintenance	2,500	
Studies and forecasting	2,400	
Total		$5,200

Sincerely yours,

PAUL H. SYMMOL
Colonel, Corps of Engineers
District Engineer

cc - Mr. Preston
Mr. Ord

A-13

K/102

NPWCW 12 November 1958

Mr. Charles S. Hazen
Area Engineer
Upper Columbia Development Office
Bureau of Reclamation
U. S. Department of the Interior
W. 1323 Ida Avenue
Spokane 1, Washington

Dear Mr. Hazen:

In accordance with the telephone request on 29 October, 1958 from Mr. John Mangan of your office to Mr. B. C. Christensen of our Planning Branch, we are submitting the inclosed data on flood control benefits attributable to storage at Mason Reservoir.

This information supports that sent you in our letter NPWCW, dated 19 August 1958. It treats the several topic headings listed by Mr. Mangan plus other related items which we consider desirable as a part of this presentation.

Sincerely yours,

RSL/dj

BCC
GFH
MJO
LER
ECF
VB
WJH
PHS
M&R

1 Incl (In trip)
Flood control data

PAUL H. SYKES
Colonel, Corps of Engineers
District Engineer

cc: Water Control Sec.

A-14

FLOOD CONTROL DATA
U.S.B.R. MASON PROJECT
Powder River, Oregon

Streamflow characteristics. - Flows in Powder River occur from a combination of snowmelt and rains, with snowmelt as the dominant cause of most flows and rainstorms a major factor in intermittant high flows of short duration. Flows are consistently low during months of July through early winter and also usually remain low through February except on those occasions when warm rains cause rapid increases in flow. Usually flows increase in March and are high in April and May. Normally during June, flows are receding but occasionally during the month warm rains cause some abnormally high flows. Annual maximum discharges occur among high fluctuating flows of several days to several weeks duration.

Flood characteristics. - With respect to channel capacities at critical sections, peak discharges in most years are of flood magnitude. Because of the snowmelt runoff characteristics of the stream, high flows are related to the annual runoff volumes and in years of abnormal runoff, flood flows are sustained for durations of several weeks, also after flows have receded below bankfull, there is an additional level period during which water drains slowly from flooded lands. Some of the highest flood peaks in the upper valley occur in the early spring from rain and/or snowmelt with frozen ground conditions.

Past floods. - Records are neither very long nor for many locations in the area to show flood magnitude. By combinations of the various records and estimates from other streams, a total of 51 years peak estimates have been derived for the Powder River near Salisbury. In 35 of these years, annual flood peaks have exceeded the 500 c.f.s. capacity of the river in the valley below Baker. The largest flood peaks in order of magnitude for the valley below Baker were 2,040 c.f.s. in May 1921, 1,980 c.f.s. in March 1910, 1,830 c.f.s. in April 1904, 1,640 c.f.s. in May 1956, 1,300 c.f.s. in May 1948, 1,260 c.f.s. in May 1952, 1,120 c.f.s. in May 1922 and 1,100 c.f.s. in February 1957. Five additional floods at the location exceeded 1,000 c.f.s. peak discharge. The estimated 1,500 c.f.s. channel capacity of the stream in the city of Baker has been exceeded during five of the known floods. From data for the stations above and at Baker, the peak discharge and volume of largest floods are estimated as follows:

Date	Peak(cfs)	Maximum 30-day Volume (ac.ft.)
February 1957	2,350	------
May 1921	1,860	60,000
March 1910	1,820	45,000
April 1901	1,690	55,000

From hydrologic characteristics of Powder River and a few records of climatological data, the 1894 flood very likely was much larger, both in peak and volume than any of the more recent floods but definition of the magnitude of the flood is not accurate enough to warrant statements as to actual peaks or runoff volumes.

Past flood causes. - Although Powder River is primarily a snowmelt runoff stream, flood causes are quite variable. One of the major factors causing large

flood volumes has been abnormal accumulations of water in snow. The sequence of temperatures occurring during the snowmelt seasons has much to do with the concentration of high flows from snowmelt. Flood peaks have usually resulted from the occurrence of storm rainfall, and frozen ground has at times been a significant factor in production of high peak flows.

The 1894 flood resulted primarily from a heavy winter accumulation of water in snow and unusually high temperatures combined with an abnormal amount of rain in late May and early June.

The 1904 flood was caused by above normal snow cover accumulated before April and by unusually high temperatures during the second week of April and to some extent during the ensuing weeks. (4)

The 1910 flood was caused by high temperatures causing rapid melt from a somewhat abnormal snow pack. A rainstorm on 19 March considerably augmented the peak flow. Because of the concentration of high temperatures, extremely high flows were confined to a brief period of about 10 days. (3)

The 1921 flood originated from an above normal winter snow accumulation, combined with a period of approximately a week of rain in May. Temperatures responsible for snowmelt during the flood were somewhat below normal and precipitation amounts were distributed so that high flows existed for several days without a high-short duration peak. (2)

A late accumulation of snow in the basin in April and May, during a period of cool temperatures, followed by unusually warm temperatures in late May interspersed with rainstorms on 22 and 28 May were responsible for the 1948 flood. Because the runoff was delayed later than usual by cool temperatures, the subsequent warm temperatures caused an extended period of nearly a month of high flows.

The 1952 flood resulted from a greater than normal winter snow cover, cool weather and excessive precipitation in early March followed by warm weather in late March and rainstorms on 24 and 25 March. Following the peak on 26 March high flows were sustained for several days from snowmelt runoff.

Approximately normal snow cover accumulated early in the season of the 1956 flood season but was increased in mid spring to somewhat above average. In April and early May several periods of precipitation alternately deposited snow and rain on the area and caused prolonged high runoff. The peak discharge resulted from warm rain on May 23 and 24.

The February 1957 flood was caused by rain and warm temperatures occurring chiefly in the area below 5,000 feet elevation. Frozen ground conditions had the marked effect of diminishing infiltration capacities and increasing the magnitude and rapidity of runoff. Upper elevation areas contributed little to the flood peak but several weeks later produced the usual snowmelt runoff. (1)

Standard project flood. - Comprehensive hydrologic studies including derivation of the standard project flood have not been made for Powder River Basin. A tentative estimate of the standard project flood was prepared by adding directly

the top of the large volume flood of 1904 a rain flood hydrograph derived from the May 1906 storm in the Blue Mountains after transposition and adjustment of the storm to the area above Baker, Oregon. Correlations of seasonal runoff volumes versus seasonal precipitation indicate that the volume of this estimated flood would be approximately that of the maximum annual flood derived from some 70 years of records of seasonal precipitation with conditions favorable for maximum runoff production. The flood volume of 34,000 acre-feet in excess of a discharge of 500 c.f.s. at the gorge near Baker is 36 percent greater than the comparable volume of the largest flood of record and the peak discharges of 4,400 c.f.s. is 87 percent larger than the largest recorded flood peak at Baker. This tentative estimate is considered adequate to represent the standard project flood for preliminary studies, but critical review should be made of the flood producing potentialities of the basin prior to final plans for comprehensive flood control.

Flood regulation. - The Bureau of Reclamation proposes to construct and operate Mason Reservoir, to be located in Powder River about 16 miles upstream from the city of Baker, Oregon, tributary drainage area 175 square miles. The reservoir would have an active capacity of 100,000 acre-feet, and would be used to supply irrigation water and afford regulation of floods for Baker Valley. Flood regulation would be accomplished by use of 38,000 acre-feet of storage capacity in one of two plans studied. One of these plans would involve maintaining 17,000 acre-feet of space available exclusively for flood control plus use of 21,000 acre-feet of space made available jointly for irrigation and flood control. The other plan would involve use of the entire 38,000 acre-feet operated jointly for flood control and irrigation. The joint use space, in either plan would be made available for flood control on a basis of forecast of runoff and evacuation of storage when needs indicate but only to the extent that it could dependably be refilled during the flood runoff for subsequent irrigation supply.

Refill criteria based on the best available forecasts show that with the potential variability of occurrence of flood runoffs, space could not be held to the end of the flood season and still dependably be filled, hence the need for exclusive flood control space to effect optimum operation. However, with 17,000 acre-feet of space exclusively for flood control plus 21,000 acre-feet joint-use the studies show potential for effective control at the site of all floods including the tentative standard project flood. In contrast, if all storage were operated only on a joint-use basis some of the late spring high flows would not be regulated.

One further problem not fully solved by the plan of regulation is that some of the floods originate below the reservoir to the extent that they could not be regulated to 500 c.f.s. As yet, studies made have not fully evaluated possibilities of operation of the project to effect optimum reduction of such floods. In general floods having these characteristics would be early spring flashy rain or snowmelt floods such as the 1957 flood and would have relatively little runoff volume. However, the floods occur with relatively little warning and in view of travel times of flow, there may be limited opportunity for regulation of contributions from above the site.

Flood frequencies. - Natural annual peak discharge frequencies were analyzed the method described in Statistical Methods in Hydrology, a publication from

ne Office, Chief of Engineers. The several stream gaging stations where records have been obtained in the basin were studied, and because of the scarcity of records flows at the various sites were correlated and estimates prepared to obtain some 50 annual peak discharges used for frequency studies. The natural annual peak discharge frequencies are depicted on Charts 1, 2, and 3 for Powder River at Salisbury, Baker and Haines respectively.

From flood regulation studies, regulated peak discharges were estimated for the locations enumerated above. Only the lower floods of record were studied and hence the regulated peak discharges were arranged in descending order and assigned frequencies of exceedence in a frequency series of floods for a 50-year period. The regulated flood frequencies are also depicted on Charts 1, 2, and 3 together with natural frequencies.

Extent and character of flooded area. - Damage-wise in the total basin and peak discharge-wise at Baker, the most significant flood of record was the one which occurred in February 1957. This is the only flood of record on which reliable damage data are presently available. A recurrence of a flood of this magnitude would inundate approximately 16,750 acres consisting largely of farmland and developed properties in the City of Baker. The greatest part of the damages occur in Baker which has an estimated population of 9,500. Approximately 300 residences would suffer varying degrees of damage. Commercial properties subject to inundation include such businesses as a motel, 3 grocery stores, 1 tire shop, 1 trailer sales agency and 2 sawmills. Public facilities in this flood plain include the city sewage treatment plant and communication and transportation facilities. Approximately 70 percent of the agricultural land is wild hayland, 20 percent is timothy and red clover, and the balance is in small grains. The region is not highly developed agriculturally due largely to a combination of such factors as the serious drainage problem, shortage of late season irrigation water, and flooding. These water control problems have discouraged development of improved pasture and hayland or growing of other crops associated with intensive farm operation.

Damages resulting from historical flood. - The February 1957 flood caused damages along Powder River estimated at $250,000. Of this total, the community of Baker suffered approximately $200,000 damages including costs of $55,000 incurred from flood fight activities. Distribution of damages among the various types of property affected was estimated as follows:

Industrial	$30,000
Commercial	70,000
Residential	50,000
Municipal	30,000
Other	20,000

In the areas outside of Baker, mostly downstream, damages amounted to $50,000. These damages consisted largely of loss of use of pasture due to prolonged inundation and silt deposition, damage to farm roads, bridges, fences, and irrigation structures, and induced growth of noxious weeds and unpalatable grasses.

Two factors are of special interest in relation to the 1957 flood. The first is that only slightly greater discharges would have made the flood fight work ineffective resulting in very substantial increases in damages. Under such circumstances damages to commercial properties would be greatly increased since it was in this area where the 1957 flood fight work was largely centered. The second factor is that major increases in peak discharges would result in proportionally greater increases in damages to rural areas as compared to urban areas.

Average annual damages. - Data collected by field appraisal on damages suffered along Powder River during the 1957 flood comprise the principal basis for computation of average annual damages. To determine the average annual damages, the Powder River was divided into six zones as shown in Table 1. The field appraisal damage data, data on channel characteristics and bankfull capacity, and the appraiser's judgment on the magnitude of damages for floods both smaller and larger than the 1957 flood were used in preparation of discharge damage curves for each of the six zones. These discharge damage curves in combination with the natural discharge frequency curves for each zone, as illustrated by Charts 1, 2, and 3, for three upper zones, were used in preparing the average annual damage tables for

each zone. From these data it was estimated that average annual flood damages along Powder River amount to approximately $52,000 annually, distributed among the six zones as shown on Table 1.

To show the method used, a discharge damage curve, Chart 4, and an average annual damage and benefit table for the two proposed methods of operation, Table 2, are included. These examples pertain only to Zone 2, the Baker area, which represents the major source of damages and project benefits.

Type and amount of damages prevented by flood control storage in Mason Reservoir. - Operation of Mason Reservoir to provide 21,000 acre-feet of joint-use storage and 17,000 acre-feet of exclusive storage for flood control would result in average annual benefits along downstream sections of Powder River estimated at $40,000 annually. However, should Mason Reservoir be operated to provide 38,000 acre-feet of joint use-storage only, the average annual benefits would be approximately $20,000. The benefits in either case result from prevention of flood damages of the general character and distribution as described above for the 1957 flood. Distribution of the benefits among the six zones for each method of operation is shown in Table 1.

In determining flood control benefits, no allowance has been made for possible property enhancement values. Such values would not accrue in the residential, commercial and industrial areas of the City of Baker where the major benefits are derived. Enhancement of the rural areas could be significant but the values involved are considered to be inseparably related to the irrigation aspects of the Mason Project and to the needed drainage improvements proposed to be accomplished by local owners and residents.

TABLE 1

POWDER RIVER

Estimated Average Annual Flood Damages
and
Flood Control Benefits Creditable to Mason Reservoir
1958 Prices and Economic Development

Zone No.		Ave. Annual Damages	Remaining Damages		Benefits	
			21,000 Joint Use 17,000 F/C	38,000 Joint Use	21,000 Joint Use 17,000 F/C	38,000 Joint Use
1	Mason Dam Site - Baker	$ 1,540	$ 440	$ 760	$ 1,100	$ 780
2	Baker	40,000	5,800	23,000	34,200	17,000
3	Baker Valley	2,900	1,980	2,430	920	470
4	Haines - North Powder	4,780	3,200	3,920	1,580	860
5	Lower Powder Valley	1,720	1,620	1,630	100	80
6	Below Lower Powder Valley	1,440	1,330	1,400	110	40
	Total	$52,380	$14,370	$33,140	$38,010	$19,240
	Benefits assigned				$40,000	$20,000

TABLE

A-14

Average Annual Damages With Unregulated

ischarge n c.f.s. t Baker	Frequency	Flood Damages	Average Damage
250	1.000	---	---
1,000	.268	---	250
1,500	.104	500	5,250
1,750	.066	10,000	25,000
	.0425	40,000	110,000
2,250	.0275	180,000	290,000
2,500	.0182	400,000	850,000
2,750	.013	1300,000	1710,000
3,000	.0087	2120,000	2260,000
3,250	.0062	2400,000	2487,000
3,500	.0044	2574,000	2630,000
3,750	.0032	2686,000	2718,000
4,000	.0023	2750,000	2800,000
4,500	.0012	2850,000	2875,000
5,000	.0000	2900,000	

Average Annual Dama

Rounded

ıal Flood Damages With 38,000 acre-feet ɔod Control Storage in Mason Reservoir

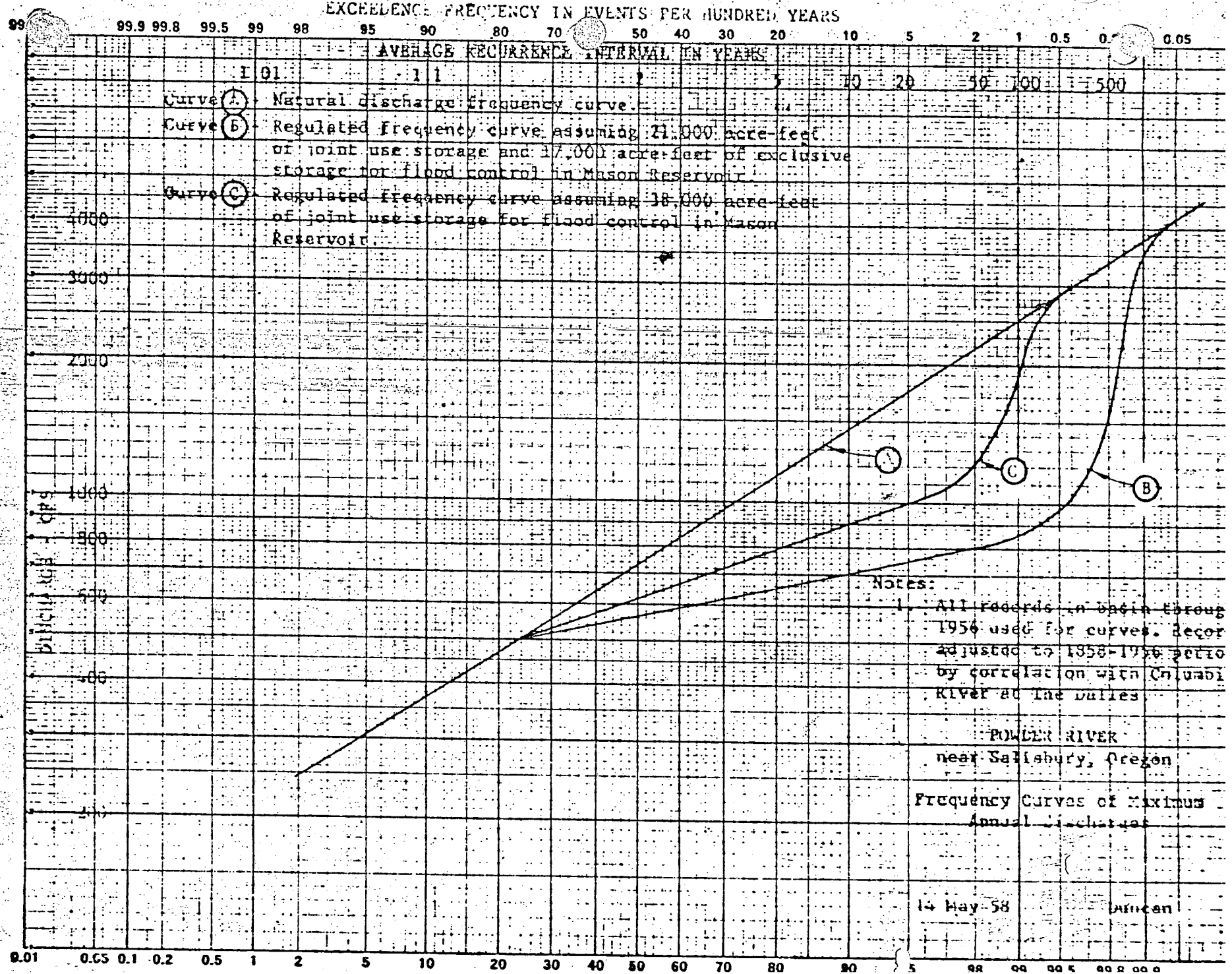
Flood Damages	Average Damages	Times Per Year	Remaining Ave. Ann. Damages
---			
	---	.802	
---	250	.159	40
500	5,250	.0192	100
10,000	25,000	.0066	170
40,000	110,000	.0024	260
180,000	290,000	.0014	410
400,000	850,000	.0012	1,020
300,000	1710,000	.0014	2,390
120,000	2260,000	.0012	2,710
400,000	2487,000	.0012	2,980
574,000	2630,000	.0012	3,160
686,000	2718,000	.0009	2,450
750,000	2800,000	.0011	3,080
850,000	2875,000	.0012	3,450
900,000			

e Annual Remaining Damages $ 22,220

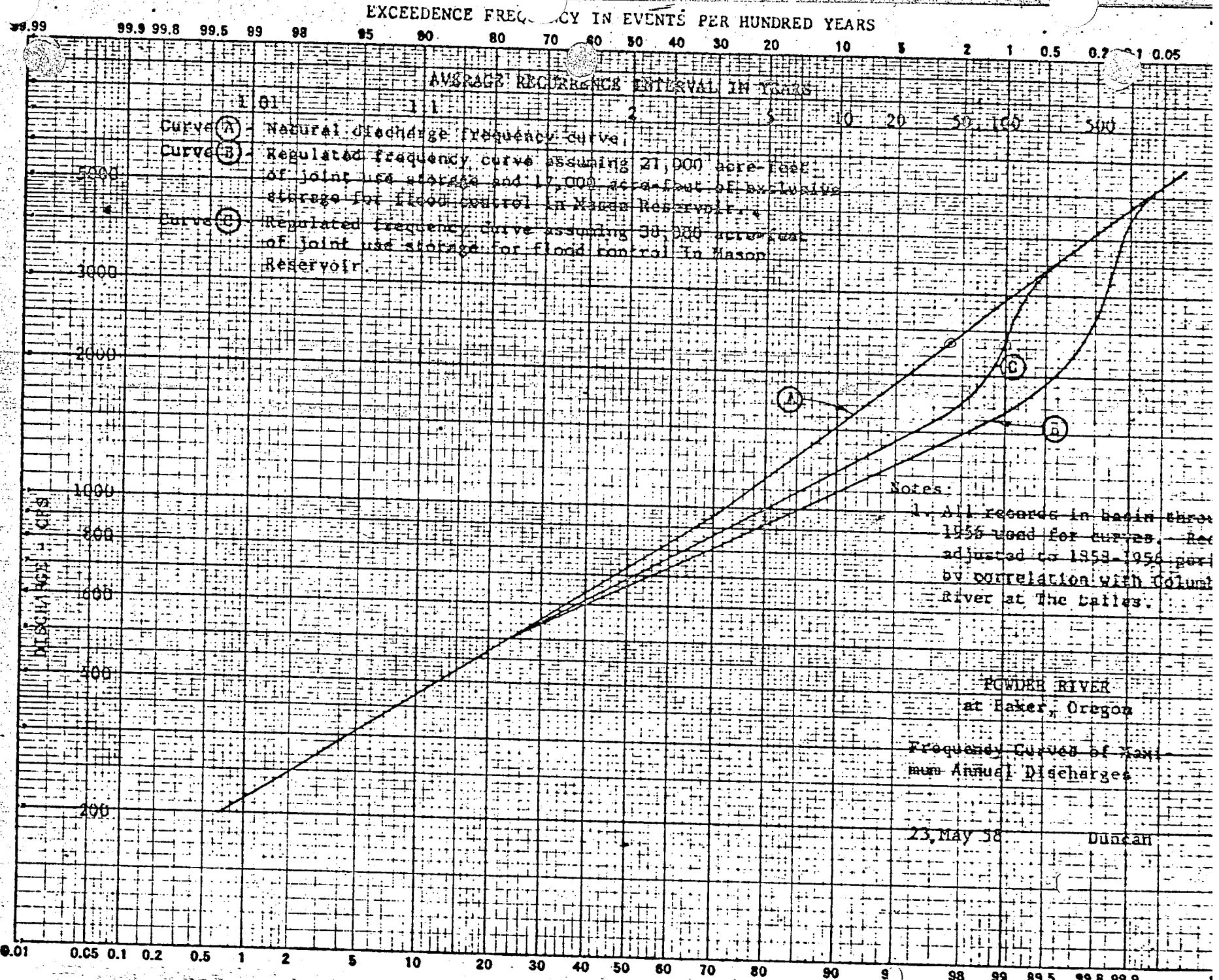
Rounded to $ 23,000

age Annual Benefits $ 17,000

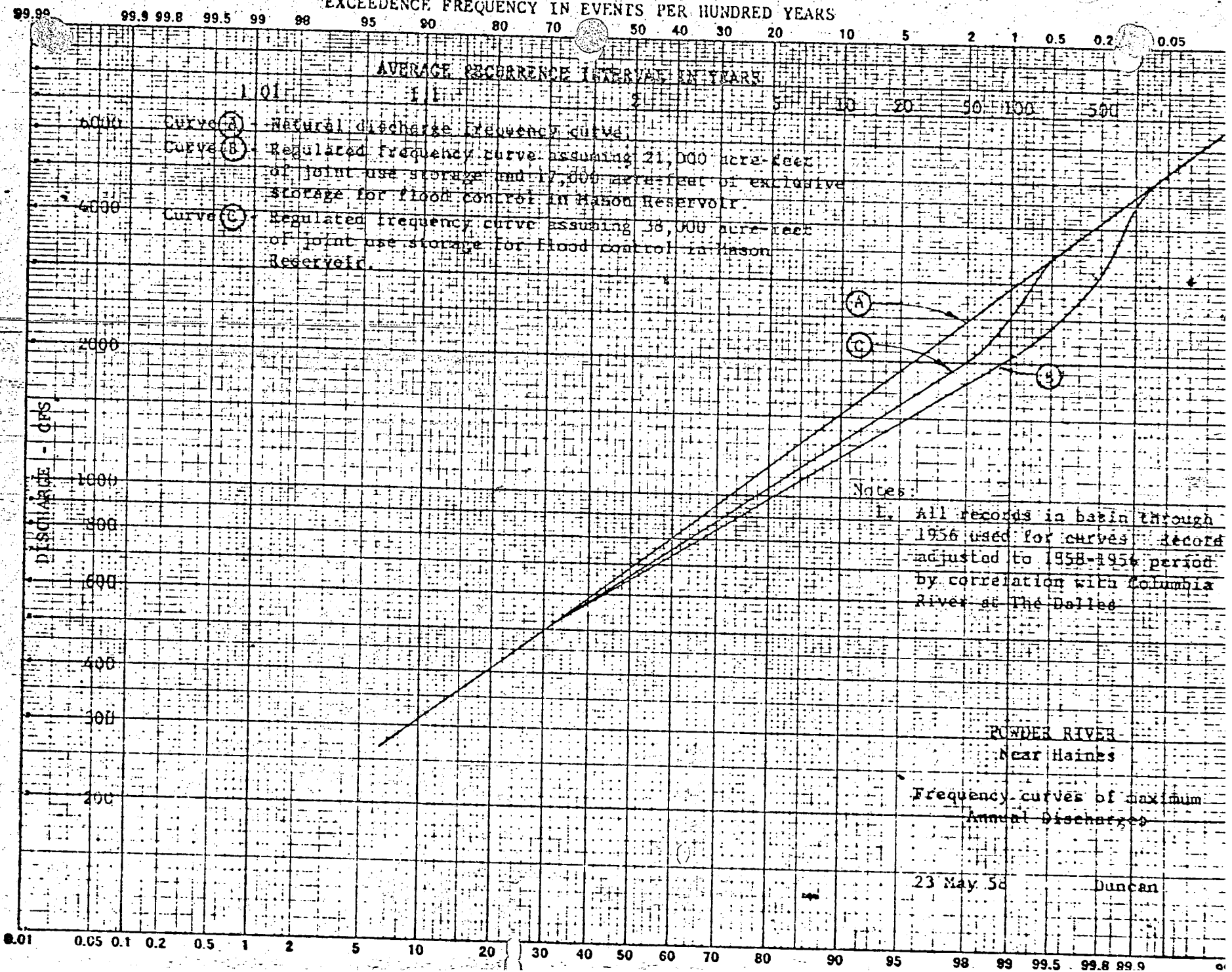
Table 2 A-14


EXCEEDENCE FREQUENCY IN EVENTS PER HUNDRED YEARS
99 99.9 99.8 99.5 99 98 95 90 80 70 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05
AVERAGE RECURRENCE INTERVAL IN YEARS
1 01 1 1 2 5 10 20 50 100 500
Curve (A) - Natural discharge frequency curve.
Curve (B) - Regulated frequency curve assuming 21,000 acre-feet of joint use storage and 17,000 acre-feet of exclusive storage for flood control in Mason Reservoir.
Curve (C) - Regulated frequency curve assuming 38,000 acre-feet of joint use storage for flood control in Mason Reservoir.
4000
3000
2000
1000
900
800
700
600
500
400
300
200
100
Discharge in c.f.s.
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.5 99.8 99.9
A
B
C
Notes:
1. All records in basin throug
1956 used for curves. Recor
adjusted to 1936-1956 perio
by correlation with Columbi
River at The Dalles.
POWDER RIVER
near Salisbury, Oregon
Frequency Curves of Maximum
Annual Discharge
14 May 58
Duncan

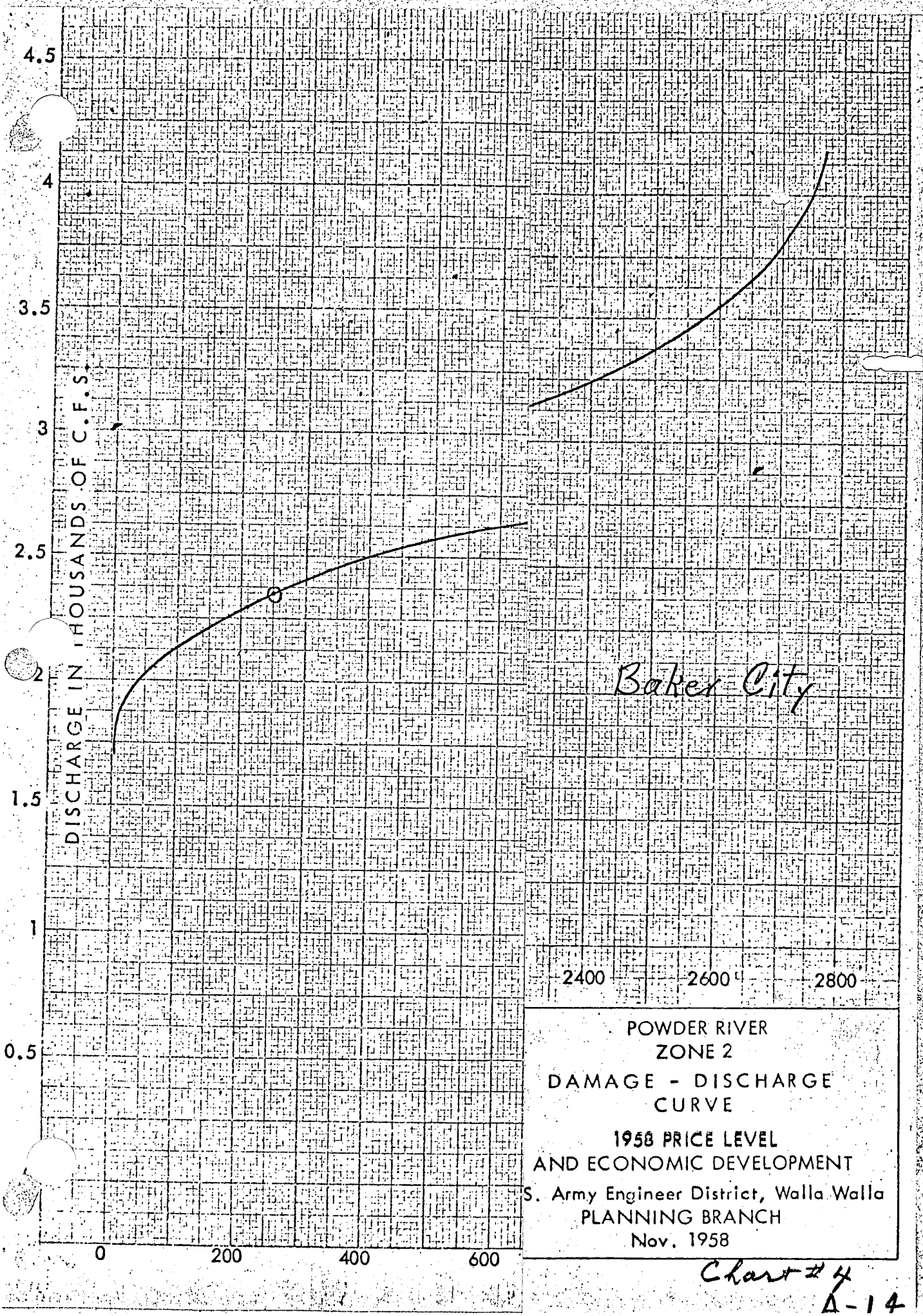
A-14


EXCEEDENCE FREQUENCY IN EVENTS PER HUNDRED YEARS
99.99 99.9 99.8 99.5 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05
AVERAGE RECURRENCE INTERVAL IN YEARS
1.01 1.1 2 5 10 20 50 100 500
Curve (A) - Natural discharge frequency curve.
Curve (B) - Regulated frequency curve assuming 21,000 acre-feet of joint use storage and 17,000 acre-feet of exclusive storage for flood control in Mason Reservoir.
Curve (C) - Regulated frequency curve assuming 38,000 acre-feet of joint use storage for flood control in Mason Reservoir.
5000
3000
2000
1000
800
600
400
200
DISCHARGE IN SECOND-FEET
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.5 99.8 99.9
A
C
B
Notes.
1. All records in basin thro
1956 used for curves. Re
adjusted to 1858-1956 peri
by correlation with Colum
River at The Dalles.
POWDER RIVER
at Baker, Oregon
Frequency Curves of Maxi-
mum Annual Discharges
23 May 58
Duncan

A-14


EXCEEDENCE FREQUENCY IN EVENTS PER HUNDRED YEARS
99.99 99.9 99.8 99.5 99 98 95 90 80 70 50 40 30 20 10 5 2 1 0.5 0.2 0.05
AVERAGE RECURRENCE INTERVAL IN YEARS
1.01 1.1 2 5 10 20 50 100 500
DISCHARGE - CFS
6000
4000
2000
1000
800
600
400
300
200
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.5 99.8 99.9
Curve (A) - Natural discharge frequency curve.
Curve (B) - Regulated frequency curve assuming 21,000 acre-feet of joint use storage and 17,000 acre-feet of exclusive storage for flood control in Hason Reservoir.
Curve (C) - Regulated frequency curve assuming 38,000 acre-feet of joint use storage for flood control in Hason Reservoir.
A
C
B
Notes:
1. All records in basin through 1956 used for curves; record adjusted to 1958-1956 period by correlation with Columbia River at The Dalles
POWDER RIVER
Near Haines
Frequency curves of maximum Annual Discharges
23 May 58
Duncan

A-14



POWDER RIVER
ZONE 2
DAMAGE - DISCHARGE
CURVE

1958 PRICE LEVEL
AND ECONOMIC DEVELOPMENT

S. Army Engineer District, Walla Walla
PLANNING BRANCH
Nov. 1958

Chart # 4

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGIONAL OFFICE, REGION 1
BOX 8008
BOISE, IDAHO 83707

IN REPLY
REFER TO: 760

JAN 5 1968

District Engineer
Walla Walla District
Corps of Engineers
Building 602, City-County Airport
Walla Walla, Washington 99362

Dear Sir:

Reference is made to our letter of October 25, 1967, revised schedule for processing of flood control regulation for Mason Dam.

We regret that the January 1, 1968, date set for initial draft of Sec. 7 regulations for Mason Dam has not been met. We hope to have an initial draft of the regulations submitted to your office by January 20.

The revised regulations on Malheur River system are in the mail.

Sincerely yours,

Norman H. Moore
Acting for H. T. Nelson
Regional Director

A-15

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

REGIONAL OFFICE, REGION I
BOX 8008
BOISE, IDAHO 83707

IN REPLY
REFER TO: 765

FEB 7 1968

District Engineer
Corps of Engineers
Building 602, City-County Airport
Walla Walla, Washington 99362

Dear Sir:

Enclosed is a preliminary draft of Part 208, Flood Control Regulation, along with a copy of our operation study for Mason Dam and Reservoir (Phillips Lake), Powder River, Baker Project, Oregon. These have not yet been fully reviewed within the Bureau, therefore must be considered as only tentative at this time.

Because storage of water has already started, a tentative agreement on the operating plan would be desirable for the flood control operation this spring. We will appreciate your review and comment on the proposed plan.

Sincerely yours,

Norman H. Moore

Assistant Regional Director

Enclosures

A-16

Regional Office Draft
February 1, 1968

PART 208

FLOOD CONTROL REGULATIONS
MASON DAM AND RESERVOIR (PHILLIPS LAKE)
UPPER DIVISION, BAKER PROJECT, OREGON

Pursuant to the provisions of Section 7 of the Act of Congress approved December 22, 1944 (58 Stat. 890; 33 U. S. C. 709) the following §208 ____ is hereby prescribed to govern the use and operation of Mason Dam and Reservoir on Powder River, Oregon, for flood control purposes.

§208 ____ Mason Dam and Reservoir, Powder River, Oregon.

The Bureau of Reclamation, acting through the Baker Valley Irrigation District, shall operate Mason Dam and Reservoir in the interest of flood control as follows:

(a) Storage space in Mason Reservoir will be kept available for flood purposes in accordance with the flood control storage reservation schedule currently in force.

(b) Releases from Mason Reservoir shall be restricted to quantities which will not cause the flow to exceed 500 cubic feet per second in Powder River at Baker insofar as this can be accomplished with the authorized 17,000 acre-feet of exclusive storage space and 21,000 acre-feet of joint-use storage space prescribed in the current space reservation schedule.

(c) Flood control regulations are subject to temporary modification by the District Engineer, Corps of Engineers, if

found necessary in time of emergency. Request for action on such modifications may be made by any available means of communication, and the action requested by the District Engineer shall be confirmed in writing under date of the same day to the office of the Regional Director of the Bureau of Reclamation which has jurisdiction of the area in which the project is located.

(d) The flood control storage reservation diagram for Mason Reservoir currently in force as of the promulgation of this section is the one dated _____, File No. _____ and is on file in the office of the Chief of Engineers, Department of the Army, Washington, D. C., and in the office of the Commissioner, Bureau of Reclamation, Washington, D. C. Modification of the flood control storage reservation diagram for Mason Reservoir may be made from time to time as deemed necessary and approved by the Corps of Engineers and the Bureau of Reclamation. Each such revision shall be effective upon the date specified in the approval thereof by the Chief of Engineers and the Commissioner of Reclamation, and from that date until rescinded, shall be in force for purposes of this section. Copies of the flood control storage reservation diagram currently in force shall be kept on file in the Office of the District Engineer, Corps of Engineers, and the Regional Director, Bureau of Reclamation, charged with the responsibility of the project and may be obtained from the respective offices.

(e) Nothing in the regulations in this section shall be construed to require dangerously rapid changes in magnitude of releases, or that releases be made at rates or in a manner that would be inconsistent with requirements for protecting the dam and the reservoir from major damage.

(f) The Bureau of Reclamation, acting through the Baker Valley Irrigation District, shall procure current basic hydrological data, make determinations of the required flood control space reservations to effect the regulation set forth in the objectives prescribed in these regulations, and make calculations of permissible releases from the reservoir as are required to accomplish the flood control objectives prescribed in this section.

(g) The Bureau of Reclamation shall keep the District Engineer, Corps of Engineers, advised of hydrological conditions and other operating criteria which affects the flood control operation. Also, the Bureau of Reclamation shall keep the Watermaster, acting under the control and supervision of the State Engineer of Oregon, currently advised of reservoir releases.

(Regs., _____ date _____ ENGWE)(Sec. 7, 58 Stat. 890; 33 U.S.C.709)

(Seal)

Major General, U. S. Army
The Adjutant General

(F.R. Doc. _____; filed, date, time)

Copies from Federal Register dated _____

Regional Office Draft
February 1, 1968

FLOOD CONTROL REGULATIONS (33 CFR 208)
FLOOD CONTROL SPACE RESERVATION SCHEDULE
MASON RESERVOIR (PHILLIPS LAKE), OREGON

The controlling flood control space reservation at any time during the flood season is the maximum space requirement as determined from any one of the applicable parts of this schedule. Reservoir releases shall be planned so as to provide flood control storage space in amounts at least equal to the current flood control space reservation requirement and so as to accomplish this with minimum practical rates and fluctuations in discharge. Storage of water within the space reserved for flood control will be permitted only as required to prevent flows in excess of 500 c.f.s. in Powder River at Baker, Oregon.

Mason Reservoir--The flood control space reservation for Mason Reservoir is the maximum of the requirements determined under parts 1 and 2 which follow:

Part 1.--Reservoir filling schedule. A minimum flood control space reservation of 17,000 acre-feet shall be provided for exclusive flood control.

Part 2.--Flood control space reservation based on forecast. This reservation applies during the snowmelt season from February 1 through June 15 each year. Forecast of runoff volume will be made periodically from February 1 through the

flood season, and upon these forecasts and storage space reservation diagram, reservoir releases will be scheduled to evacuate and refill reservoir space without exceeding the downstream bankfull capacity.

Prepared pursuant to flood control regulations for Mason Reservoir (33 CFR 208).

Approved _____
Commissioner, Bureau of Reclamation

Approved _____
Chief of Engineers

Effective Date _____

765

February 1, 1968

To: Chief, Hydrology Branch, Boise, Idaho
Through: Head, Flood Studies Section

From: Harold R. Brush, Hydraulic Engineer, Boise, Idaho

Subject: Operation plan for Mason Reservoir (Phillips Lake), Baker Project, Oregon

Introduction

Construction of Mason Dam and the operation of it, to satisfy project requirements presents the need for a formalized plan of operation. Authorization of the project was for the principal purposes of irrigation and flood control. Procedure for forecasting volume runoff and a flood control storage reservation diagram were developed to give the required flood control without reduction in irrigation storage water yields.

General Description

Location

The Upper Division, Baker Project is in Baker and Bowen Valleys, along the Powder River in Baker County, northeastern Oregon.

Mason Dam is located on the Powder River at the lower end of Sumpter Valley, upstream from the project lands, as shown on location map Plate 1.

Basin Description

The 175 square mile drainage area above Mason Dam is roughly elliptical in shape, with the major axis in a northwest-southeast direction. It is encircled by mountains which range in elevation from about 5500 feet on the southwestern boundary to 9100 feet in the rugged Elkhorn Ridge on the northeast. The valley floor is mostly free of cover and is used principally for pasture. Above the valley floor the basin is generally forest-covered.

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Climate

The Powder River drainage lies to the east of the Blue Mountains, and at lower elevations is relatively arid. Normal annual precipitation at Baker is reported variously from 11.0 to 13.2 inches, depending on the period used. This increases to a maximum of 40 inches on the higher ridges. Precipitation at the higher elevations, however, is mostly snowfall which occurs during the winter.

Records Available

The stream gage, Powder River near Sumpter, located just below Mason Dam, was established in April 1965; therefore, to date the record was too short to be of use in this study. A stream gage record is available for the Powder River at a location about 6.5 miles downstream from Mason Dam. The record extends from December 1903 to August 1914, and from June 1926 to date. Formerly the gage was known as Powder River at Salisbury but is presently called Powder River near Baker.

There are no temperature or precipitation gages currently operated in the drainage basin; therefore, nearby stations at (1) Baker, (2) Rock Creek, and (3) Unity were used in this study. Location of the stations is shown on Plate 1.

Records at six snow courses in and on the perimeter of the basin were considered for an indication of spring snow pack conditions on the basin. The six snow courses considered have periods of record as follows:

Snow Course	Elevation	Period of Record
Anthony Lake	7125	1936 - Present
Gold Center	5340	1939 - "
Bourne	5800	1936 - "
Ellertson Meadows	5400	1938 - "
Goodrich Lake	6775	1947 - "
Dooley Mountain	5430	1939 - "

The location of the above snow courses is shown on Plate 1. From the six snow courses listed above only the last four were finally used in the development of a forecast equation for the runoff from the watershed.

RESERVOIR OPERATION

In addition to the need for storage water to overcome irrigation shortages, which occur some years as early as May 15, there is a definite need for storage to prevent or reduce damage from floods that occur during the winter and spring months. An operational plan was developed, using a runoff forecast equation, to determine the flood control space required for the flood season.

A discussion of the principal criteria and assumptions used in the flood control operation follows.

Reservoir

Macon Reservoir has a total capacity of 100,000 acre-feet, of which 5,000 acre-feet are dead storage. The active reservoir capacity of 95,000 acre-feet is to be used as follows: (1) 17,000 acre-feet -- exclusive flood control, (2) 21,000 acre-feet -- joint flood control and irrigation, (3) 57,000 acre-feet -- irrigation storage.

Runoff Forecast

The forecast equation shown below for the runoff volume (February through July) at Powder River near Baker was developed using the 29 years of recorded data 1939 to 1967. The multiple correlation printout for the equation is shown in Appendix "A".

$$(B\text{-}65)Y = 2.538\,X_1 + 3.049\,X_2 + 2.116\,X_3 - 48.971$$

Where:

Y = Runoff at Powder River near Baker, February through July in 1,000 acre-feet

X_1 = "Fall Precipitation Index" - This term is the total October through December precipitation at Baker, Rock Creek, and Unity.

X_2 = "Winter Precipitation Index" - This term combines (1) the total January through March precipitation at Baker, Rock Creek, and Unity with (2) 1/5 the total April 1 snow water content at four snow courses weighted as follows:

Snow Course	Weight
Bourne	1
Dooley Mountain	2
Ellertson Meadows	1
Goodrich Lake	.5

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X_3 = "Spring Precipitation Index" - This term is combined total precipitation at Baker, Rock Creek, and Unity weighted as April, 2/3 May and 1/3 June.

The basic data for developing the forecasts equation are given in: Table 1 - month by precipitation October to June at Baker, Table 2 - monthly precipitation October to June - Rock Creek, Table 3 - monthly precipitation October to June - Unity, Table 4 - April 1 snow water content - Bourne, Dooley Mountain, Eilertson Meadows and Goodrich Lake, and Table 5 - monthly runoff Powder River near Baker.

Prior to the time all precipitation and snow data have been measured, probable forecast of runoff can be prepared by substituting average values for unknown data. Table 6 gives the 1939 - 1967 average values used for this purpose.

Table 7 gives forecast of February through July runoff at Powder River near Baker which would have been prepared using the forecast equation on the first of each month January through July, 1939 through 1967, with average values used for unmeasured data to date.

Table 8 gives the residual forecast of Table 7 on the first of each month for the period 1939 through 1967.

Operation Plan

Regulation of flows from Mason Reservoir shall be restricted so that, in so far as possible, the flow in Powder River at Baker will not exceed 500 c.f.s. This regulation would be accomplished by using 17,000 A.F. of exclusive and 21,000 A.F. of joint-use storage, the joint-use storage being made available on a forecast basis.

Storage parameters were needed that would reflect the needed reservoir storage to control flows in the Powder River to 500 c.f.s. Since the drainage area at Mason Dam was only 85% of the area above the Powder River near Baker gage, it was felt that a better control of flood flows could be maintained if storage could be maintained for all the flow above 450 c.f.s. Therefore, using a control of 450 c.f.s. and total runoff from date to July 31, the points on Plate 2 were determined, using the period of record of the gage. Using the points for April 1 on 1904 and 1910, and May 1910 and 1958 the slope of the parameters was selected. The parameter lines were then spaced so that all points were enveloped and nearly equally spaced. The spacing was controlled by points of

March 15, 1910 and April 15, 1910. The parameters from Plate 2 were then redrawn on Plate 3 to be in the standard format.

Using the runoff forecast equation (B-66) and flood control parameters on Plate 3, the required flood control storage space needed from February through June 15, can be determined.

As a check of the forecast equation and the flood control storage parameters on Plate 3, the estimated forecasts for date through July given in Table 8 were used with Plate 3 to determine in what years flood storage space in excess of the 17,000 A.F. exclusive would be needed. From the above check the 29-year period, 1939 - 1967 showed the following:

Month	Number Year Space in Excess 17,000 A.F. Needed	
	First of Month	End of month
February	1	3
March	3	4
April	8	0
May	2	0
June	0	

Although, there were no forecasts made for the period 1929-1938, a check of the operation study [1] (Appendix A) showed no reason why flood control operation during this period would have caused a shortage in the irrigation supply.

[1] Table 4 - Water Supply Appendix - Baker Project - Definite Plan Report - 1964.

CONCLUSION

The forecast equation B-66 developed in this study can be used with the Flood Control Storage diagram, Plate 3, to determine the required storage space needed to control the flow of the Powder River at Baker to 500 c.f.s. without producing a subsequent shortage to the irrigation supply.

It is also felt that after checking the operation for a period of years and with improvement in forecasting, the 17,000 A.F. of exclusive flood control space might possibly be changed to joint-use space.

Such a change, if found practicable in the future, would permit filling a portion of the 17,000 acre-feet near the end of the flood season when the snow-pack is depleted below amounts which would contribute significantly to the flood potential.

Harold R Brust

Noted:

G. W. Kilpatrick

Head, Flood Studies Section

Approved:

Harold A Hafferson

Chief, Hydrology Branch

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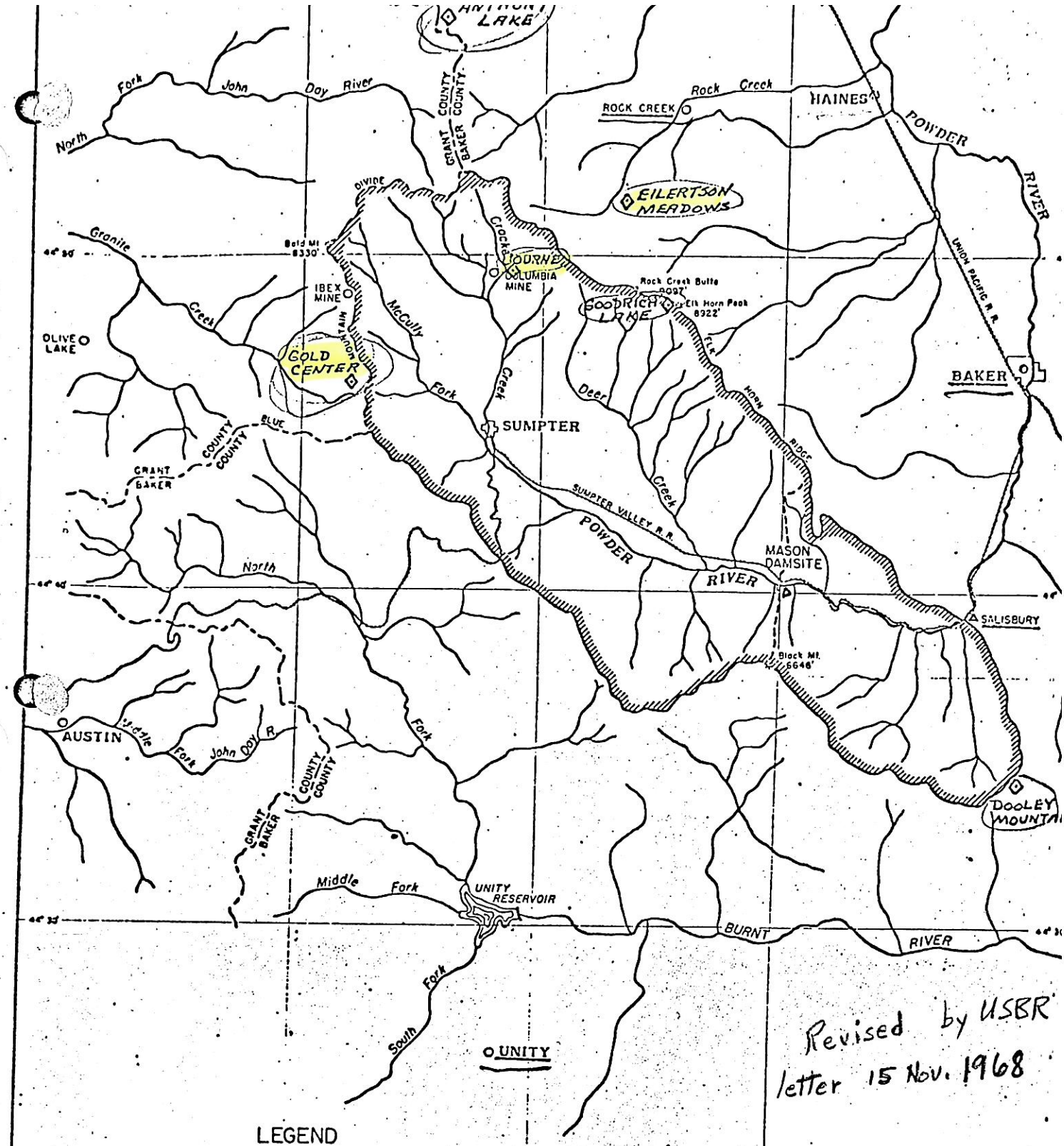

Revised by USBR
letter 15 Nov. 1968

PLATE 1
A-16

REQUIRED STORAGE SPACE IN 1,000 A.F.

40
35
30
25
20
15
10
5
0

APRIL 1
MARCH 15
MARCH 1
FEBRUARY 15
FEBRUARY 1

0 10 20 120 130

ONTROL PARAMETERS

RVOIR (PHILLIPS LAKE)

R, BAKER PROJECT,

REGON

r. 1 ⊙-Apr. 1 ⊡-May 1.

r. 15 ⊍-Apr. 15 ⊎-May 15

△-Jun. 1.

-14, 1927-1966

ontrol Powder River Near

aker to 450 C.F.S.

PLATE 2

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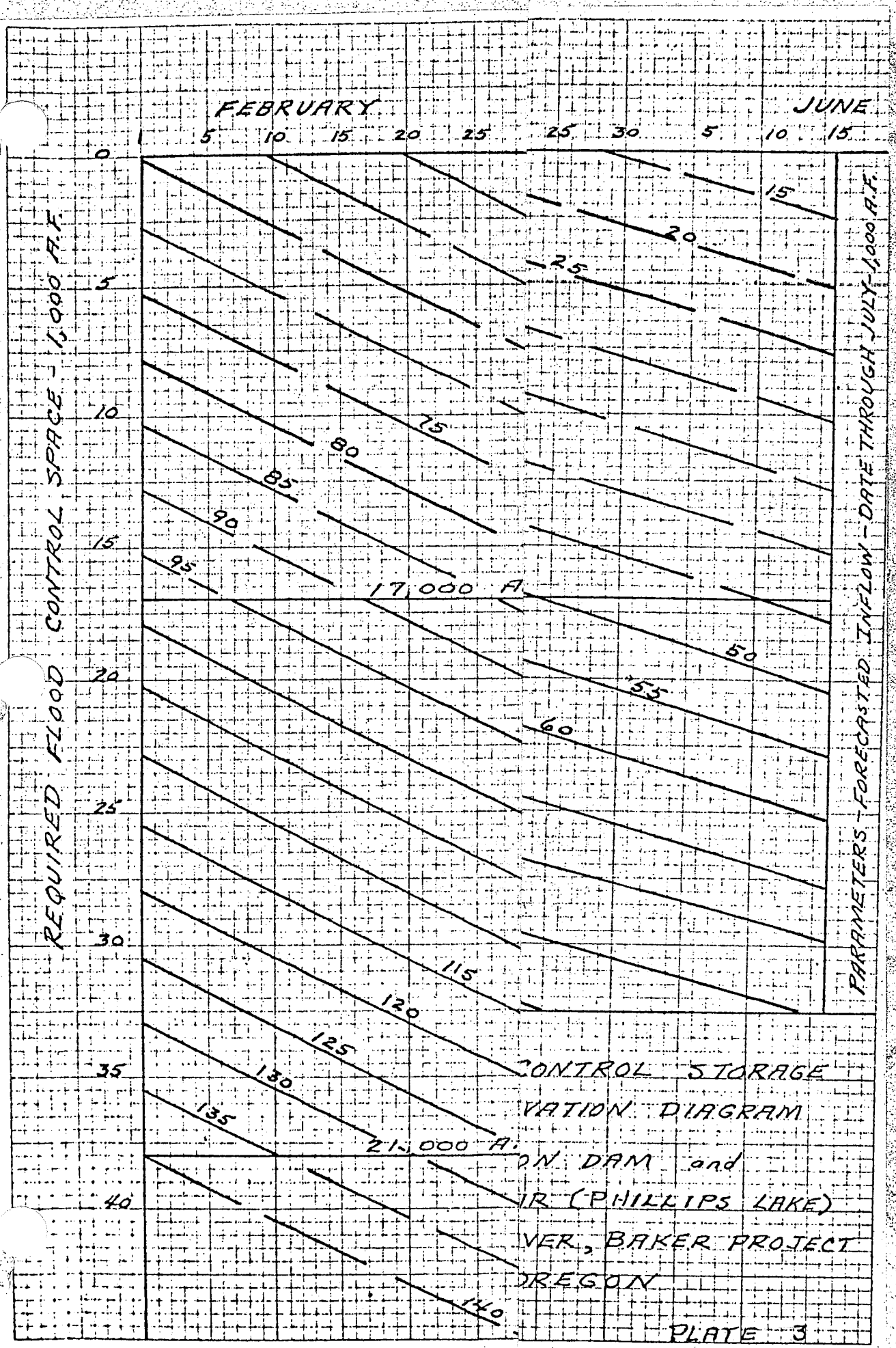

CONTROL STORAGE

VATION DIAGRAM

ON DAM and

IR (PHILLIPS LAKE)

VER, BAKER PROJECT

OREGON

PLATE 3

TABLE 1

MONTHLY PRECIPITATION OCTOBER THROUGH JUNE

BAKER FAA AIRPORT, OREGON

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1938- 39	0.49	0.82	0.96	0.52	0.61	0.36	0.29	0.87	0.60
1939- 40	0.50	0.00	0.85	1.79	1.51	1.92	0.85	0.38	0.68
1940- 41	2.68	0.93	0.54	0.69	1.31	0.04	1.33	1.04	3.02
1941- 42	1.01	0.75	1.98	1.04	0.83	0.47	1.33	3.61	1.02
1942- 43	0.59	1.51	1.91	1.59	0.49	0.36	1.07	0.51	2.81
1943- 44	1.08	0.48	0.38	0.32	0.82	0.32	0.53	1.28	2.48
1944- 45	0.30	1.01	0.35	0.92	1.18	0.56	0.25	2.09	0.93
1945- 46	0.35	1.63	1.39	0.83	0.56	0.91	0.48	2.64	0.84
1946- 47	0.76	1.37	0.74	0.66	0.34	0.69	0.64	1.00	1.77
1947- 48	1.67	0.92	0.40	0.44	0.73	1.32	1.28	2.34	2.02
1948- 49	0.51	0.95	1.50	0.33	0.88	0.63	0.71	1.60	0.15
1949- 50	0.19	1.26	0.44	0.96	0.15	0.70	0.64	0.04	2.23
1950- 51	0.84	0.46	0.46	1.04	0.51	0.87	0.31	0.79	0.32
1951- 52	0.77	0.92	1.23	0.90	1.25	0.49	1.18	2.03	2.06
1952- 53	0.02	0.44	0.75	1.38	1.37	0.71	1.24	3.80	1.83
1953- 54	0.63	0.67	0.83	0.45	0.67	0.54	0.68	1.05	0.92
1954- 55	0.25	0.30	0.66	0.57	0.59	0.54	0.98	0.69	0.39
1955- 56	1.12	1.55	1.97	1.03	1.07	0.38	0.39	3.03	1.33
1956- 57	1.64	0.16	0.79	0.90	0.92	1.93	0.42	1.74	1.26
1957- 58	2.18	0.75	1.22	0.69	0.61	0.62	1.23	1.06	3.45
1958- 59	0.35	0.76	0.93	0.51	0.49	1.02	0.41	1.23	0.66
1959- 60	0.38	0.27	0.26	0.91	0.29	1.14	0.60	3.01	0.14
1960- 61	0.20	1.75	0.43	0.21	0.90	0.67	0.21	1.93	0.70
1961- 62	0.75	1.51	1.16	1.34	0.75	0.47	1.39	2.20	0.04
1962- 63	1.56	1.08	1.00	1.00	0.67	0.44	0.69	1.26	1.61
1963- 64	0.35	0.97	0.82	1.81	0.31	0.78	0.56	0.57	5.06
1964- 65	0.26	0.50	2.83	1.90	0.17	0.66	1.73	0.18	1.19
1965- 66	0.11	0.82	0.26	0.55	1.17	0.93	0.19	0.57	1.31
1966- 67	0.35	1.13	1.69	0.70	0.21	1.29	1.37	1.16	1.03

Note: October 1938 - December 1946 USED BAKER, OREGON

TABLE 2

MONTHLY PRECIPITATION OCTOBER THROUGH JUNE

ROCK CREEK , OREGON

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1938- 39	1.39	2.16	1.59	1.72	3.14	2.47	0.32	1.63	0.78
1939- 40	1.17	0.04	2.75	2.66	5.56	2.67	1.21	0.34	1.65
1940- 41	4.33	2.77	2.18	1.95	3.03	0.28	1.85	3.73	4.35
1941- 42	1.73	1.94	5.24	1.30	2.45	0.76	2.09	3.50	2.33
1942- 43	0.91	3.96	4.62	3.96	2.02	1.27	1.82	1.47	3.16
1943- 44	1.66	0.92	1.32	0.76	2.58	1.43	1.45	0.85	4.07
1944- 45	1.16	2.36	1.38	2.13	3.16	1.51	1.25	2.88	1.20
1945- 46	0.41	4.99	3.36	2.40	1.88	1.20	0.48	3.16	1.48
1946- 47	1.80	3.94	1.78	1.84	0.88	0.99	1.66	0.96	2.87
1947- 48	4.24	2.67	2.09	3.40	2.56	2.40	2.91	3.04	3.36
1948- 49	1.25	3.73	5.17	0.49	4.18	0.85	0.72	2.30	0.63
1949- 50	0.50	2.13	2.01	3.62	2.18	2.23	1.39	0.40	2.98
1950- 51	3.69	1.90	1.86	3.70	1.83	2.84	0.46	1.91	0.72
1951- 52	2.76	2.22	4.36	3.08	1.95	1.13	1.03	2.26	2.93
1952- 53	0.00	0.82	3.59	4.41	2.76	2.97	1.80	3.41	2.35
1953- 54	0.81	2.34	2.71	3.80	1.32	1.15	1.45	0.90	2.51
1954- 55	0.51	1.23	1.67	1.46	1.27	1.85	2.22	1.20	0.99
1955- 56	2.10	3.70	6.20	3.80	3.13	1.23	0.73	4.14	2.24
1956- 57	2.66	1.11	2.57	1.71	2.76	2.94	1.60	4.18	1.18
1957- 58	2.99	1.38	4.30	3.27	2.86	1.92	3.03	1.13	2.76
1958- 59	1.49	3.45	3.03	3.14	1.70	1.41	0.54	2.34	0.54
1959- 60	1.40	1.36	0.91	2.13	2.79	2.34	1.78	3.60	0.37
1960- 61	0.98	4.34	1.22	0.71	3.02	2.10	0.79	1.83	0.90
1961- 62	1.38	2.79	2.42	1.65	1.89	1.80	1.31	2.77	0.39
1962- 63	4.20	2.34	1.78	0.71	2.53	2.38	2.37	2.03	0.99
1963- 64	0.56	3.05	1.52	3.50	0.70	2.15	0.65	0.74	3.56
1964- 65	0.61	2.31	9.38	5.62	0.93	0.71	1.71	0.94	1.47
1965- 66	0.19	2.27	1.10	3.30	1.97	1.61	0.40	0.77	1.34
1966- 67	1.16	3.04	3.41	2.93	0.66	3.04	2.15	1.16	1.78

TABLE 3

MONTHLY PRECIPITATION OCTOBER THROUGH JUNE

UNITY , OREGON

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1938- 39	0.44	0.50	0.67	0.64	1.14	1.04	0.21	1.19	0.21
1939- 40	0.63	0.02	0.78	1.05	1.37	1.61	1.25	0.39	0.38
1940- 41	2.68	1.67	1.00	1.05	1.34	0.23	0.78	2.29	2.00
1941- 42	1.04	0.92	2.09	1.19	1.62	0.42	0.80	2.19	0.38
1942- 43	0.39	2.04	2.43	1.95	0.27	1.14	1.10	1.05	1.94
1943- 44	1.04	0.42	0.69	0.23	0.85	0.30	0.65	0.70	3.23
1944- 45	0.13	1.13	0.57	0.83	1.40	0.60	0.60	2.21	0.71
1945- 46	0.33	1.50	1.93	0.86	0.27	0.77	0.27	2.09	0.82
1946- 47	1.33	1.72	0.60	1.44	0.93	0.69	1.37	0.73	2.18
1947- 48	1.67	0.92	0.40	0.40	0.71	1.31	0.13	2.10	2.83
1948- 49	1.51	2.33	1.50	0.23	1.22	0.03	0.44	1.79	0.00
1949- 50	0.18	1.50	0.45	1.35	0.90	1.07	0.41	0.00	1.80
1950- 51	0.34	0.46	0.46	1.56	0.55	0.71	0.00	0.71	0.86
1951- 52	0.77	0.92	1.58	1.72	1.25	0.48	0.71	1.52	1.90
1952- 53	0.00	0.37	1.33	0.10	1.44	0.84	0.32	3.72	1.22
1953- 54	0.58	0.81	0.88	0.92	0.28	0.43	0.40	0.52	1.37
1954- 55	0.24	0.23	0.65	0.47	0.24	0.71	1.21	0.39	0.92
1955- 56	0.46	1.20	2.54	1.82	0.83	0.21	0.42	2.60	0.88
1956- 57	2.19	0.15	1.10	0.83	1.00	1.90	0.68	2.47	1.20
1957- 58	1.94	0.33	1.96	0.97	1.47	0.92	1.38	0.81	2.45
1958- 59	0.58	0.77	1.05	1.37	0.37	0.34	0.27	1.37	0.09
1959- 60	0.45	0.45	0.41	0.82	1.12	1.03	0.36	1.83	0.08
1960- 61	0.24	2.41	1.07	0.19	0.50	0.70	0.29	1.29	0.86
1961- 62	0.52	1.11	0.99	1.03	0.90	0.47	0.71	2.48	0.07
1962- 63	2.52	1.49	0.70	0.66	0.89	0.46	1.63	1.35	1.22
1963- 64	0.08	1.08	1.20	1.63	0.24	0.61	0.52	0.78	1.43
1964- 65	0.11	0.88	3.86	3.23	0.16	0.50	1.38	0.87	1.74
1965- 66	0.09	1.05	0.36	0.44	0.81	0.77	0.58	0.19	0.92
1966- 67	0.52	1.66	1.27	0.75	0.05	0.96	0.53	0.60	1.64

TABLE 4

APRIL 1 SNOW WATER CONTENT

YEAR	BOURNE	DOOLEY MOUNTAIN	EILERTSON MEADOWS	GOODRICH LAKE
1939	11.30	3.00	9.80	30.50
1940	11.60	5.30	10.70	34.02
1941	9.60	8.20	8.50	45.30
1942	13.80	11.70	10.90	38.70
1943	22.20	11.70	14.70	50.00
1944	8.20	7.20	6.50	27.40
1945	21.70	10.30	8.90	42.00
1946	19.90	10.80	15.20	49.20
1947	8.50	2.10	6.80	31.30
1948	14.10	9.50	9.20	34.70
1949	14.60	12.00	15.20	46.00
1950	20.00	10.50	14.80	48.20
1951	17.80	10.20	14.50	42.00
1952	19.80	14.80	17.00	51.00
1953	19.80	11.60	15.40	48.00
1954	14.50	4.40	10.20	39.10
1955	14.20	7.80	11.40	26.20
1956	19.20	9.10	13.70	45.70
1957	14.90	6.60	9.50	32.90
1958	19.90	13.20	16.90	41.80
1959	12.50	6.50	7.20	28.70
1960	11.50	7.30	7.50	22.60
1961	13.70	5.50	9.70	39.90
1962	17.30	10.50	10.20	45.00
1963	5.20	0.10	0.80	19.40
1964	17.70	9.50	14.40	36.50
1965	19.90	11.70	17.00	40.00
1966	12.60	5.00	13.00	33.40
1967	12.20	8.30	11.90	38.10

(7-56)

TABLE 5

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Monthly Discharge - Ac. Ft.

Powder River Near Baker, Oregon (3½ miles South of Baker) Drainage Area 219 Sq. Miles.

YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	TOTAL
1927	609	1,260	3,170	2,260	3,730	11,300	23,000	24,000	23,200	2,820	959	946	97,300
28	2,200	4,750	3,520	5,530	3,970	21,700	18,100	35,700	6,430	1,840	492	375	105,000
29	658	1,140	1,040	922	666	8,850	10,100	19,500	11,800	1,240	437	292	56,600
30	474	595	1,290	922	3,710	5,250	9,940	7,930	3,610	510	326	238	34,800
31	467	619	738	676	1,370	4,960	11,600	10,900	2,110	238	31	28	33,800
32	276	533	1,230	922	1,730	12,500	25,600	33,300	14,300	1,760	417	181	92,700
33	373	1,060	836	1,050	1,110	3,760	20,500	23,300	26,100	2,620	682	321	81,700
34	482	791	2,080	3,430	3,140	6,730	7,540	3,170	1,310	472	64	15	29,220
35	307	960	1,810	1,690	2,440	4,140	11,750	16,020	5,910	971	117	33	46,350
36	117	334	684	1,020	1,210	5,090	27,680	17,620	5,200	915	219	124	60,210
37	240	337	716	524	696	4,440	9,860	18,380	8,740	1,770	700	385	46,190
38	765	1,320	4,870	3,510	4,010	14,500	25,880	26,750	13,940	2,800	777	401	99,540
39	473	1,000	1,210	1,230	1,430	14,470	18,180	10,920	3,400	873	120	110	53,420
40	313	390	963	1,740	3,600	15,900	20,710	18,540	5,140	924	343	472	69,080
41	1,450	2,610	2,810	3,030	3,560	17,050	18,070	25,010	14,260	4,110	1,820	2,470	96,250
42	1,840	2,820	6,840	4,430	4,200	8,270	31,550	22,900	14,810	4,160	1,060	642	103,500
43	763	1,620	3,270	4,520	5,570	14,440	37,150	20,530	18,260	7,580	1,560	859	116,100
44	1,010	1,550	1,390	1,340	1,500	2,930	6,210	9,360	7,830	2,080	707	392	36,300
45	433	950	916	1,580	2,560	4,360	12,380	24,310	13,920	2,550	783	612	65,350
46	970	1,330	2,160	2,460	1,980	11,710	29,780	29,250	12,070	3,750	906	698	97,030
47	1,180	2,100	4,210	3,780	5,440	11,160	13,060	20,350	7,740	1,540	487	425	71,470
			Sum	46,766	57,622	203,530							

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TABLE 6

Data	Average 1939-67	
October	3.22	(Precipitation Baker, Rock Creek and Unity)
November	4.38	"
December	5.13	"
January	4.51	"
February	3.90	"
March	3.25	"
April	2.88	"
May	4.95	"
June	4.67	"

April 1 Snow Water Content 12.50 ~~(Bourne, 2x Dooley Mt., Eilertson Meadows and .5x Goodrich Lake)~~

(1/5 Bourne plus 2/5 Dooley Mtn plus 1/5 Eilertson plus 1/10 Goodrich Lake.)

Revised by USBR letter 15 Nov 1968

TABLE 7

FORECAST POWDER RIVER NR BAKER
FORECAST DATE FIRST OF MONTH FOR FEB - JUL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	OBS
1939	63133.	58156.	61178.	50785.	46423.	44651.	42479.	49300.
1940	57554.	60565.	74411.	75732.	76640.	71226.	69843.	64900.
1941	86894.	84386.	89817.	78326.	80609.	83593.	86903.	82000.
1942	81926.	78931.	81983.	80127.	82960.	89106.	88442.	85900.
1943	85744.	94853.	91441.	103885.	106231.	103527.	105809.	103500.
1944	60613.	50849.	51919.	36251.	35720.	32734.	36333.	29900.
1945	61592.	59663.	65277.	69428.	67775.	70928.	69637.	60200.
1946	79944.	78656.	75031.	85371.	81877.	86033.	84953.	88500.
1947	75417.	73672.	68340.	48982.	50651.	47468.	48981.	59300.
1948	77717.	76887.	77195.	80888.	83933.	87510.	90003.	84100.
1949	86208.	75652.	82912.	86330.	84191.	85241.	82499.	81600.
1950	62252.	66575.	64535.	77436.	76503.	70144.	71791.	71300.
1951	67905.	73355.	70279.	80680.	76213.	74045.	72092.	84600.
1952	79063.	82684.	84365.	98790.	98372.	100093.	101655.	96900.
1953	58973.	63174.	68269.	83975.	84988.	93434.	93947.	105000.
1954	66168.	68173.	63206.	53697.	52954.	49460.	49761.	49500.
1955	55107.	48971.	43486.	38033.	41268.	37505.	35834.	34700.
1956	92057.	98574.	102023.	104649.	101811.	108620.	108464.	114000.
1957	71331.	68061.	70443.	75721.	75338.	80199.	79472.	85300.
1958	82783.	84056.	87230.	100772.	106609.	103863.	108083.	119300.
1959	71429.	72976.	68894.	58013.	54498.	54490.	52107.	56200.
1960	55474.	53485.	54403.	47516.	47217.	52149.	49273.	65200.
1961	71991.	61617.	63206.	58911.	55544.	55691.	54133.	51400.
1962	71918.	70417.	69322.	72955.	74074.	77608.	74668.	61100.
1963	81853.	75321.	75903.	47582.	51409.	50978.	50378.	57300.
1964	64626.	72028.	63951.	69017.	66591.	62550.	66339.	60900.
1965	91912.	110831.	102785.	109435.	113538.	109366.	109174.	116400.
1966	56355.	55677.	55528.	49495.	45874.	41053.	40277.	36500.
1967	75882.	75479.	66396.	70943.	73416.	70557.	70400.	71700.

TABLE 8

FORECAST POWDER RIVER NR BAKER

YEAR	FEB - JUL JAN	FEB	DATE FIRST OF MONTH THRU JUL MAR×	APR⊙	MAY⊡	JUN△	JUL	Feb-July OBS
1939	63133.	58156.	59778.	34985.	12323.	-348.	-5920.	49300.
1940	57554.	60565.	70811.	-56232.	-36440.	12426.	6043.	64900.
1941	86894.	84386.	-86217.	-57826.	-42009.	20093.	9003.	82000.
1942	81926.	78931.	-77783.	-67727./	-38960.	22206.	6742.	85900.
✓1943	85744.	94853.	-85841.	-83885.×	-49031.×	25827.	9709.	103500.
1944	60613.	50849.	50419.	31851.	25120.	12734.	8533.	29900.
1945	61592.	59663.	62677.	-62428.	-48375.×	27328.	12237.	60200.
1946	79944.	78656.	-73031.	-71771.×	-38477.	30533.	25653.	88500.
1947	75417.	73677.	62940.	32382.	21051.	-2591.	-8618.	59300.
1948	77717.	76887.	-74195.	-73088.×	-60333.×	35210.	10403.	84100.
1949	86208.	75652.	-80812.	-73530.×	-42591.	13241.	2699.	81600.
1950	62252.	66575.	62335.	-59636.	-49103.×	22544.	4591.	71800.
1951	67905.	73355.	64879.	-64980./	-27913.	45.	-10407.	34600.
1952	79063.	82684.	-82065.	-89090./×	-61372./×	21692.	8255.	96900.
1953	59973.	63174.	63169.	-69275.	-50088.×	32534.	-1152.	105000.
1954	66168.	68173.	59206.	42497.	-29554.	9860.	2661.	49600.
1955	55107.	48971.	42586.	35533.	-33569.	18205.	4034.	34700.
1956	93057.	-98574.	-98423.	-84649./×	-46611.✓	14920.	-2135.	114000.
1957	71331.	68061.	66643.	-61321.	-40838.✓	13599.	-3527.	85300.
1958	82783.	84056.	-79630.	-84272.×	-62609.×	8663.	-7617.	119300.
1959	71429.	72976.	65594.	-49113.	-29598.	13190.	-1392.	56200.
1960	55474.	53495.	52803.	32416.	11317.	1749.	-14026.	65200.
1961	71991.	61617.	58606.	47611.	-34244.	18391.	4133.	51400.
1962	71918.	70417.	66322.	-65355.	-43474.	31108.	15668.	61100.
1963	81958.	75321.	68403.	34482.	-28909.	7178.	-4721.	57300.
1964	54626.	72028.	62371.	-64286.	-49341.×	29190.	8679.	60900.
1965	91812.	-110831.	-90965.	-84175.×	-55998.×	21506.	-1855.	116400.
1966	56955.	55677.	54018.	41765.	25584.	10233.	4926.	36500.
1967	75882.	75478.	62606.	-61373.	-57186.×	26027.	2290.	71700.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGIONAL OFFICE, REGION 1
BOX 8008
BOISE, IDAHO 83707

IN REPLY
REFER TO: 765

JUN 19 1968

District Engineer
Corps of Engineers
Building 602, City-County Airport
Walla Walla, Washington 99362

Dear Sir:

The attached Plate 2 (Flood Control Parameters) and 3 (Flood Control Storage Reservation Diagram) will supersede the respective plates in the operation study for Mason Dam and Reservoir (Phillips Lake), Powder River, Baker Project, Oregon transmitted to your office by our letter of February 7, 1968.

As pointed out in the phone call from your office to Mr. Lindgren, the low forecast made for May 1958 in the operation study would not indicate the needed flood control storage space to keep the flow in the Powder River at Baker from exceeding 500 c.f.s. In checking the forecast made for flood control operation in 1958, it was determined that the residual on April 30 of the April-July forecast would be more critical in the need for flood control space than that of the May 1 forecast. Therefore, the slope of storage parameters was adjusted using the points for May 1910 and the needed storage on May 1958 (24,900 acre-feet) with the residual forecast of April 30, 1958 (56,700 acre-feet). The other parameter lines were then drawn so that all points were enveloped and nearly equally spaced. The spacing was controlled by points of March 1, 1910, April 15, 1910 and the use of April 1958 forecast with required flood control space. The parameters from adjusted Plate 2 were then redrawn on Plate 3 to be in the standard format.

A check of the 29-year period, 1939-67 was made using the forecasted runoff for date through July (table 8 of the study) and the adjusted Plate 3. This check indicated that the required flood control storage

space needed to control the flow of Powder River at Baker to 500 c.f.s. could be accomplished without producing a subsequent shortage to the irrigation supply.

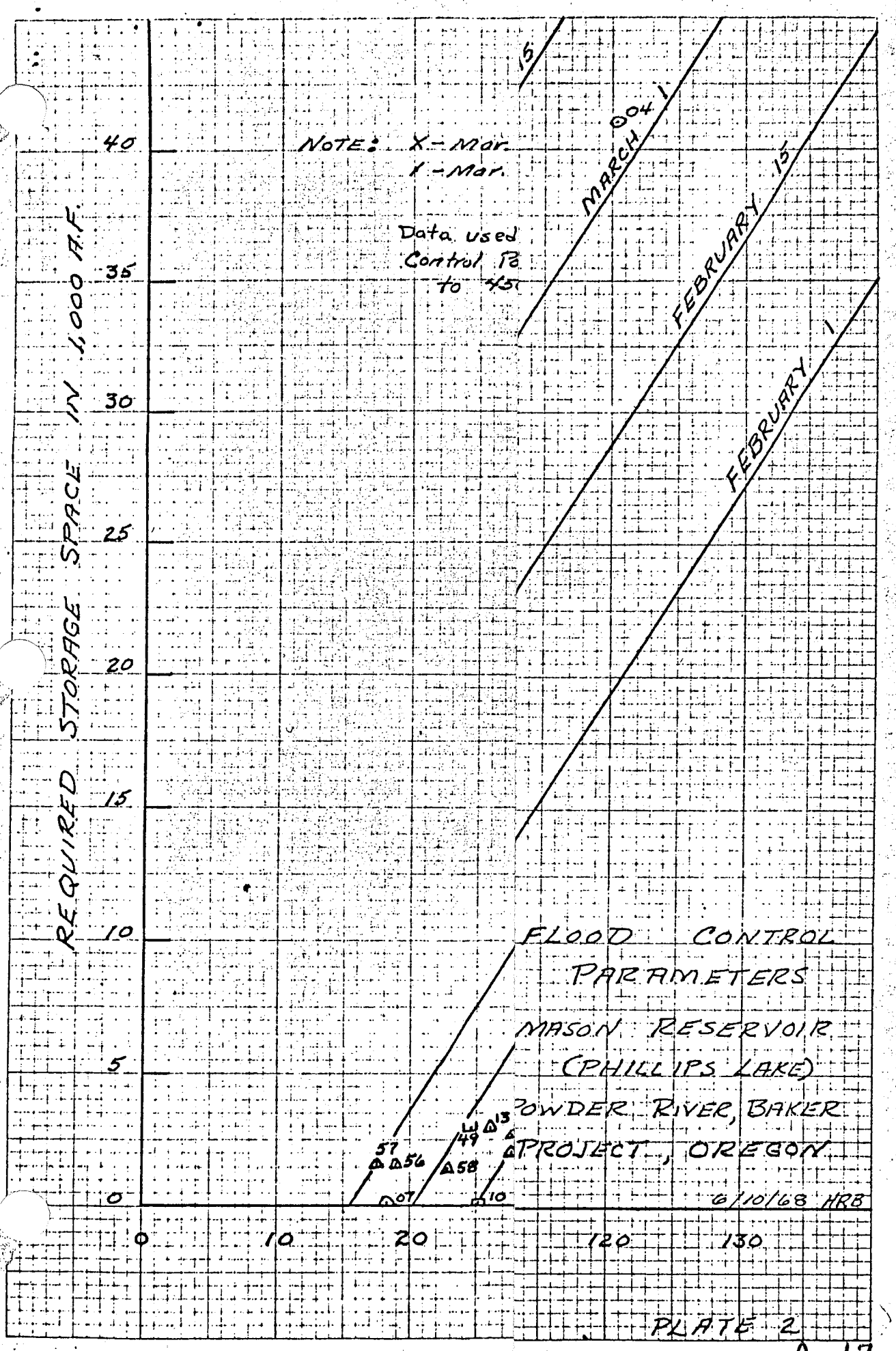
Sincerely yours,

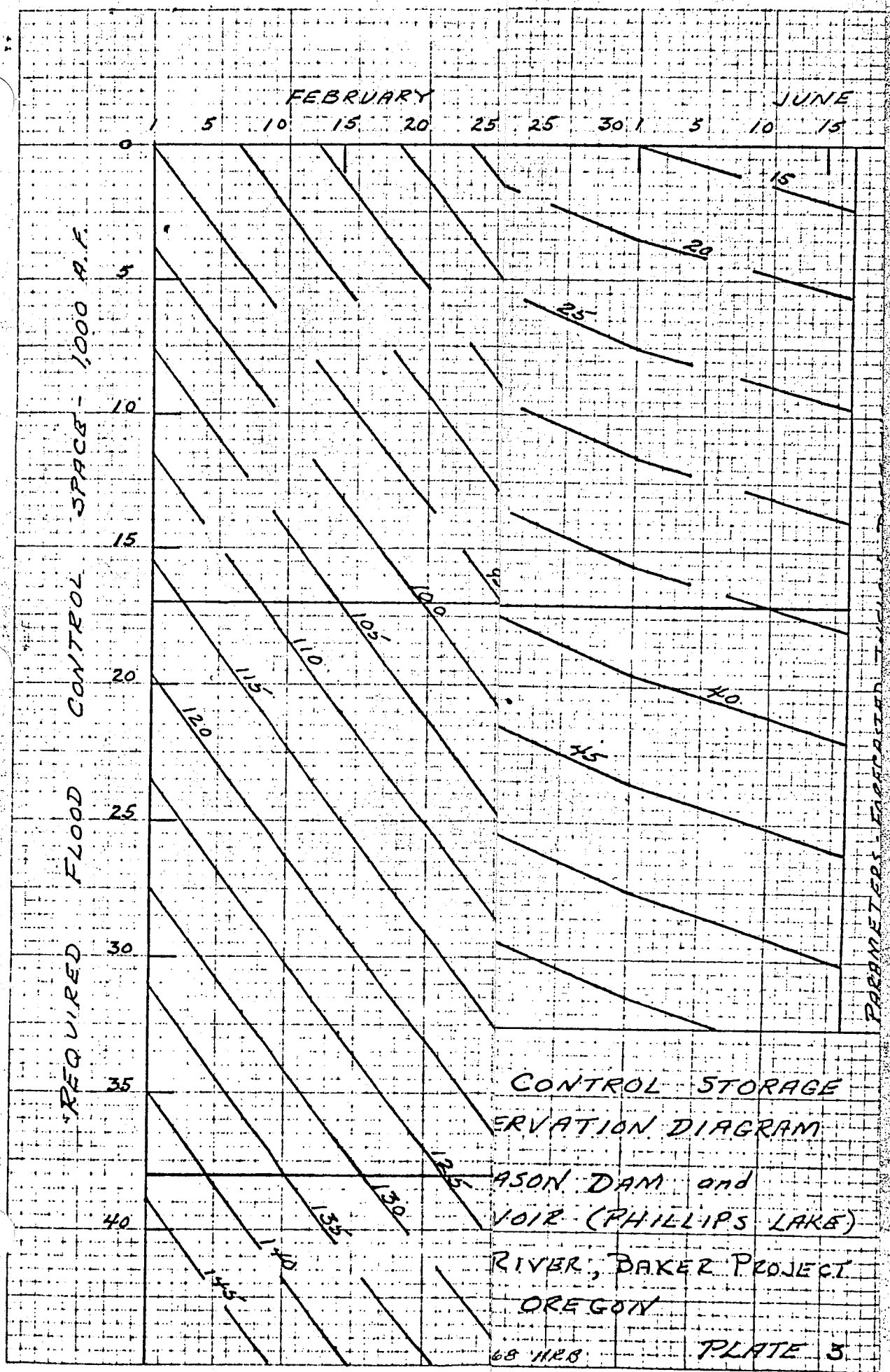
Norman H. Moore

Acting Regional Director

Attachments

A-17


REQUIRED STORAGE SPACE IN 1,000 A.F.
0
5
10
15
20
25
30
35
40
0
10
20
120
130
NOTE: X - Mar. 15
1 - Mar. 1
Data used
Control Pd
to 4/5
MARCH 1
FEBRUARY 15
FEBRUARY 1
57
56
58
49
13
07
10
FLOOD CONTROL
PARAMETERS
MASON RESERVOIR
(PHILLIPS LAKE)
POWDER RIVER, BAKER
PROJECT, OREGON
6/10/68 HRB
PLATE 2



CONTROL STORAGE
ERVATION DIAGRAM
ASON DAM and
VOIR (PHILLIPS LAKE)
RIVER, BAKER PROJECT
OREGON
68 HRB PLATE 3

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGIONAL OFFICE, REGION I
BOX 8008
BOISE, IDAHO 83707

IN REPLY
REFER TO: 430

JUL 29 1968

District Engineer
Corps of Engineers, U. S. Army
Walla Walla District
Building 602, City-County Airport
Walla Walla, Washington 99362

Attention: Ken Wise

Dear Sir:

In response to a telephone request from Mr. Wise, of your office, on July 23, 1968, we are enclosing two photos of Mason Dam. We trust one of them will be suitable for the cover on your Reservoir Regulation Manual.

We are also enclosing a copy of the Designers' Operating Criteria for Mason Dam. Some of the elevations and capacities shown in this document are currently being revised to agree with data shown in the area-capacity table dated April 1968. A copy of this table was provided to you earlier. A revised copy of the Designers' Operating Criteria will be provided as soon as available.

Please advise if further information is needed.

Sincerely yours,

E Hread

Regional Supervisor of Irrigation

Enclosures

A-18

NPWEN-PL

15 August 1968

Mr. H. T. Nelson
Regional Director
Bureau of Reclamation
Regional Office, Region 1
P. O. Box 8008
Boise, Idaho 83707

Dear Mr. Nelson:

Reference is made to letter from your office dated 7 February 1968, file No. 765, transmitting a preliminary draft of Part 208, Flood Control Regulations, and a copy of the Bureau's operation study for Mason Dam and Reservoir (Phillips Lake), Powder River, Baker Project, Oregon. On 19 June 1968, your office furnished copies of revised Plates 2 (Flood Control Parameters) and 3 (Flood Control Storage Reservation Diagram) to supersede the respective plates in the operation study transmitted with your letter of 7 February. By letter dated 29 July 1968, file 430, we received two photos of Mason Dam and a copy of the Bureau's Designers' Operating Criteria dated March 1968. Mr. Wise has also been in contact with Mr. Lindgren by telephone concerning these flood control regulations.

Earlier considerations of proposing multipurpose use of some of the originally planned 17,000 acre-feet of exclusive flood control space have now been dropped after noting that the dam was not constructed as originally designed. As built, it is apparent that reservation of the exclusive flood control space is necessary to protect the dam during a possible spillway design flood. Accordingly, we are proposing a Part 208, Flood Control Regulations and Flood Control Regulation Schedule, substantially in agreement with that furnished by your office on 7 February and revised 19 June. Most of the changes proposed by us are a matter of form to facilitate future revisions to the Flood Control Regulation Schedule that may become desirable. A copy of our version is inclosed for your review and comment.

A-19

NPWEN-PL
Mr. H. T. Nelson

15 August 1968

When these Regulations are forwarded to higher authority for approval, it will be necessary to furnish a report with them giving backup information. It is desirable to show the regulation of your spillway design flood in that report if you can furnish it.

The need for a gaging station at the control location of Powder River at Baker is obvious. It is assumed that your office will actively pursue establishment of the needed gaging facility. Our report will so state unless we hear otherwise from you.

Sincerely yours,

ROBERT J. GIESEN
Colonel, CE
District Engineer

2 Incl
1. Part 208, Flood Control Regulations
2. Flood Control Regulation Schedule

KWW/
ROP
MJO
HAP
HLD
VB
RJG
M&R
ENGR

A-19

PART 208

FLOOD CONTROL REGULATIONS
MASON DAM AND RESERVOIR (PHILLIPS LAKE)
UPPER DIVISION, BAKER PROJECT, OREGON

Pursuant to the provisions of Section 7 of the Act of Congress approved December 22, 1944 (58 Stat. 890; 33 U. S. C. 709) the following #208 ___ is hereby prescribed to govern the use and operation of Mason Dam and Reservoir on Powder River, Oregon, for flood control purposes.

#208 ___ Mason Dam and Reservoir, Powder River, Oregon.

The Bureau of Reclamation, acting through the Baker Valley Irrigation District, shall operate Mason Dam and Reservoir in the interest of flood control as follows:

(a) Storage space in Mason Reservoir will be kept available for flood purposes in accordance with the Flood Control Regulation Schedule currently in force.

(b) Releases from Mason Reservoir shall limit the flow of Powder River at Baker, Oregon to bankfull capacity or less insofar as this can be accomplished by use of the authorized flood control storage space in the reservoir.

(c) The Flood Control Regulations of this Section are subject to temporary modification by the District Engineer, Corps of Engineers, if found necessary in time of emergency. Request for action on such modifications may be made by any available means of communication, and the action

requested by the District Engineer shall be confirmed in writing under date of the same day to the office of the Regional Director of the Bureau of Reclamation which has jurisdiction of the area in which the project is located.

(d) The Flood Control Regulation Schedule for Mason Reservoir currently in force as of the promulgation of this Section is the one dated _____, File No. PW-123-2/1 and is on file in the office of the Chief of Engineers, Department of the Army, Washington, D.C., and in the office of the Commissioner, Bureau of Reclamation, Washington, D.C. Modification of the Flood Control Regulation Schedule for Mason Reservoir may be made from time to time as deemed necessary and approved by the Corps of Engineers and the Bureau of Reclamation. Each such revision shall be effective upon the date specified in the approval thereof by the Chief of Engineers and the Commissioner of Reclamation, and from that date until rescinded shall be in force for purposes of this Section. Copies of the Flood Control Regulation Schedule currently in force shall be kept on file in the office of the District Engineer, Corps of Engineers, and the Regional Director, Bureau of Reclamation, charged with the responsibility of the project, and may be obtained from the respective offices.

(e) Nothing in the regulations in this Section shall be construed to require dangerously rapid changes in magnitude of reservoir releases, or that releases be made at rates or in a manner that would be inconsistent with requirements for protecting the dam and the reservoir from major damage.

(f) The Bureau of Reclamation shall procure current basic hydrological data, make determinations of the required flood control space reservations to effect the regulation set forth in the objectives prescribed in these regulations, and make calculations of permissible releases from the reservoir as are required to accomplish the flood control objectives prescribed in this Section.

(g) The Bureau of Reclamation shall keep the District Engineer, Corps of Engineers, advised of hydrological conditions and other operating criteria which affect the flood control operation. Also, the Bureau of Reclamation shall keep the Watermaster, acting under the control and supervision of the State Engineer of Oregon, currently advised of reservoir releases.

(Regs., _____ date _____ ENGWE) (Sec. 7, 58 Stat. 890; 33 U.S.C.709)

(Seal)

Major General, U.S. Army
The Adjutant General

(F.R. Doc. _____; filed, date, time)

Copies from Federal Register dated _____

A-19

FLOOD CONTROL REGULATIONS (33 CFR 208)
FLOOD CONTROL REGULATION SCHEDULE
MASON RESERVOIR (PHILLIPS LAKE), OREGON

The controlling flood control space reservation at any time is the maximum space requirement as determined from any one of the applicable parts of this schedule. Reservoir releases shall be planned to provide flood control storage space in amounts at least equal to the current flood control space reservation requirements; and to accomplish this with minimum practical rates and fluctuations in discharge. Storage of water within the space reserved for flood control will be permitted only as required to prevent or reduce flood damages downstream. Control location for flood regulation is Powder River at Baker, Oregon. Insofar as possible under criteria established herein, river flows in Powder River will be controlled to 500 cubic feet per second or less. To the extent possible, reservoir releases in excess of inflow shall not be made when the flow at Baker, Oregon exceeds 500 cubic feet per second.

PART I - RULE CURVE SCHEDULE

A minimum flood control space reservation of 17,000 acre-feet between reservoir elevation 4062.4 and 4070.5 feet shall be provided for the exclusive purpose of controlling floods.

PART 2 - FORECAST SCHEDULE

This schedule applies to 21,000 acre-feet of joint use space between elevation 4050.63 and 4062.4 during the snowmelt season from February 1 through June 30 each year. Storage space shall be kept available for flood control purposes in accordance with the Flood Control Reservation

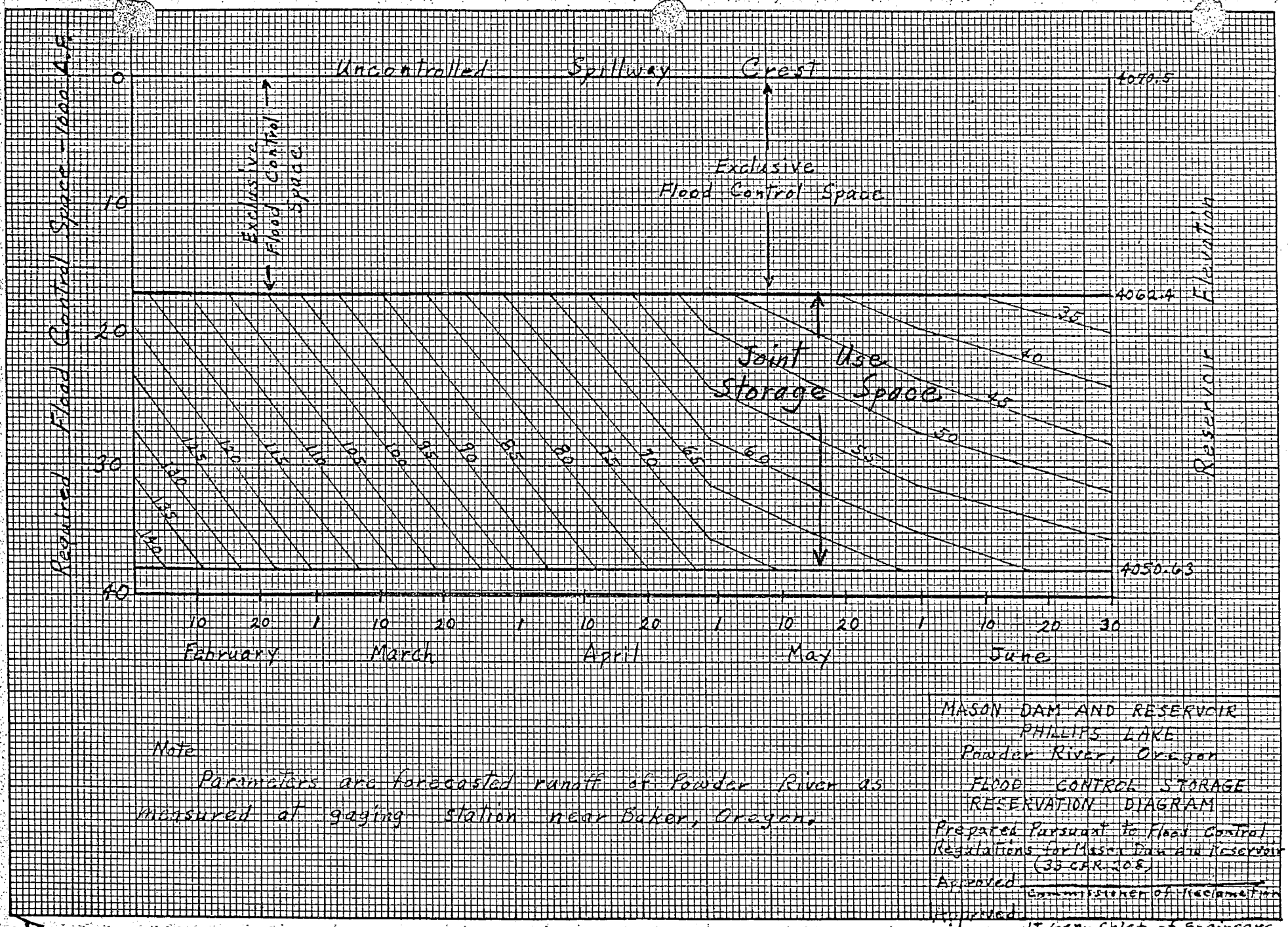
Diagram currently in force and a current forecast of reservoir inflow. Reservoir releases will be scheduled to evacuate and refill reservoir space without exceeding the downstream bankfull capacity. The Flood Control Storage Reservation Diagram currently in force is attached, having File No. PW-123-2/2. Forecasts of inflow to Mason Reservoir shall be made according to procedures contained in the Report on Reservoir Regulations for Flood Control, Mason Reservoir, Powder River, Oregon.

Prepared pursuant to flood control regulations for Mason Reservoir (33 CFR 208).

APPROVED _____
Commissioner
Bureau of Reclamation

APPROVED _____
Chief of Engineers

EFFECTIVE DATE _____
File No. PW-123-2/1



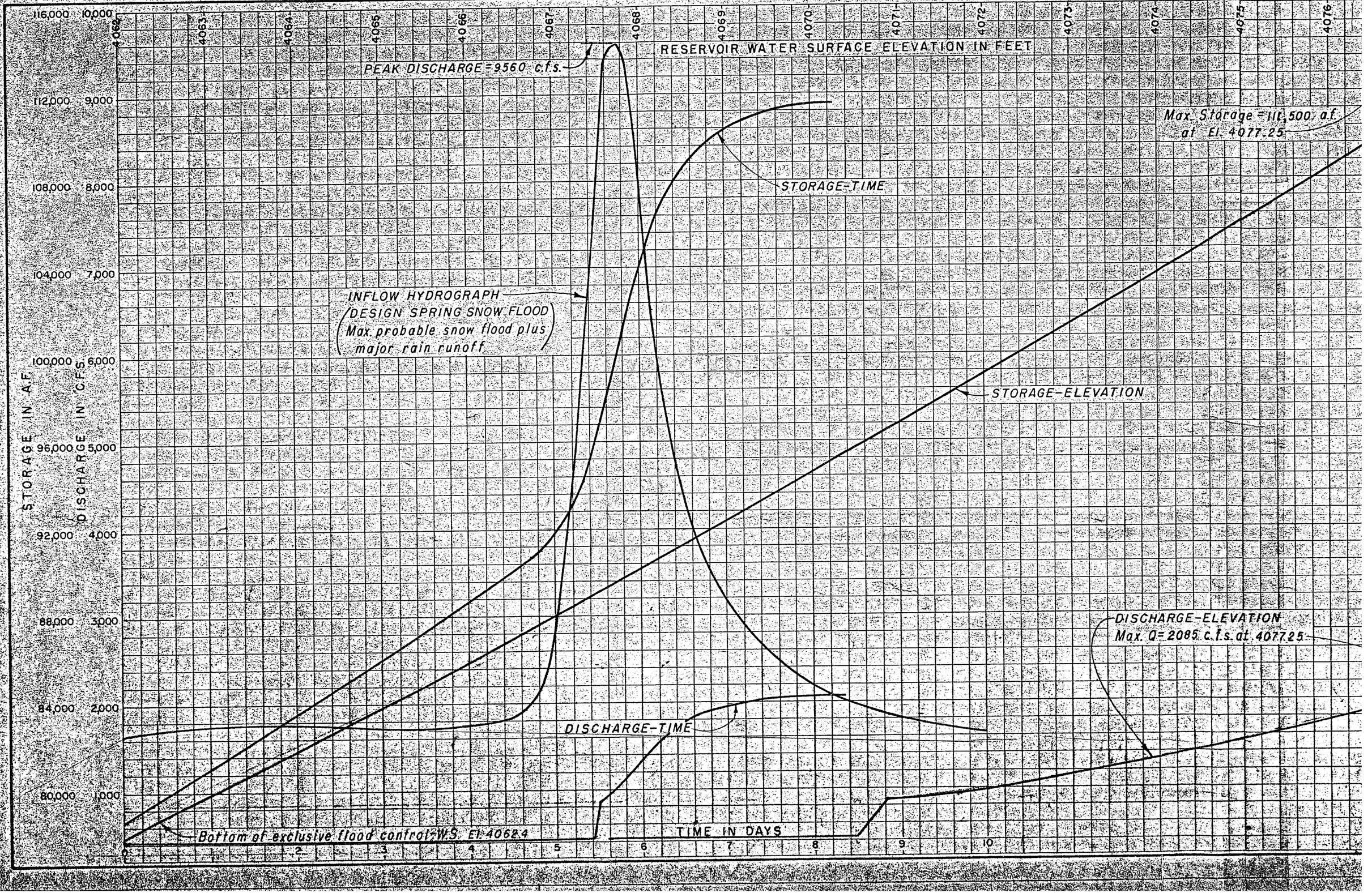
Note

Parameters are forecasted runoff of Powder River as measured at gaging station near Baker, Oregon.

MASON DAM AND RESERVOIR
PHILLIPS LAKE
Powder River, Oregon
FLOOD CONTROL STORAGE
RESERVATION DIAGRAM
Prepared Pursuant to Flood Control Regulations for Mason Dam and Reservoir (33 CFR 208)

Approved _____
Commissioner of Reclamation

Approved _____
Lt. Gen'y Chief of Engineers


RESERVOIR WATER SURFACE ELEVATION IN FEET
4062
4063
4064
4065
4066
4067
4068
4069
4070
4071
4072
4073
4074
4075
4076
PEAK DISCHARGE = 9560 c.f.s.
INFLOW HYDROGRAPH
(DESIGN SPRING SNOW FLOOD
Max. probable snow flood plus
major rain runoff
Max. Storage = 111,500 a.f.
at El. 4077.25
STORAGE-TIME
STORAGE-ELEVATION
DISCHARGE-ELEVATION
Max. Q = 2085 c.f.s. at 4077.25
DISCHARGE-TIME
STORAGE IN A.F.
DISCHARGE IN C.F.S.
116,000 10,000
112,000 9,000
108,000 8,000
104,000 7,000
100,000 6,000
96,000 5,000
92,000 4,000
88,000 3,000
84,000 2,000
80,000 1,000
Bottom of exclusive flood control-W.S. El. 4062.4
TIME IN DAYS
0
1
2
3
4
5
6
7
8
9
10

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGIONAL OFFICE, REGION I
BOX 8008
BOISE, IDAHO 83707

IN REPLY
REFER TO: 765

NOV 15 1968

District Engineer, Walla Walla District
Corps of Engineers, U. S. Army
Building 602, City-County Airport
Walla Walla, Washington 99362

Dear Sir:

Please refer to your letter dated August 15, 1968 which transmitted a revised preliminary draft of Part 208, Flood Control Regulations, for Mason Dam and Reservoir (Phillips Lake), Powder River, Baker Project, Oregon. Since the revised draft is substantially in agreement with the draft furnished you by this office on February 7, 1968, it is acceptable to this office.

As requested by your letter, a blackline print and one reproducible print of Drawing No. 569-D-165 entitled "Mason Dam Flood Routing" is enclosed for use in the Regulation Manual.

The copy of the operation plan study dated February 1, 1968, for Mason Dam and Reservoir (Phillips Lake) which we transmitted to your office by letter of February 7, 1968, should be revised as follows:

1. Page 3: In the B-66 Forecast Equation, the constant "48.871" should be changed to "48.971."

2. Plate 1: Replace with the enclosed revision.

3. Table 6: The parenthetic note describing the April 1 snow water content average value of 12.50 should be revised to read: "(1/5 Bourne plus 2/5 Dooley Mountain plus 1/5 Eilertson Meadows plus 1/10 Goodrich Lake.)"

Sincerely yours,

Norman H. Moore

Assistant Regional Director

Enclosure No. 140466

A-20