UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
LAHONTAN BASIN DEVELOPMENT OFFICE
P.O. BOX 640
CARSON CITY, NEVADA

IN REPLY
REFER TO:

November 3, 1958

18006

Mr. L. K. Hill
Executive Officer
State Water Rights Board
Box 1592
Sacramento 7, California

Dear Mr. Hill:

As requested in your letter of October 31, 1958, we are enclosing five copies of the "Prosser Creek Reservoir Operation Study" of January 14, 1958. The revisions of July 1, 1958, have been incorporated in these copies.

Very truly yours,

H. A. Hunt,
Area Engineer

Enclosure

106

EXHIBIT
tabbies
TCID-95

18006

PROSSER CREEK RESERVOIR OPERATION STUDY

A reservoir on Prosser Creek located about 1.5 miles upstream from its confluence with the Truckee River is under study as a feature of the Washoe Project. The primary purpose of this reservoir, officially named Prosser Creek Reservoir, is to improve fishery conditions in the project area as provided in the Washoe Project Authorizing Act and to provide equally important regulation of Prosser Creek flood flows. Development of this reservoir for the purposes mentioned above would be independent of the Washoe Project as originally planned. It would, however, provide additional needed flood protection on the Truckee River system and provide the increased minimum water releases from Lake Tahoe included in the Authorizing Act.

Preliminary studies by the Bureau of Reclamation show that Prosser Creek Reservoir would not be justified economically for fishery purposes alone, but that it would be economically justified for flood control alone, or as a dual purpose reservoir for flood control and fisheries. These findings are based on (a) preliminary operation studies and cost estimates prepared by the Bureau of Reclamation, (b) preliminary flood control benefit values supplied by the Corps of Engineers, (c) preliminary fishery benefit values supplied by the Fish and Wildlife Service, working cooperatively with fish and wildlife interests of Nevada and California, and (d) that Lake Tahoe releases maintained in the feasibility studies for the September 1954 report would be increased to a minimum of 50 second-feet from October 1 through March, and 70 second-feet from April 1 through September, except when physical limitations prohibit release of these minimum flows.

Under present operation of Lake Tahoe Reservoir, as well as with development of the Washoe Project, it becomes necessary to curtail releases from Lake Tahoe to practically nothing, or to very low flows during several months each year. As a result, a reach of the Truckee River about 4 miles in length immediately below the outlet of the lake is virtually dry during the period when water is not being released from the lake. This condition, of course, prevents the maintenance of a suitable fishery in this stretch of the stream.

Minimum releases recommended by fishery interests to maintain a fishery in the upper portion of the Truckee River varies from 50 second-feet during the fall and winter months, to 70 second-feet during the spring and summer. Such releases, however, would decrease the amount of water that would otherwise be stored at the lake for irrigation use unless an equal amount of replacement water could be stored at some other point on the river system. Prosser Creek Reservoir appears to be the most practical development site to replace the Lake Tahoe storage so released.

To accomplish the replacement and maintain decreed Truckee River stream flows at Floriston the plan would require that water be stored in Prosser Creek Reservoir concurrently and in the same amount as additional releases are made from Lake Tahoe for fishery purposes. For example, if a 50-second-foot release from Lake Tahoe is required for fishery purposes during a certain period, an equivalent flow would be retained and stored in Prosser Creek Reservoir during the same period. As soon as demands from

Lake Tahoe for irrigation and other established rights exceed the minimum flow recommended for fishery purposes, releases from Lake Tahoe would be continued at 50 or 70 second-feet as the case might be, and the remaining demand normally supplied from Lake Tahoe would be released from Prosser Creek Reservoir. This exchange storage procedure would be followed until all water stored in Prosser Creek Reservoir to make the Lake Tahoe fishery exchange is released. Normally at the end of each irrigation season the exchange would be completed at which time the lake content would be status quo.

There would be periods during critical dry cycles when the level of Lake Tahoe would recede below the gravity outflow elevation. As this level is approached it would not always be possible to release the required amount without resorting to pumping from the lake. From past records such an occurrence would be likely only about once in 50 years or more. Occasionally during low stream-flow years, the flow of Prosser Creek would also be too small to match the desired increased release from Lake Tahoe. In these cases, releases from Lake Tahoe would be restricted to the lesser of the flow in Prosser Creek available for exchange, or that which is physically possible to release from Lake Tahoe. Usually the release limitations at Lake Tahoe and low flows in Prosser Creek occur at the same time.

If Prosser Creek Reservoir were operated on a simple "fill and empty" schedule for fishery purposes only, without considering reservoir evaporation losses in effecting the exchange, a maximum reservoir capacity of about 28,000 acre-feet would be required. This full capacity, however,

would have been used during only one two-year period, (1927-28), out of the 39 years covered by the study, 1917 through 1955. The maximum capacity required in any other year during the 39-year period of study would be about 19,000 acre-feet. It was concluded that the cost of providing the maximum exchange capacity of 28,000 acre-feet to be used only once in 50 years could not be justified. Following discussion of this matter with the fishery interests, it was agreed that flows less than the recommended 50 and 70 second-feet could be tolerated occasionally rather than to design the reservoir for this maximum capacity. If the capacity required in this one period is reduced, a maximum capacity of about 18,000 acre-feet would be required in 9 of the 39 years covered by the study. A maximum capacity of about 12,000 acre-feet would be required in 6 years, and a capacity of 10,000 acre-feet or less would have been sufficient in the remaining 24 years. These required capacities are shown on the accompanying hydrograph.

One disadvantage to this simple plan is that evaporation losses would occur at the Prosser Creek Reservoir which would reduce conservation supplies by the amount of the evaporation losses. With the reservoir operated in this manner, these losses are estimated to average about 500 acre-feet annually over the 39-year period. The only way the losses could be offset without reducing conservation supplies would be by salvaging water which would otherwise be spilled at Derby Dam. This would require additional storage space, especially since it is necessary to hold salvable spills for use in years when spills do not occur at Derby Dam. An additional

capacity of about 7,000 acre-feet would be required to develop sufficient water to offset evaporation in effecting the exchange over a period similar to the 7-year dry cycle, 1928-35, and to maintain a minimum pool to protect fish life. This added to the 19,000 acre-feet of capacity required for exchange storage alone results in a reservoir capacity of 26,000 acre-feet if it is used for fishery purposes only. The cost of a reservoir of this size is approximately $4,100,000. If Lake Tahoe releases were not reduced in the 1927-28 period, the reservoir would require a capacity of about 35,000 acre-feet and would cost about $4,700,000.

The Corps of Engineers has recommended a capacity of 20,000 acre-feet in Prosser Creek Reservoir for flood control. This capacity would be needed during the rain-flood period during the winter months. Generally speaking the reservoir would be used for exchange storage for fishery purposes only during the spring and summer months. For this reason most of the reservoir storage space could be used for both purposes without conflict. Although a capacity of 26,000 acre-feet would be needed for exchange storage alone and 20,000 acre-feet would be needed for flood control, a reservoir of 30,000 acre-feet total capacity would serve both purposes because of this timing of the two uses.

Operation studies with a Prosser Creek Reservoir of 30,000-acre-foot capacity show that exchange requirements for fishery purposes could be maintained, losses to offset evaporation could be developed from water that would otherwise be spilled at Derby Dam, 20,000 acre-feet of flood control capacity could be provided during critical rain-flood period, and a minimum reservoir pool of 1,200 acre-feet could be maintained.

111

An operation study utilizing Prosser Creek Reservoir has been made to accomplish the objectives listed above. The results of this study are shown on the accompanying hydrograph. Criteria revised and expanded in accordance with recommendations of the California and Nevada Departments of Fish and Game and the Fish and Wildlife Service at the Reno meeting, December 19, 1957, are as follows:

1. Release outflows at Lake Tahoe resulting from the Washoe Project Feasibility Studies, report of September 1954, formed the basis for determining the increased releases necessary to maintain recommended minimum flows at the lake outlet. Other basic flow data used such as the Truckee River flows maintained at Floriston and spills at Derby Dam were those of the Washoe Project Feasibility Studies.

2. Minimum continuous releases of 50 second-feet would be maintained at Lake Tahoe outlet from October 1 through March 31, and releases of 70 second-feet would be maintained from April 1 through September 30, except when certain physical limitations as described below would impose lesser amounts.

(a) When the level of Lake Tahoe drops below certain elevations it becomes physically impossible to release the amount of water needed for fishery purposes. For an outflow of 70 second-feet with the gates wide open, the minimum water surface elevation is about 6224.9, and for 50 second-feet it is about 6224.7. When the lake surface drops to elevation 6,223.0 or below, it is impossible to obtain any gravity outflow. Releases from the lake would therefore be limited during low lake levels to those physically possible with the outlet gates wide open.

112

(b) During years of low streamflow, the increased release from Lake Tahoe for fishery purposes would normally be limited to the inflow to Prosser Creek Reservoir, less the 5 second-feet described under Item 8. Otherwise more water would be released from Lake Tahoe than would be stored in Prosser Creek Reservoir to make the exchange, and would result in a shortage to irrigation use. However, when more than 10,000 acre-feet of excess water salvaged from spills at Derby Dam are creditable in the reservoir, the limitation would not necessarily apply. The amount of salvaged water in excess of 10,000 acre-feet stored in the reservoir could be considered as exchange water. For example, in 1942-43 a considerable amount of spill would occur at Derby Dam and by the end of June it would be possible to fill Prosser Creek Reservoir with water that otherwise would spill at Derby Dam into Pyramid Lake. Only 4,200 acre-feet of the amount in storage would be fishery exchange water. In July and September the flow of Prosser Creek would be less than that required to match the 70 second-foot release from Lake Tahoe. In this case, the 70 second-foot flow could be maintained at Lake Tahoe and the shortage in Prosser Creek flows could be made up by the excess water creditable in the reservoir.

(c) Releases from Lake Tahoe for fishery purposes would also be limited to the extent of capacity provided in Prosser Creek Reservoir to make the exchange. With a total reservoir capacity of 30,000 acre-feet, no more than this amount could be stored for exchange purposes. The space available for storage

would ordinarily be less than 30,000 acre-feet because a capacity up to 10,000 acre-feet is normally reserved to offset evaporation losses. The limitation caused by reservoir capacity would seldom affect Lake Tahoe releases. Further explanation of this limitation is made in Item 3 (a).

3. Flows of Prosser Creek equal to the releases at Lake Tahoe made for fishery purposes would be impounded in Prosser Creek Reservoir at the same time releases were made at the lake with the following exceptions:

(a) When an amount of water in excess of that required for evaporation and fishery exchange purposes is in the reservoir, it would not be necessary in all cases to impound Prosser Creek flows equal to the Lake Tahoe release. The excess stored water could be used to make up a deficiency in Prosser Creek flows as explained in Item 2 (b). There may also be times when the reservoir would be completely full and no more water could be impounded. In this case, the required fishery releases could be maintained at Lake Tahoe and the excess water in storage in the reservoir would be used for exchange purposes.

(b) Reservoir space must be reserved for flood control purposes as set forth in Item 6. There would be times when flows of Prosser Creek could not be impounded for exchange purposes without encroaching on the flood reservation space. Operation studies have shown that the releases from Lake Tahoe need not be curtailed in such cases even though equivalent flows of Prosser

Creek are not simultaneously impounded. The water held in the reservoir for evaporation purposes would be used for exchange purposes. Examples of such years includes 1921, 1925, and 1937. In all such cases in the period of the study (1917-1955) the water held for evaporation would be sufficient for this purpose. There is, however, a certain risk in operating in this manner. The water supply forecast would be considered so as to reduce the risk of shortage in making the exchange.

4. During a year of unusually high runoff, it is likely that the capacity of Prosser Creek Reservoir at 30,000 acre-feet would not be large enough to store all exchange water on the 50-70 release schedules heretofore explained. In such a year, the stream inflow below Lake Tahoe would be sufficient to meet the Floriston Rate for a period of several months without releasing water from Lake Tahoe. The Tahoe releases for fishery purposes over such a long period would exceed the capacity of Prosser Creek Reservoir provided to make the exchange. Operation studies show that this condition happened but once during the period covered by this study. The effect of such a circumstance could be minimized through the aid of official stream flow forecasts by reducing the releases from Lake Tahoe for fisheries so that exchange capacity of Prosser Creek Reservoir would not be exceeded. Studies show that the capacity of the reservoir would be exceeded if the 50-70 second-foot release criteria were maintained only when the April 1 runoff forecast indicates that a snowmelt runoff in excess of 150 percent of normal will occur, and when 10,000 acre-feet has been stored in the reservoir for fishery exchange purposes prior to April 1. When this condition is confronted, fishery releases would be reduced so that the capacity remaining in the reservoir would allow a somewhat uniform

115

exchange release for the estimated remaining period during which releases from Lake Tahoe would not be required to meet Floriston Rates. Releases would be continued at the reduced rate until the exchange storage cycle had been completed.

5. Water impounded in Prosser Creek Reservoir for fishery exchange purposes would be released as soon as practicable and in such amounts as required to maintain required flows in the Truckee River at Floriston. Whenever releases at Lake Tahoe required to maintain the Floriston Rate exceed the minimum flow for fishery purposes (50 or 70 c.f.s.), the lake releases would be held at the minimum flow and the remainder would be released from Prosser Creek Reservoir to meet the Floriston Rate. In this manner the exchange cycle would be completed and the storage in Lake Tahoe would be restored to the amount it would have been without the fishery release. Releases from Prosser Creek Reservoir would be made as needed to supplement the recommended minimum Lake Tahoe releases in order to maintain the Floriston Rate as determined from the operation study. Maximum average monthly releases would not exceed 250 second-feet. Releases necessary to evacuate the reservoir for flood control purposes would be in addition to the fishery releases.

6. The reservoir would be evacuated to provide 20,000 acre-feet of inviolate space for flood control during the rain-flood period November through April 10 each year. Between April 10 and July 15, varying amounts of flood control space would be held inviolate depending on snow surveys and runoff forecasts, as recommended by the Corps of Engineers.

7. Whenever active storage space is available in the reservoir without encroaching on the inviolate flood space, excess flows of Prosser

Creek which would normally cause or contribute to spills at Derby Dam would be stored in the reservoir in addition to exchange storage requirements. This excess stored water would be held and used to offset reservoir evaporation losses. It would also be used as an operational pool to offset deficient flows of Prosser Creek as explained in Item 2 (b), and for exchange purposes as explained in Items 3 (a) and 3 (b). This excess stored water would be released in such amounts and at such times as desirable or necessary to provide flood control space or to meet exchange storage requirements.

8. A minimum flow of 5 second-feet would be maintained in Prosser Creek below Prosser Creek Dam, except that only the natural flow of Prosser Creek at the dam would be maintained when the natural flow was less than 5 second-feet. This minimum release from the reservoir would have first priority on the use of Prosser Creek flows and would be maintained even though the flows were not sufficient to meet other operational demands.

9. A minimum reservoir of 1,200 acre-feet would be maintained.

Annual benefits attributable to this development based on preliminary estimates supplied by the Corps of Engineers and the Fish and Wildlife Service, and Bureau of Reclamation cost estimates are as follows:

Estimated annual benefit:

Flood control benefits (Jan. 1956 price level)	$200,000
Fishery benefits (price level unknown)	51,000
Total estimated annual benefits	$251,000

Estimated development cost Prosser Creek Reservoir:

1/ Construction cost, 30,000 acre-feet capacity	$4,500,000
Interest during construction	112,500
Total	$4,612,500
Annual equivalent of construction cost including interest during construction over 100 years with interest at $2\frac{1}{2}$ percent	$126,000
Estimated OM&R	7,800
Total annual cost	$133,800

$$\text{Benefit/cost ratio} = \frac{251}{133.8} = 1.88 \text{ to } 1.00$$

1/ Estimate based on current construction costs.

118

The following table summarizes capacity requirements of Prosser Creek Reservoir for flood control and fishery purposes, independently and as a joint venture, together with respective estimates of associated benefits and development costs.

	Single purpose Prosser Creek Reservoir		Dual purpose Prosser Creek Reservoir
	For fisheries	For flood control	For fisheries and flood control
Capacity required (A.F.)	26,000	20,000	30,000
Estimated construction cost	$4,100,000	$3,600,000	$4,500,000
Interest during construction	102,500	90,000	112,500
Annual equivalent of construction cost including interest during construction over 100 years at 2½ per cent interest	$114,800	$100,800	$126,000
Estimated annual OM&R cost	7,800	6,800	7,800
Total estimated annual cost	$122,600	$107,600	$133,800
Annual benefits	$51,000	$200,000	$251,000
Ratio of benefits to costs	0.42 to 1.00	1.86 to 1.00	1.88 to 1.00

By inspection, the fishery increment (Prosser Creek development costs for a 30,000-acre-foot reservoir minus those for a 20,000-acre-foot reservoir) would be justified economically.

Annual cost of fishery increment = $133,800 minus $107,600 = $26,200

Estimated annual fishery benefits = $51,000

Ratio of benefits to costs = $51,000/$26,200 = 1.9 to 1

Using the Separable Cost-Remaining Benefit Method of allocation, the costs of developing Prosser Creek Reservoir to a capacity of 30,000 acre-feet would be apportioned between the two purposes as follows:

	Flood Control	Fisheries	Total
Construction cost	$2,948,000	$1,552,000	$4,500,000
Interest during construction	76,500	36,000	112,500
Total development cost	$3,024,500	$1,588,000	$4,612,500
Annual equivalent of development cost over 100 years at 2½ percent interest	$82,600	$43,400	$126,000
Allocated OM&R	5,300	2,500	7,800
Total allocated annual cost	$87,900	$45,900	$133,800
Estimated annual benefits	$200,000	$51,000	$251,000
Benefit/cost ratio	2.28 to 1.00	1.11 to 1.00	1.88 to 1.00

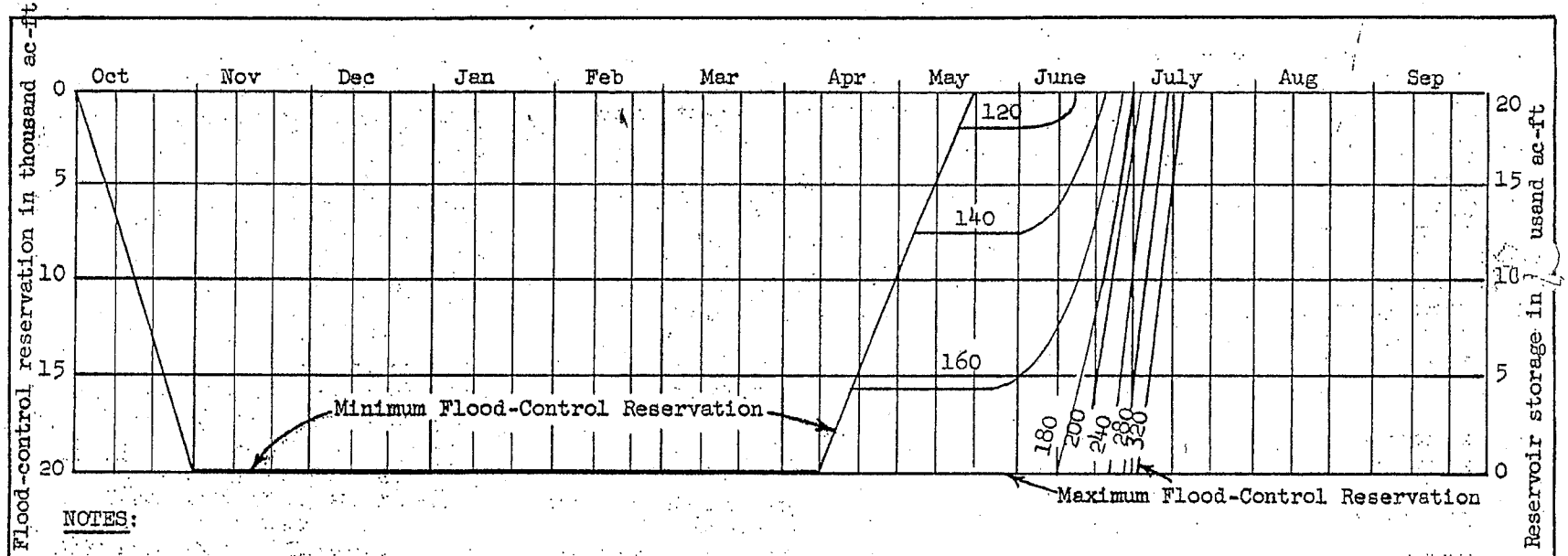
January 14, 1958
Rev. July 1, 1958

120

EFFECT OF PROSSER CREEK RESERVOIR
ON LAKE TAHOE OUTFLOWS
UNDER PLAN OF DEVELOPMENT

Water Year	Number of Months That Average Flow at Lake Tahoe Outlet Was As Shown Below					
	Without Project (Newlands Study)		Washoe Project Operation			
			Without Prosser Creek Reservoir		With Prosser Creek Reservoir	
	Zero Flow	Less than 50-70	Zero Flow	Less than 50-70	Zero Flow	Less than 50-70
1917	3	3	1	2		
1918	4	4	3	3		
1919	4	4	1	3		
1920	4	4	2	3		
1921	6	7	4	7		
1922	4	4	2	3		
1923	2	3	2	2		
1924	0	0	0	0		
1925	6	6	5	5		
1926	4	4	3	3		1
1927	8	9	5	9		8
1928	5	5	3	4		2
1929	2	3	1	2		
1930	7	7	4	5		
1931	1	4	0	1		
1932	7	9	4	9		5
1933	3	8	2	5		1
1934	3	10	1	8		6
1935	9	10	9	10	7	8
1936	7	11	6	8	2	4
1937	6	7	3	6		
1938	8	8	2	4		1
1939	3	3	2	2		
1940	6	7	1	2		
1941	5	5	1	1		
1942	3	4	2	2		
1943	2	4	2	3		
1944	4	4	1	3		
1945	6	6	4	4		1
1946	3	4	1	1		
1947	3	4	2	2		
1948	4	4	4	4		1
1949	3	3	2	2		
1950	7	7	5	7		3
1951	2	3	2	2		
1952	2	2	2	2		
1953	4	4	6	8		2
1954	3	5	2	3		1
1955	3	3	2	2		

121



NOTES:

1. Parameter values are forecast remaining natural runoff to 31 July, in percent of normal, of Truckee River at Farad, excluding releases from Lake Tahoe. These parameters are based on values of normal remaining runoff shown hereon.

2. When the empty space below gross pool level is less than either the minimum flood-control space or the space indicated by the parameter corresponding to the current official forecast of snowmelt runoff, water shall be released as rapidly as possible without causing flows in Truckee River below Reno to exceed 6000 cfs, but releases shall be coordinated with any simultaneous releases from Boca Reservoir to assure that the percentages of encroachment into the flood-control space at Prosser Reservoir and at Stampede and Boca Reservoirs combined tend toward equality insofar as is possible without reducing the required combined release.

3. Releases shall at all times be restricted insofar as possible to quantities (sometimes zero) which will not cause flows in Truckee River below Reno to exceed 6000 cfs.

Normal Remaining Runoff
Truckee River at Farad

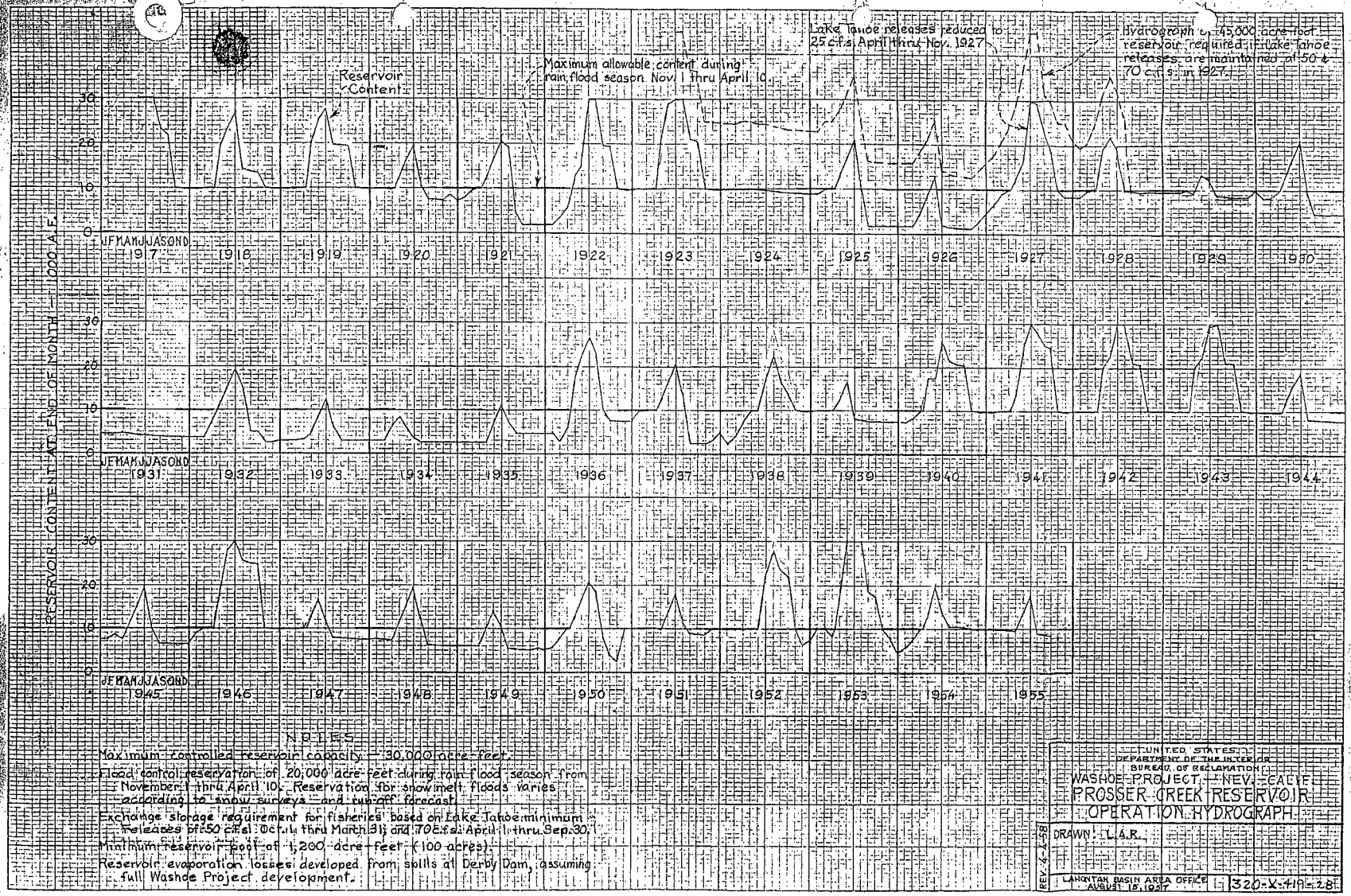
1 Apr to 31 Jul . . .	281,000ac-ft
1 May to 31 Jul . . .	194,000ac-ft
1 Jun to 31 Jul . . .	88,000ac-ft
1 Jul to 31 Jul . . .	21,000ac-ft

Truckee River Basin, California-Nevada

FLOOD-CONTROL STORAGE
RESERVATION DIAGRAM

PROSSER RESERVOIR

Corps of Engineers Sacramento, Calif.
Prepared: H.A.K. Rev. 20 Feb. 1958
Copied by USBR - Carson City, Nevada



NOTES

Maximum controlled reservoir capacity - 30,000 acre-feet.

Flood control reservation of 20,000 acre-feet during rain flood season from November 1 thru April 10. Reservation for snowmelt floods varies according to snow surveys and runoff forecast.

Exchange storage requirement for fisheries based on Lake Tahoe minimum releases of 50 c.f.s. Oct. 1 thru March 31, and 70 c.f.s. April 1 thru Sep. 30.

Minimum reservoir pool of 1,200 acre-feet (100 acres).

Reservoir evaporation losses developed from spills at Derby Dam, assuming full Washoe Project development.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

WASHOE PROJECT — NEV. - CALIF.

PROSSER CREEK RESERVOIR

OPERATION HYDROGRAPH

DRAWN: L.A.R.

LAHONTAN BASIN AREA OFFICE
AUGUST 18, 1937

320-X-419-28

REV. 4-1-38

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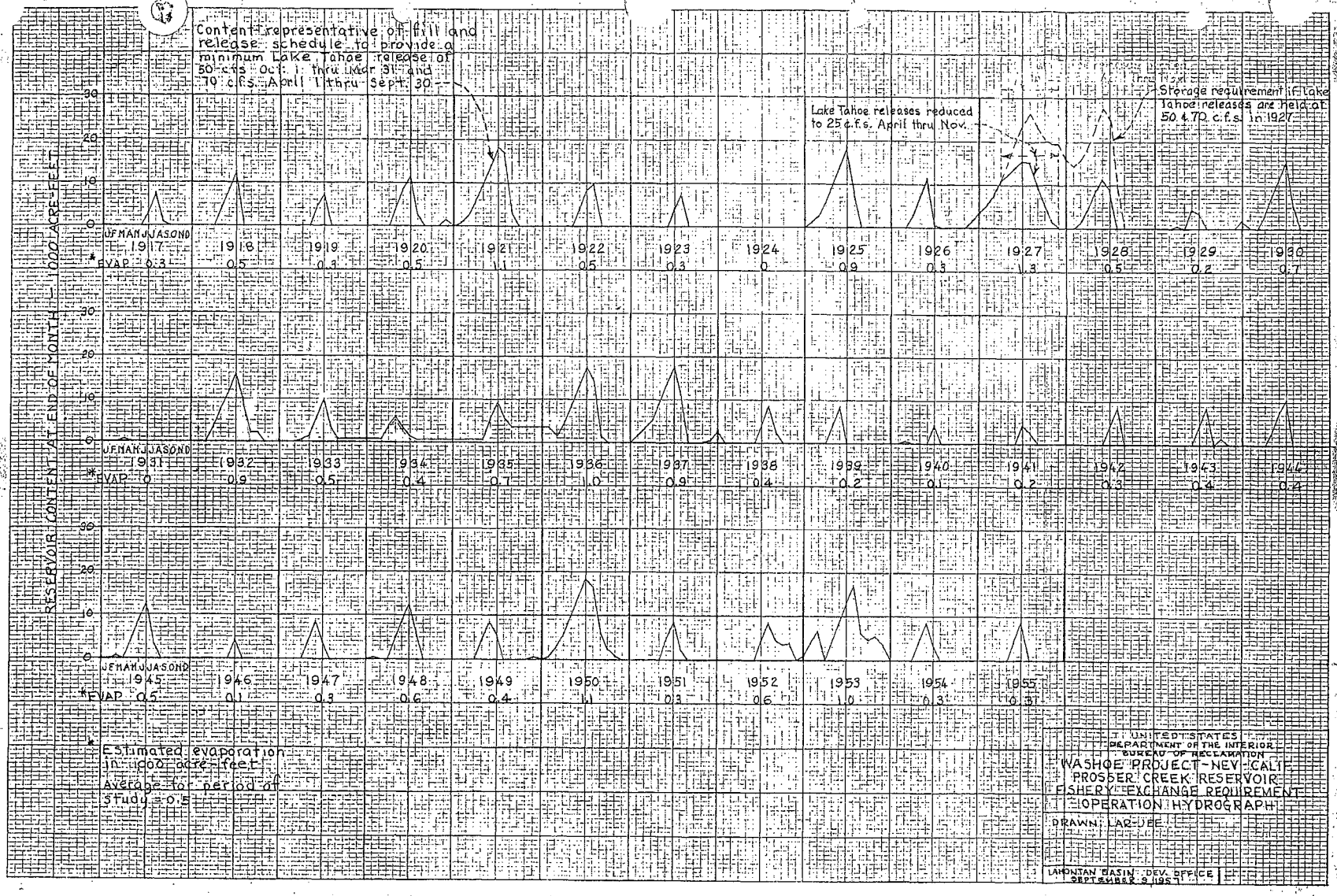


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Releases less than 50 or 70 c.f.s.
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
WASHOE PROJECT NEV. CALIF.
LAKE TAHOE RELEASES WITH
PROSSER CREEK RESERVOIR
DRAWN JEE
LAHONTAN BASIN DEV. OFFICE
SEPTEMBER 9, 1957