INVESTIGATION OF PROBABLE POWER VARIATION
AT
BLACK CANYON RESERVOIR

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BOULDER DAM
IN ITS TRUE MEANING.

There are those, to be sure, to whom Boulder Dam will mean nothing more than a dam higher than any other dam in the world, a great many millions of tons of water, and a great many millions of bags of cement - a construction feat for which our engineers are to be commended. But there are others to whom Boulder Dam means an intangible something which cannot be measured in cubic feet - something which caused citizens in every town along the banks of the majestic Colorado River to ring bells, fire cannons, and meet in public halls to testify to their joy and relief when news came to them that President Calvin Coolidge had signed the Swing-Johnson bill, committing the Government to provision of $165,000,000 for the conservation and use of the waters of the lower Colorado.

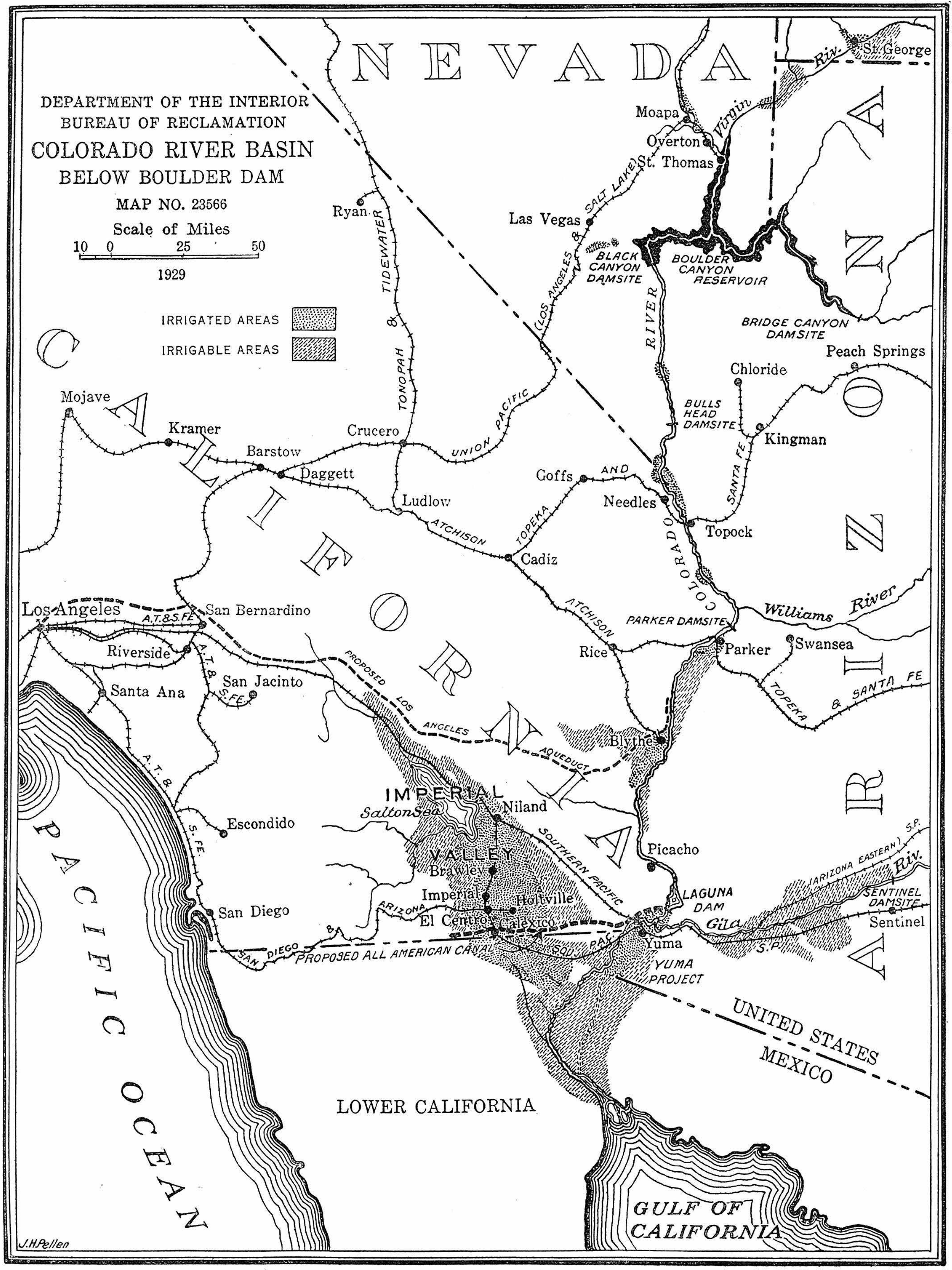
For to these people Boulder Dam means the protection of their homes and families, the crops that are their livelihood; to them it means relief in the dreaded periods of drought, protection in time of flood. It means the development of the entire Southwest, the building of a vast region, the reclamation of desert areas; it means the springing up of cities, the hum of commerce and trade.

Lucy Salamanca

(In Washington Post, January 12, 1930).

TABLE OF CONTENTS

C.



DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER BASIN
BELOW BOULDER DAM
MAP NO. 23566
Scale of Miles
10 0 25 50
1929
IRRIGATED AREAS
IRRIGABLE AREAS
NEVADA
CALIFORNIA
ARIZONA
St. George
Riv.
Virgin
Moapa
Overton
St. Thomas
Las Vegas
Ryan
TONOPAH & TIDEWATER
LOS ANGELES & SALT LAKE
BLACK CANYON DAMSITE
BOULDER CANYON RESERVOIR
BRIDGE CANYON DAMSITE
Peach Springs
Chloride
BULLS HEAD DAMSITE
Kingman
SANTA FE
RIVER
COLORADO
Mojave
Kramer
Barstow
Daggett
Crucero
UNION PACIFIC
Ludlow
Goffs
AND
Needles
Topock
ATCHISON
TOPEKA
Cadiz
Williams River
PARKER DAMSITE
Parker
Swansea
Los Angeles
A.T.&S.FE
San Bernardino
Riverside
A.T.&S.FE.
San Jacinto
Santa Ana
Rice
TOPEKA & SANTA FE
PROPOSED LOS ANGELES AQUEDUCT
Blythe
A.T.&S.FE.
IMPERIAL
Salton Sea
Niland
Escondido
VALLEY
Brawley
SOUTHERN PACIFIC
Picacho
LAGUNA DAM
(ARIZONA EASTERN) S.P.
Riv.
SENTINEL DAMSITE
Sentinel
Gila
Imperial
Holtville
El Centro
Calexico
San Diego
ARIZONA
SAN DIEGO &
PROPOSED ALL AMERICAN CANAL
Yuma
S.P.
YUMA PROJECT
UNITED STATES
MEXICO
PACIFIC OCEAN
LOWER CALIFORNIA
GULF OF CALIFORNIA
J.H.Pellen

FOREWORD

This study has been made with the object in mind of tabulating and charting the power possibilities that would exist at Boulder Dam consistent with flood control, irrigation, and domestic use. The writer realizes that the Bureau of Reclamation engineers, and others, have made exhaustive studies of this project for many years, and has based his study principally upon the results of their work. For his own benefit, however, and possibly that of others, who may be so interested, the writer has attempted to compile these results under one cover; with a complete outline of how such a power study would be made.

Altho Bureau of Reclamation data has been used predominently thru out, the final results seem to be at varience with theirs; probably because other assumptions were made as to evaporation, river losses, water duty, etc. This was done in several cases where there was wide variation between different reports. Others were chosen in an attempt to show the worst possible condition or else an average of several reports may have been taken.

The writer wishes to express his sincere thanks to the following men for kind personal aid rendered during the study: Dr. Elwood Mead, Mr. R.F.Walter, and Mr. R.M.Priest, all of the Bureau of Reclamation; Professor Franklin Thomas, head of the Civil Engineering Department at C.I.T.; Mr.M.J. Dowd, Chief Engineer of the Imperial Irrigation District.

Financial status being rather low at this time of the year, the writer has had to type his own work, and trusts that errors in spelling and English will be overlooked.

Thomas H.Evans
Pasadena, June 8, 1930.

PART I

RECONSTRUCTION OF THE COLORADO RIVER.

A power study consists essentially of knowing the amount of river discharge at a cefain point along its course. In order to arrive at this, however, the investigator must have at hand a mass of data concerning past stream flows, river losses, flood control features, and withdramals for irrigation, if such exist. Accuracy of results, of course, depends upon accurady and length of time for which hydrographic data has been obtained.

It was not until 1902 that the Bureau of Reclamation, formerly the Reclamation Service, established a gaging station on the Colorad River at Yuma. Therefore, it is apparent that studies made on this river are of doubtful accuracy, since a twenty-eight year hydrographic record is relatively short. Previousto 1902, when the Yuma records start, there may have occúrred a relatively dry period of years which would be of value in the record.

Some authorities claim that rainfall, and consequently river flow, occurs in cycles of wet and dry seasons of, roughly, eleven years duration. Others disagree with this, claiming the existence of cycles of twenty or more years. Both of these theories seem to hold for different areas, and since the watershed which the Colorado River drains is of such magnitude it is problematical of what length the wet an dry cycles might be.

Be that as it may, it is certain that the official Yuma records do not contain an important period occurring previous to 1902. Some more or less reliable estimates of these run-offs have been made in order to include part of it in the investigations. We are exceedingly fortunate if the thirty-one year record we now have is a true representation of future periods of such length, for it is upon this that all succeeding computations are based.

Two different periods have been chosen for investigation, the conditions in each of which will doubtless affect differences in reservoir regulation. The first, hereafter called Case I, assumes that the Boulder Dam was completed at the beginning of the period of record and operating under conditions of 1930; while the second, Case II, considers a period in the far distant future when full development will have occurred in both the Upper and Lower Basins. Case II also assumes additional evaporation losses due to the completion of more upstream reservoirs.

In the next few pages the outline of investigations under conditions as existing in 1930 will be made. This is done using as basic data the twenty-eight year period of river flow at Yuma.

What is desired is the flow at Black Canyon if the irrigation development and transmountain diversions in the Upper Basin had always been the same as in December, 1929. It should be here noted that "Upper Basin" is used in a different sense from that of the Seven-State Compact, which includes the watersheds only to Lee's Ferry. For the purposes of this study it will include all watersheds up to Black

Canyon, since all development above this point must be treated as a unit. Wherever Boulder Dam or reservoir is used in this paper it should be taken to mean that at Black Canyon, since this is to be the actual location of the project.

In order to find the present and future irrigable acreage in the Upper Basin several reports were used and a comparison made, as shown in Exhibit I. It should be noted that LaRue and Weymouth agree precisely as to future acreage, altho they disagree slightly on that in 1922.

Upper Basin Irrigable Acreage.

Acres in thousands.

Report	Present	Future	
		Total	Difference
LaRue, 1922 W.S.#552	1,500	4,240	2,740
"Development of Imperial Valley", 1920	1,470	3,930	2,460
Weymouth, Vol.II, 1922	1,450	4,190	2,740
U.S.G.S., 1922	1,360	3,600	2,240
Averages	1,470	4,120	2,650

EXHIBIT I

All of the values given seem to check within reasonable limits. Those of the U.S.G.S. are for only three of the tributary basins and check if the acreages for the smaller basins are included.

For the final analysis the figures from W.S.#556 were used, as were those for the rates of acreage increase since the beginning of the period.[1]

[1] W.S.#556, P.109

In order to bring everything up to date(1930) an increase in acreage from 1922 the same as that for the previous eight years was assumed. This gave a figure of 1,780.000 acres of land irrigated at present in the Upper Basin.

Another source of withdrawal upstream are the transmountain diversions into the Salt Lake and Mississippi regions. These increased from 1,000 acre-feet annually in 1906 to 115,000 in 1922.[1] Assuming a similar increase to 1930 gives 160,000 acre-feetbso diverted.

Now we must interpolate between the values given in W.S.#556 in order to obtain the probable acreage irrigated during each year of the period. Since monthly data is wanted the area will be assumed as constant thru out any one year. These data are found in Table III in the Appendix.

In order to arrive at figures for the total diversion for each month of the period a fair water duty must be obtained. The duty in the Upper Basin has been variously estimated from 1.25 to 1.54 feetbper acre per year, and averages about 1.40. In order to make a conservative estimate a value of 1.55 will be used. This is close to that used by Mr.E.C. LaRue,[2] and his values for monthly duty are used with a change in the figure for March. He assumes a return flow of .05 acre-feet vs. 0.00 used by the writer. Exhibit II gives the duty by months. The negative quantities are return flows

1. W.S.#556

2. Ibid.

from areas in the wetter months of the year. The algebraic total for the year is 1.55 acre-feet, however.

Monthly Diversion in Acre-Feet per Acre.

	Diversion	Return	Net
January	0	0.05	-0.05
February	0	0.05	-0.05
March	0	0	0 (change)
April	0.2	0.05	0.15
May	0.4	0.1	0.3
June	0.7	0.2	0.5
July	0.8	0.3	0.5
August	0.6	0.3	0.3
September	0.3	0.2	0.1
October	0	0.1	-0.1
November	0	0.05	-0.05
December	0	0.05	-0.05
	3.0	1.45	1.55

EXHIBIT II

Now all that is necessary is to multiply the acreage by the monthly water duty and the total monthly diversion, or return for irrigation is obtained. To this must be added any transmountain diversion for the month. In order to obtain this monthly data tha yearly totals were divided in the same ratio as thatestimated for future transmountain diversion.[1] This division is shown in Exhibit III. The original table was for 1922, however, and corrections have been made to make it applicable to the future period following 1930.

Estimated Future Depletions in Upper Basin.

Acre-feet in thousands.

	Irrigation	Diversions out of basin	Total
January	20		20
February	30		30
March	50		50
April	315		315
May	1,030	22	1,050
June	1,465	148	1,605
July	585	75	660
August	165	32	195
September	40	19	55
October	# 36	16	# 20
November	# 47	7	# 40
December	# 10		# 10
	3,610	317	3,910

EXHIBIT III

1"Development of Imperial Valley,"

The total diversions, or returns, are given in Col. 3, Table III. The difference between these and that used in 1929 gives the corrections to be subtracted (or added) to the old stream-flow record for that particular month. These corrections are shown in Col. 4, Table III, and are of constantly decreasing value since 1899.

If these corrections are now applied to the hydrographic records of the river, as obtained from the Bureau of Reclamation, it will have been corrected at Yuma for all upstream diversions in Case I. Since other corrections must also be applied to the records those just determined will be used later as shown in Table IV, Appendix.

In order to obtain a reconstructed river at Black Canyon flowing under present conditions several other corrections are necessary between Yuma and Black Canyon. Since the Yuma records contain the flow of the Gila River, these must be subtracted. Diversions are also made at the Laguna Dam, ten miles above Yuma, for use on the Yuma irrigation project of the Bureau of Reclamation, in Arizona and California. These are of considerable magnitude and must be added to the hydrographic record Another addition must be made for the losses on the river between the Laguna Dam and Black Canyon which occur due to evaporation and irrigation diversions for the Parker and Blythe projects.

The first item, flow of the Gila, has been accurately tabulated since 1903 by the Bureau and is shown in Table II, Appendix. The diversions at Laguna have been obtained from the Bureau's Yuma office for the entire period for which the project has been in operation. Altho this was given in yearly amounts the monthly totals have been assumed as proportional to those of 1929, shown in Exhibit IV.

	Laguna Diversions for 1929 in Percent of the Total.		
January	7.2	July	9.2
February	6.8	August	8.9
March	8.6	September	7.4
April	8.6	October	8.7
May	8.9	November	8.3
June	8.8	December	8.6
			100.0

EXHIBIT IV

The river losses between Black Canyon and Laguna is an item subject to almost pure assumption. The evaporation losses are caused by periodic overflowing of the river banks below the canyon section exposing huge surfaces to the sun's rays. This varies greatly, of course, with the magnitude of the flood crest passing at the time. The part of the loss due to beneficial consumptive uses can be fairly accurately determined. This item of loss between Black Canyon and Laguna will be the same for both Case I and II, since all ultimate irrigation uses will draw from waters now wasting by evaporation on the flooded lands. The Bureau has estimated 865,000 acre-feet as the total annual loss[1] and uses a figure of 900,000 acre-feet.[2] The writer has chosen the latter as best adaptable to this study. Mr.M.J.Dowd, Chief engineer of the Imperial Irrigation District, estimates a loss, including reservoir evaporation, of 1,240,000 acre-feet yearly between Laguna and Lee's Ferry. By subtracting from this the item of reservoir evaporation, one arrives at a figure which checks closely that of the above, if allowance is made for the much greater river length taken by Mr. Dowd.

1. Senate Doc. #186, P.82 2. Ibid., Tables 8,13,14

In order to, obtain the monthly losses an assumption has been made that they are in approximately the same ratio as the average monthly river flows, shown in Table I, Appendix. Irrigation losses do not necessarily occur synchronously, but probably do in this case, since Yuma and Imperial diversions are heaviest during the time of greatest average stream flow.

Table I shows that the average river flow for the six months period from March thru August is 75% of the average yearly total. The average June flow is also seen to be 33% of this, or 25% of the yearly total. The final calculations as to the amount of loss attributable to each month is shown in Col.3, Table IV, Appendix.

Table IV also gives a record of all river losses under ca Case I, and by subtracting (or adding) these to the corrected Yuma records from Table III, we obtain the reconstructed river at Black Canyon, Col.6.

Since the U.S.R.S. records only extend to 1902 those of Mr. LaRue in W.S.#556 were used for the period 1899-1903. These were for flow at Hardyville which is only 150 miles below the canyon and hence need correction only for upstream diversions.

By now plotting the successive accumulations of the reconstructed river flow at Black Canyon one obtains the cumulative mass curve shown in Plate I. This gives graphically the total mass in acre-feet which has passed thru Black Canyon since the beginning of the record. The data from which this was plotted is in Col.7, Table IV. From this mass curve the reservoir regulation can be determined graphically for present conditions, as will be explained later.

In order to determine what equated flow and power may be expected in the distant future another curve must be plotted with corrections for further Upper Basin diversions and losses.

The average of all reports in Exhibit I shows an ultimate increase in irrigated area in the Upper Basin as 2,650,000 acres. This figure, and a water duty of 1.5 feet per acre, gives 3,925,000 acre-feet additional diversion per year. The additional transmountain diversion is estimated at 360,000 acre-feet per year. The reports used, however, were for 1922, and so far all calculations used have been based on 1930 corrections, with the increase assumed as 250,000 acres between 1922 and 1930. Thus the additional diversion is (3,925,000 #360,000- 375,000) or 3,910,000 acre-feet per year. This is split into monthly diversions as shown in Exhibit III. The reason that less return flow will be realized in the future is that the majority of the new lands to be developed are at much greater distance from the stream and any return is improbable.

With ultimate future diversions established the cumulative masses have been calculated and entered into Col.2, Table V. By subtracting these from the present mass at Black Canyon we obtain the net future mass that will probably exist at Black Canyon, Col.4, Table V. This has also been plotted on Plate I and is shown as a broken line of much less slope than that for present conditions.

USE OF MASS DIAGRAM TO DETERMINE RIVER REGULATION.

This is based upon the fact that the slope of any line in the mass curve gives the flow in second feet, if divided by the proper constant converting acre-feet to second feet. Slope equals $\frac{\text{total ordinate}}{\text{total abscissae}} = \frac{\text{acre-feet}}{\text{months}}$. If we now divide by 60 the number of second-feet continuous flow over the period is obtained. Thus with the mass diagram plotted, and by properly adjusting to it a sloping straight line, a regulated flow is obtained which should satisfy all conditions necessary to the operation of the reservoir for flood control, irrigation, and power.

If during a low period of actual river flow it is desired to utilize the impounded waters to supplement this, the resulting flow is obtained graphically by adding to the end of the period of slack flow, Feb.,1905 or Mar.,1906 on Pl. I, an ordinate equal in acre-feet to the portion of the reservoir capacity available for this purpose. If a straight line is now drawn from the end of this ordinate tangent to the curve at the beginning of the low period the slope will equal the equated flow resulting from such regulation.

At the point where the ordinate was constructed, of course, it was assumed that that much of the total capacity has been drawn off. The ordinate was erected at the end of the period, however, and from then on the rate of river flow becomes greater than the slope of the straight line; thus more is entering the reservoir than leaving. At the point where the continuation of the straight line cuts the river flow-curve the reservoir has been again filled to the maximum level.

Before actually attempting to plot the equated flow line it is necessary first to determine the amount of water in the reservoir at the beginning of the period; the amount necessary to be kept absolutely dry for flood control; and the minimum head allowable for the best power development.

Bureau of Reclamation estimates give eight years for the total construction period on the dam and appurtenant structures. Five years of this will be consumed in the erection of appurtenances and only three in the actual construction of the main mass of the dam. Thus water can stored during erection but for the last three years only. In order to use the worst possible conditions a three year dry period was assumed to exist just previous to the completion of the dam in 1899, altho this was not actually the case. The three year period was assumed the same as the worst of record, 1902-1904, during which a total of only 26,450,000 acre-feet flowed. Under present conditions there are only 710,000 acres under cultivation in the Lower Basin, including Mexico, with an average water duty of 3.5 feet per acre, or 7,455,000 acre-feet for the three years. This would leave approximately 19,000,000 acre-feet in storage at the end of the construction period if evaporation were neglected.

In a recent communication from Mr.R.F.Walter, Chief engineer of the Bureau of Reclamation, he states that with the new heigth of dam now being designed, the upper 9,500,000 acre-feet is to be utilized for flood control. Since floods take almost a month to reach Black Canyon from upriver a certain percentage of this space can be use for power until a flood notice is received, at which time the remainder of the flood volume can be emptied if necessary. The maximum flow which can be maintained and not disrupt the levee system is 75,000 second-feet. It has been determined from the mass diagram that the maximum equated flow is 24,000 second-feet for present conditions. Therefore, only 51.000 can be spilled from the flood control space. Allowing 40 days for this gives a maximum of (40 x 2 x 51,000) or 4,080,000 acre-feet cleared. Thus if 5,000,000 acre-feet are always clear this should be sufficient, since it takes about one moth for the flood crest to reach the canyon and perhaps several weeks more for the rest of the high water to follow. Thus, 25,000,000 acre-feet is the maximum useful volume for conservation, since the new dam is designed to impound 30,000,000 acre-feet.

The total raise in water surface is now to be 575 feet instead of 550 feet according to previous designs. For the best power development authorities state that a head lower than from 3/4 to 2/3 of the maximum should not be used. The maximum head here will of course be at the level of the 25,000,000 acre-foot volume, or 537 feet. The minimum head will be taken as .65 of the maximum or 349 feet (at the 8,000,000 acre-foot level). During the latter part of both the present and future periods it was found that a greater flow could be realized, and for these portions of the diagram a minimum head of 430 feet was used, or .80 of the maximum. This corresponds to a volume of 13,800,000 acre-feet.

What is equivalent to plotting an ordinate equal to the useful reservoir volume at the end of the low-flow period is to make the straight line pass under this point by an ordinate equal to the minimum allowable volume (8,000,000). This is possible since the difference in ordinates between the two curves shows the capacity in the reservoir at any one time.

The curves of regulated flow are shown to, start at -19,000,000 acre-feet at the beginning of the period, since the reservoir contains that volume at that time. This straight line must then be ajusted so as to miss the lowest portion of the river-flow diagram by 8,000,000 acre-feet during the period 1899-1907, and by 13,800,000 for the remainder of the record. The same is true for Case II, or the flow under ultimate future conditions.

By plotting a parallel straight line which is separated from the other by an ordinate osf 25,000,000 acre-feet, points can be determined showing when the reservoir is full or spilling. Wherever the mass curve of river-flow crosses the upper one for equated flow a point of spill has been reached. These are shown as white areas on Plate I.

The general trend of the curves for the period 1899-1907 is low and the equated flows found for Cases I and II are 18,250 and 13,480 second-feet, respectively. For the remainder of the record a much higher flow is found possible, namely 24,000 18,500 second-feet, respectively. Both of these flows are greater than would actually exist,, provided the calculations were correct, since several corrections are necessary for evaporation, etc., as discussed later. Whether such a change in the flow is justified will be discussed in Part II.

CORRECTIONS.

To both regulated flows must be subtracted a correction for the period beginning in 1908. The correct diversions at Laguna Dam since its first use in 1908 were received from the Yuma office of the Bureau after after all tables had been completed, and at a time such as to make impossible the changing of all calculations. For the purpose of the study Laguna diversions were estimated by taking the correct 1929 figure and the corresponding area under cultivation, and assuming that previous diversions were in the same ratios of water to land as existed in1929. This could be done since the correct acreage figures were obtained from the report of the Secretary of the Interior for each year since 1908. The 1929, diversions, however, were about 5 times as much as needed for the area, since much was wasted and used for power along the canal system. This was a source of error which threw previous totals off considerably. Since receiving the correct from Mr. Priest, Superintendent at Yuma, it was found that 7,700,000 acre-feet too much had been added to the flow over the period 1908-1930. Thus an average correction of $\frac{7,700,000}{22 \times 720}$, or 490 is necessary to all flow records subsequent to 1908.

For all of Case I a correction must be made to the flow due to evaporation at Black Canyon. The average area exposed here will be 95,000 acres and an assumptiom of 3.5 feet per acre per year has been used for evaporation in this area. The average correction in second-feet to be (~~added~~) subtracted is $\frac{95,000 \times 3.5}{720}$, or 460.

For Case II, under full development, it is assumed that all of the major reservoirs for complete river control have been finished, exposing an average surface area of 200,000 acres, or annually losing on the average $\frac{200,000 \times 3.5}{720}$, or 970 second-feet continuous flow by evaporation.

Another source of loss as far as power is concerned may be the withdrawal by the Metropolitan Water District of Southern California of its allowance of 1,500 second-feet. At present four routes are under consideration by this group, three of which have headings below the dam. If either of these three are chosen the water will then of course be available for power. Since this item is still undecided at the time set for completion of this study, it will be assumed that withdrawals are to be below the dam and no correction is necessary as far as power calculations are concerned. If diversion should take place above the dam an average aontinuous power loss of approximately 60,500 horse power would take place.

LOWER BASIN IRRIGATION INVESTIGATIONS.

The purpose for which the Black Canyon Dam is to be constructed is primarily flood control, then irrigation , and last for power development. If at any time a further drawdown is necessary for irrigation than that desired for the best power development, the former will govern as stated in the Boulder Canyon Act. In order to obtain as much revenue from power as possible, however, the regulation will probably always be such as to give maximum output, if possible.

In CASE I the minimum regulated flow obtained is more than necessary to satisfy the maximum irrigation demand below the dam. The maximum diversions are during June and JUly and are slightly less than 14% of the yearly total for each month. For Case I this amounts to 6,650 second-feet just for irrigation. If the Metropolitan Water District allotment is added to this it will total a little less than half the possible equated flow.

Under ultimate future conditions, if sufficient water is obtainable, the maximum monthly diversion will be 14% of the yearly total for June and July, and 12% for May and August. Mr. M.J.Dowd has given a figure of 3.3 feet as the probable water duty when the river is regulated and sluicing, now necessary below, can be done away with. A duty of 3.5 Feet will be used here for safety on the assumption that some waste will be necessary.

The ultimate acreage in the Lower Basin, including Mexico, has been rather closely agreed upon by previously quoted authorities as 2,170,000 acres. In a recent communication from Mr.Dowd he states that surveys subsequent to the Bureau's last report show 315,000 additional acres irrigable in the Pilot Knob, West Side Mesa, and Coachella areas, bringing the grand total to 2,485,000 acres. The diversion required for this, at an average water duty of 3.5, feet would be 8,700,000 are-feet annually just for irrigation; or 200,000 acrepfeet more than has been allotted to the entire Lower Basin. O

On the assumption, for the present, that 8,000,000 acre-feet of this amount might be obtained from the reservoir, the maximum required flow in June and July would be $\frac{8,000,000 \times .14}{60}$ or 18,700 second-feet plus the 1,500 to the District. The maximum flow obtained in Case II thru the dry period was 12,510 second-feet after correcting. This flow would of course be insufficient, but the Bureau contemplates building a reregulating reservoir at either Bull's Head or Mojave after finishing the Black Canyon Dam. If this is done the 12,510 second-feet is just sufficient to supply a yearly total of 9,000,000 acre-feet to the Lower Basin, or 8,000,000 for irrigation and 1,000,000 for the District. The assumption of a reregulating dam downstream is used in this study and the 12,510 second-foot flow utilized for power.

POWER COMPUTATIONS.

It seems that under both present and future conditions the flows determined from the mass curves are sufficient to take care of the allowable irrigation demand below the dam.

The average head obtainable each month is directly related to the volume which is the difference between the ordinates of the demand curve and the stream-flow curve. This could be picked right off the graph, but would not be as accurate, since the scale is necessarily small, as making actual subtractions of the two values. This latter was done for each month, altho it is not shown in the tables. By knowing the volume in the reservoir at any time one can obtain the head by reading the chart on Plate III, the capacity-head curve for Black Canyon. These heads are listed in Col.1, Table VI.

The so-called "primary power" listed in this table was based upon the constant flow obtained and an efficiency of 80% thru the conduits and turbines. This reduces to a formula: $H.P. = \frac{Q\ H}{11}$.

The so-called "spilled power" is that which may be obtain- from the water which must be dumped above the 537 foot level for flood control. The volume ordinates shown each month between the upper demand line and the mass diagram of river flow do not truly represent that spilled for that month. The quantity spilled one month takes that much away from the value shown for the succeeding month, since it has already been passed down the river. Therefore, the length of the white areas on Plate I. do not represent the number of months in which spill takes place, since all of it has really passed out of the reservoir at the maximum ordinate of these areas.

Spilled power is calculated by assuming that the quantity is dumped continuously over that month. Spilled H.P. equals .833 volume in acre-feet.

The actual definition of primary, or firm, H.P. is the maximum which can be guarenteed over any period. and is of course a constant. Spilled, or secondary, is actually any above the primary and, consequently, is usually sold at a cheaper figure to customers who can use steam standby at times when this power is not obtainable. Therefore, the headings used in the tables are misnomers according to these definitions. For purposes of this study primary is that which potentially exists at the reservoir during any month which is not derived from spilled water.

The actual primary h.p. that can be guarenteed according to the data obtained is shown by heavy black lines on the chart, Plate II, and has different values for different periods both in Case I and II. The Bureau assumes a load factor of 55% and a maximum installed capacity of 1,000,000 h.p., making 550,000 firm h.p. desirable. From the charts, Plate II, it is seen that the minimum primary power obtainable is 420,000 h,p. during a future dry period similar to that of 1902-1905. This is the absolute minimum of course, and by increasing the flow or using some steam standby a much higher value for firm h.p. can be obtained. The absolute minimum for the same period under present conditions is 550,000 h.p. and this is only for a very short period. For the remainder of the record much higher values are of course obtainable if necessary altho the maximum plant output will only be 1,000,000 h.p. A value as high as 2,915,000 h.p. from spilled water was obtained for one month.

In the case where the full 550,000 h.p. cannot be developed the flow could be stepped up so as to utilize the reregulator to the maximum, then when the reservoir began to fill more rapidly again and more power potentially existed than was needed, the flow could be cut in order to save as m much water as possible for a future dry period.

PART II

CONCLUSIONS.

The subject of river reconstruction is one with which much fault may be found. Many assumptions must of course be made as in a variety of engineering problems, but by playing well enough on the safe side the final outcome should be o one upon which a fair degree of reliance may be placed.It is a case of, especially with the Colorado, doing the best and doing it now.

The use of only a thirty year stream flow record of course widens the possibility for error in making calculations for future useage.and output, since this is a relatively short period in which long, previous dry spells may not have repeated themselves. Altho the three dry years 1902-1904 give a fair indication of what may be expected at some later date, such a period may be only half as long.

Altho the mass curve may show that the reservoir can be operated at a certain constant flow until a minimum volume is reached at which time the inflow will increase, a future dry spell might be long enough to practically dry the reservoir. Of course for a proper regulation the flow would be continually cut down as the dangerous level was reached, and the the possibility of greater flow from upstream looked scarce. If it becomes necessary to almost dry the reservoir in order to supply the irrigation demand below, the power would suffer considerably, and the industries being supplied from Black Canyon accordingly. Altho the average over a future 31 year period may be the same as for the one studied, the relative length of wet and dry spells may be entirely different.

Assume, for instance, that a far-future dry period of six years duration ocurred with the same yearly average as in 1902-1904. This would give an approximate total flow into the reservoir of 54,000,000 acre-feet under present Upper Basin conditions. Under future conditions they will probably divert 3,910,000 more per year, or a total of 23,400,000 during the 6 year period. This may be possible since the Boulder Canyon Act only requires 75,000,000 to be sent down in a 10 year period. Thus there would be left for the Lower Basin, assuming an originally full reservoir, 56,600,000 acre-feet for the 6 years. Allowing only 6 800,000, or 4,200,000 to the Water District, leaves 51,800,000 for irrigation, or enough for 2,460,000 acres at a duty of 3.5 feet. This is approximately the estimated total for the future. Thus it can be seen that an extremely long dry period would be necessary before great harm can be done in the Lower Basin. Before this takes place the Upper Basin would also have to begin-sacrificing in order to help. Even with no flow from upstream the reservoir capacity would supply the Metropolitan Water District and the total acreage below thw dam for a period of 2 years and 9 months.

Thus it is apparent that altho the present record may be quite different from future flow records for the same period of years, it gives a fairly safe indication of what may be expected.

The possibility of regulating to different flows in wet and dry cycles seems justified, altho it is impossible to tell in advance when the entry is made into a particular cycle. It was of course possible for past flows but future s are more or less unpredictable, altho a fair indication may be had from a residual mass cirve of past records. If then after an accurate attempt at predicting it is thot a ~~dry~~ wet period is comung on, and the reservoir is constantly spilling, the previous equated flow can be stepped up. If it becomes apparent that the year is only a wet one in the dry cycle the flow out can be cut down again before the dangerous level has been reached.

BLACK CANYON DAM SITE, WHERE THE BOULDER DAM WILL BE CONSTRUCTED

THE BILL PROVIDING FOR THE DEVELOPMENT OF THE COLORADO RIVER BASIN PASSED THE SENATE ON DECEMBER 14, THE HOUSE OF REPRESENTATIVES ON DECEMBER 18, AND WAS APPROVED BY PRESIDENT COOLIDGE ON DECEMBER 21, 1928

ADMINISTRATIVE ORGANIZATION FOR THE BUREAU OF RECLAMATION

HON. ROY O. WEST, SECRETARY OF THE INTERIOR

E. C. Finney, First Assistant Secretary; **John H. Edwards**, Assistant Secretary; **E. O. Patterson**, Solicitor of the Interior Department; **E. K. Burlew**, Administrative Assistant to the Secretary

Washington, D. C.

Elwood Mead, Commissioner, Bureau of Reclamation

Miss M. A. Schnurr, Secretary to the Commissioner — P. W. Dent, Assistant Commissioner — George C. Kreutzer, Director of Reclamation Economics

W. F. Kubach, Chief Accountant — C. A. Bissell, Chief of Engineering Division — Hugh A. Brown, Assistant Director of Reclamation Economics

C. N. McCulloch, Chief Clerk

Denver, Colorado, Wilda Building

R. F. Walter, Chief Engineer; S. O. Harper, General Superintendent of Construction; J. L. Savage, Chief Designing Engineer; E. B. Debler, Hydrographic Engineer; L. N. McClellan, Electrical Engineer; C. M. Day, Mechanical Engineer; Armand Offutt, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent C. A. Lyman, Fiscal Inspector.

Project	Office	Superintendent	Chief clerk	Fiscal agent	District counsel	
					Name	Office
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	J. P. Siebeneicher	J. P. Siebeneicher	Wm. J. Burke	Mitchell, Nebr.
Boise [1]	Boise, Idaho	R. J. Newell	W. L. Vernon		B. E. Stoutemyer	Portland, Oreg
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	W. C. Berger	W. C. Berger	H. J. S. Devries	El Paso, Tex.
Grand Valley	Grand Junction, Colo.	J. C. Page	W. J. Chiesman	W. J. Chiesman	J. R. Alexander	Montrose, Colo.
Huntley [2]	Ballantine, Mont.	E. E. Lewis				
King Hill [3]	King Hill, Idaho	F. L. Kinkaid				
Klamath	Klamath Falls, Oreg.	H. D. Newell	N. G. Wheeler	Joseph C. Avery	R. J. Coffey	Berkeley, Calif.
Lower Yellowstone	Savage, Mont.	H. A. Parker	E. R. Scheppelmann	E. R. Scheppelmann	E. E. Roddis	Billings, Mont.
Milk River	Malta, Mont.	H. H. Johnson	E. E. Chabot	E. E. Chabot	do	Do.
Minidoka [4]	Burley, Idaho	E. B. Darlington	G. C. Patterson	Miss A. J. Larson	B. E. Stoutemyer	Portland, Oreg.
Newlands [5]	Fallon, Nev.	A. W. Walker		Miss E.M.Simmonds	R. J. Coffey	Berkeley, Calif.
North Platte [6]	Mitchell, Nebr.	H. C. Stetson	Virgil E. Hubbell	Virgil E. Hubbell	Wm. J. Burke	Mitchell, Nebr.
Okanogan	Okanogan, Wash.	Calvin Casteel		N. D. Thorp	B. E. Stoutemyer	Portland, Oreg.
Orland	Orland, Calif.	R. C. E. Weber	C. H. Lillingston	C. H. Lillingston	R. J. Coffey	Berkeley, Calif.
Owyhee	Nyssa, Oreg.	F. A. Banks	H. N. Bickel	Frank P. Greene	B. E. Stoutemyer	Portland, Oreg.
Rio Grande	El Paso, Tex.	L. R. Fiock		L. S. Kennicott	H. J. S. Devries	El Paso, Tex.
Riverton	Riverton, Wyo.	H. D. Comstock	R. B. Smith	R. B. Smith	Wm. J. Burke	Mitchell, Nebr.
Salt River [7]	Phoenix, Ariz.	C. C. Cragin				
Shoshone [8]	Powell, Wyo.	L. H. Mitchell	W. F Sha		E. E. Roddis	Billings, Mont.
Strawberry Valley [9]	Payson, Utah	Lee R. Taylor				
Sun River [10]	Fairfield, Mont.	G. O. Sanford	H. W. Johnson	H. W. Johnson	E. E. Roddis	Do.
Umatilla [11]	Irrigon, Oreg.	A. C. Houghton				
	Hermiston, Oreg.	Enos D. Martin				
Uncompahgre	Montrose, Colo.	L. J. Foster	G. H. Bolt	F. D. Helm	J. R. Alexander	Montrose, Colo.
Vale	Vale, Oreg.	H. W. Bashore	C. M. Voyen	C. M. Voyen	B. E. Stoutemyer	Portland, Oreg.
Yakima	Yakima, Wash.	P. J. Preston	R. K. Cunningham	J. C. Gawler	do	Do.
Yuma	Yuma, Ariz.	R. M. Priest	H. R. Pasewalk	E. M. Philebaum	R. J. Coffey	Berkeley, Calif.

Large Construction Work

Salt Lake Basin, Echo Dam.	Coalville, Utah	F. F. Smith [12]	C. F. Williams	C. F. Williams	J. R. Alexander	Montrose, Colo.
Kittitas	Ellensburg, Wash.	Walker R. Young [12]	E. R. Mills		B. E. Stoutemyer	Portland, Oreg.
Sun River, Gibson Dam.	Augusta, Mont.	Ralph Lowry [12]	F. C. Lewis	F. C. Lewis	E. E. Roddis	Billings, Mont.

[1] Operation of Arrowrock Division assumed by Nampa-Meridian, Black Canyon, Boise-Kuna, Wilder, Big Bend, and New York Irrigation Districts on Apr. 1, 1926.
[2] Operation of project assumed by Huntley Project Irrigation District on Dec. 31, 1927.
[3] Operation of project assumed by King Hill Irrigation District Mar. 1, 1926.
[4] Operation of South Side Pumping Division assumed by Burley Irrigation District on Apr. 1, 1926, and of Gravity Division by Minidoka Irrigation District on Dec. 2, 1916.
[5] Operation of project assumed by Truckee-Carson Irrigation District on Dec. 31, 1926.
[6] Operation of Interstate Division assumed by Pathfinder Irrigation District on July 1, 1926, Fort Laramie Division by Goshen Irrigation District and Gering and Fort Laramie Irrigation District on Dec. 31, 1926, and Northport Division by Northport Irrigation District on Dec. 31, 1926.
[7] Operation of project assumed by Salt River Valley Water Users' Association on Nov. 1, 1917.
[8] Operation of Garland Division assumed by Shoshone Irrigation District on Dec. 31, 1926.
[9] Operation of project assumed by Strawberry Water Users' Association on Dec. 1, 1926.
[10] Operation of Fort Shaw Division assumed by Fort Shaw Irrigation District on Dec. 31, 1926.
[11] Operation of West Division assumed by West Extension Irrigation District on July 1, 1926, and East Division by Hermiston Irrigation District informally on July 1, 1926, and formally, by contract, on Dec. 31, 1926.
[12] Construction engineer.

Important Investigations in Progress

Project	Office	In charge of—	Cooperative agency
Heart Mountain investigations	Powell, Wyo.	I. B. Hosig	
Utah investigations	Salt Lake City, Utah	E. O. Larson	State of Utah.
Truckee River investigations	Fallon, Nev.	A. W. Walker	
Yakima project extensions	Yakima, Wash.	P. J. Preston	

PART III

APPENDIX

TABLE I

COLORADO RIVER DISCHARGE AT YUMA

Quantities in Thousands Acre-Feet

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1902	229	220	301	368	2211	2530	770	257	227	264	249	249	7,959.
1903	185	183	368	819	1957	3117	2228	598	406	519	321	267	10,969.
1904	224	218	368	480	1700	2600	1412	1054	691	721	366	275	10,109.
1905	450	1560	3107	2250	2593	4550	1864	744	386	494	714	947	19,711
1906	422	530	1562	1935	3323	5009	2395	1173	699	720	575	1138	19,484.
1907	1320	1040	1480	2100	2330	5640	5930	2310	1280	836	643	458	25,467.
1908	389	817	990	1060	1670	2550	2000	1490	678	585	481	978	13,688.
1909	616	772	976	1805	3324	6240	4897	2509	2889	861	562	517	25,968.
1910	1158	509	1499	1710	3473	2798	904	591	367	429	467	427	14,333.
1911	541	743	1068	1214	2765	3819	3083	1131	530	1757	722	465	17,839.
1912	331	423	888	1253	2508	6397	2867	1397	582	677	699	403	18,358.
1913	238	337	558	1523	2398	2827	1303	580	523	634	472	393	11,788.
1914	462	645	923	1364	3308	6575	3168	1350	591	840	611	818	20,654.
1915	563	1505	951	1789	2941	2893	1897	685	270	442	356	354	14,643.
1916	2637	1615	2201	2118	3363	3539	2258	1675	736	1636	707	454	22,940.
1917	562	440	603	1565	3030	5350	5775	1442	536	465	422	420	20,610.
1918	405	322	1008	766	1787	3675	2660	710	406	473	479	451	13,145.
1919	231	398	543	1224	2221	2043	1242	654	307	325	605	944	10,740.
1920	701	2188	1112	1211	2842	7690	2647	1080	501	400	619	452	21,446.
1921	427	408	824	814	2670	6608	2816	2162	1097	551	447	636	19,464.
1922	800	598	997	1138	3437	5816	1945	742	524	239	326	455	17,019.
1923	327	321	540	1077	2875	5071	2617	1514	1271	736	828	665	17,844.
1924	785	481	520	1316	2563	3196	1123	288	184	244	369	352	11,421.
1925	213	350	530	1092	1782	2498	1742	739	1210	1150	677	474	12,457.
1926	356	288	446	1410	2776	3560	1417	536	260	438	255	459	12,201.
1927	280	1070	719	959	2990	3450	2670	913	1800	1050	732	462	17,095
1928	396	445	548	803	3270	3830	1568	539	248	398	444	292	12,781.
1929	223	268	678	1430	2720	4700	2100	2115	1480	935	464	361	17,474.

U.S.R.S.Data

TABLE II

GILA RIVER DISCHARGE.

Thousands acre-feet.

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Tatal
1903				1152				1		14			16.
1904							5	140	42	33	6		226.
1905	188	680	1022	768	299	43	4		3	11	270	375	3,667.
1906	136	167	576	422	122	4		25	4				1,459.
1907	141	57	260						90	58	13		623
1908		391	162					95	44			404	1,097.
1909	72	175	147	96	14		21	54	81				661.
1910	213	9		2									224.
1911	35	20	83				35			30	17		222.
1912			121	70			12	25		2			231
1913		1	57	16									74
1914	1	118	17				2	25	11	10	10	356	553.
1915	139	694	320	389	367	16	2	21					1,951.
1916	2093	690	747	559	27	3			71	222	53	27	4,494.
1917	163	83	132	448	243			82					1,154.
1918	2	12	243	17				52				3	329.
1919	12	24	19	60	3		42	54	9	21	188	306	739.
1920	40	424	190	108	15						9	13	801.
1921	23	8						341	41	15	6	42	478.
1922	330	82	164	34	3				7			52	672.
1923	17	5	95	2						2	83	224	429.
1924	317	22	5	30	2								376.
1925									65	10		2	78.
1926	1		228	21						61		45	357.
1927	36	415	116	9				2	54				633.
1928		23											23.
1929									3	2			5.

U.S.R.S. Data

TABLE III
RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN
Quantities in thousands acre-feet

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Hardy-ville Flow	Hardy. Flow Correct
1899	530 A.					
J	-26.5		-26.5	+62.5	600.0	662.5
F	-26.5		-26.5	+62.5	700.0	762.5
M	0			0	700.0	700.0
A	79.5		79.5	187.5	3,000.0	2,812.5
M	159.0		159.0	386.0	4,000.0	3,614.0
J	265.0		265.0	699.7	5,000.0	4,300.3
J	265.0		265.0	662.8	4,000.0	3,337.2
A	159.0		159.0	391.0	400.0	9.0
S	53.0		53.0	134.6	400.0	265.4
O	-53.0		-53.0	+117.0	400.0	517.0
N	-26.5		-26.5	+ 59.3	400.0	459.3
D	-26.5		-26.5	+ 62.5	400.0	462.5
Total	821.5		821.5	2098.5	20,000.0	17,901.5
1900	570 A.					
J	-28.5		-28.5	+ 60.5	600.0	660.5
F	-28.5		-28.5	+ 60.5	700.0	760.5
M	0			0	700.0	700.0
A	85.5		85.5	181.5	3,000.0	2,818.5
M	171.0		171.0	374.0	4,000.0	3,626.0
J	285.0		285.0	679.7	5,000.0	4,320.2
J	285.0		285.0	642.8	3,000.0	2,357.2
A	171.0		171.0	379.0	400.0	21.0
S	57.0		57.0	130.6	200.0	69.4
O	-57.0		-57.0	+113.0	200.0	313.0
N	-28.5		-28.5	+ 57.3	100.0	157.3
D	-28.5		-28.5	+ 60.5	100.0	160.5
Total	883.0		883.0	2037.0	18,000.0	15,963.0
1901	610 A.					
J	-30.5		-30.5	+ 58.5	300.0	358.5
F	-30.5		-30.5	+ 58.5	300.0	358.5
M	0			0	400.0	400.0
A	91.5		91.5	175.5	1,500.0	1,324.5
M	183.0		183.0	362.0	2,500.0	2,138.0
J	305.0		305.0	659.7	2,500.0	1,840.3
J	305.0		305.0	622.8	1,500.0	877.0
A	183.0		183.0	367.9	400.0	33.0
S	61.0		61.0	126.6	400.0	273.4
O	61.0		61.0	+109.0	400.0	509.0
N	-31.5		-31.5	+ 55.3	400.0	455.3
D	-31.5		-31.5	+ 58.5	400.0	458.5
Total	946.0		946.0	1974.0	11,000.0	9,026.0
1902	650 A.					
J	-32.5		-32.5	+ 56.5	300.0	356.5
F	-32.5		-32.5	+ 56.5	300.0	356.5
M	0			0	400.0	400.0
A	97.5		97.5	169.5	1,000.0	830.5
M	195.0		195.0	350.0	2,000.0	1,650.0
J	325.0		325.0	639.7	2,000.0	1,360.0
J	325.0		325.0	602.8	1,000.0	397.0
A	195.0		195.0	355.0	400.0	45.0
S	65.0		65.0	122.6	400.0	277.4
O	-65.0		-65.0	+105.0	400.0	505.0
N	-32.5		-32.5	+ 53.3	400.0	453.3
D	-32.5		-32.5	+ 56.5	400.0	456.5
Total	1,008.0		1,008.0	1,912.0	9,000.0	7,088.0

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1903	700 A.					
J	- 35.0		- 35.0	+ 54.0	185.4	239.4
F	- 35.0		- 35.0	+ 54.0	182.5	236.5
M	0		0	0	367.7	367.7
A	105.0		105.0	162.0	819.2	657.3
M	210.0		210.0	335.0	1,958.0	1,623.0
J	350.0		350.0	614.7	3,117.0	2,502.3
J	350.0		350.0	577.8	2,223.0	1,646.3
A	210.0		210.0	340.0	598.4	258.4
S	70.0		70.0	117.6	406.1	288.5
O	- 70.0		- 70.0	+ 100.0	518.5	618.5
N	- 35.0		- 35.0	+ 50.8	321.3	372.1
D	- 35.0		- 35.0	+ 54.0	266.6	320.6
Total	1,085.0		1,085.0	1,835.0	10,968.6	9,133.6
1904	750 A.					
J	- 37.5		- 37.5	+ 51.5	223.6	275.1
F	- 37.5		- 37.5	+ 51.5	217.8	269.3
M	0		0	0	367.7	367.7
A	112.5		112.5	154.5	479.7	325.2
M	225.0		225.0	320.0	1,699.6	1,379.6
J	375.0		375.0	589.7	2,599.5	2,009.8
J	375.0		375.0	552.8	1,412.0	859.2
A	225.0		225.0	325.0	1,054.0	729.1
S	75.0		75.0	112.6	691.5	578.9
O	- 75.0		- 75.0	+ 95.0	722.0	817.0
N	- 37.5		- 37.5	+ 48.3	366.0	414.3
D	- 37.5		- 37.5	+ 51.5	275.3	326.8
Total	1,163.0		1,163.0	1,757.0	10,108.8	8,351.8
1905	800 A.					
J	-40.0		- 40.0	+ 49.0	499.9	548.9
F	- 40.0		- 40.0	+ 49.0	1,560.4	1,609.4
M	0		0	0	3,107.4	3,107.4
A	120.0		120.0	147.0	2,250.6	2,103.6
M	240.0		240.0	305.0	2,593.0	2,288.0
J	400.0		400.0	564.7	4,550.5	3,985.8
J	400.0		400.0	527.8	1,863.7	1,335.9
A	240.0		240.0	310.0	744.1	434.1
S	80.0		80.0	107.6	386.5	278.9
O	- 80.0		- 80.0	+ 90.0	494.2	584.2
N	- 40.0		- 40.0	+ 45.8	714.0	759.8
D	- 40.0		- 40.0	+ 49.0	946.8	995.8
Total	1,240.0		1,240.0	1,680.0	19,711.1	18,031.1

TABLE III
RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1906	850 A.					
J	- 42.5		- 42.5	+ 46.5	422.4	468.9
F	- 42.5		- 42.5	+ 46.5	530.5	577.0
M	0		0	0	1,562.1	1,562.0
A	127.0		127.0	140.0	1,934.6	1,794.6
M	255.0		255.0	290.0	3,323.7	3,0337.0
J	425.0	0.5	425.0	539.2	5,009.7	4,470.5
J	425.0	0.2	425.0	294.5	2,395.3	1,892.0
A	255.0	0.1	255.0	102.6	1,173.9	879.0
S	85.0	0.2	85.0	502.8	698.6	596.4
O	- 85.0		- 85.0	+ 85.0	720.0	805.0
N	- 42.5		- 42.5	+ 43.3	575.6	618.9
D	- 42.5		- 42.5	+ 46.5	1,137.7	1,184.0
Total	1,318.0	1.0	1,319.0	1,602.0	19,484.0	17,882.0
1907	900. A.					
J	- 45.0		- 45.0	+ 44.0	1,320.0	1,364.0
F	- 45.0		- 45.0	+ 44.0	1,040.0	1,084.0
M	0		0	0	1,480.0	1,480.0
A	135.0		135.0	132.0	2,100.0	1,968.0
M	270.0		270.0	275.0	2,330.0	2,055.0
J	450.0		450.0	514.7	5,640.0	5,125.3
J	450.0		450.0	477.8	5,930.0	5,452.2
A	270.0		270.0	280.0	2,310.0	2,030.0
S	90.0		90.0	97.6	1,380.0	1,284.2
O	- 90.0		- 90.0	+ 80.0	836.0	916.0
N	- 45.0		- 45.0	+ 40.8	643.0	683.3
D	- 45.0		- 45.0	+ 44.0	458.0	502.0
Total	1,395.0	2.0	1,397.0	1,525.0	25,467.0	23,942.0
1908	950 A.					
J	- 47.5		- 47.5	+ 41.5	389.0	430.5
F	- 47.5		- 47.5	+ 41.5	317.0	853.5
M	0		0	0	990.0	990.0
A	142.5		142.5	124.5	1,060.0	935.5
M	285.0		285.0	260.0	1,670.0	1,410.0
J	475.0		475.0	489.7	2,550.0	2,060.3
J	475.0		475.0	452.8	2,000.0	1,547.2
A	285.0		285.0	265.0	1,490.0	1,225.0
S	95.0		95.0	92.6	678.0	585.4
O	- 95.0		- 95.0	+ 75.0	585.0	660.0
N	- 47.5		- 47.5	+ 38.2	481.0	519.3
D	- 47.5		- 47.5	+ 41.5	978.0	1,019.2
Total	1,475.0	3.0	1,478.0	1,445.0	13,688.0	12,243.0

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1909	1,000 A.					
J	- 50.0		- 50.0	+ 39.0	615.7	654.7
F	- 50.0		- 50.0	+ 39.0	772.8	811.8
M	0		0	0	975.1	975.1
A	150.0		150.0	117.0	1,805.0	1,688.0
M	300.0		300.0	245.0	33324.7	3,079.7
J	500.0		500.0	464.7	6,240.0	5,775.8
J	500.0		500.0	427.8	4,896.9	4,469.1
A	300.0		300.0	250.0	2,505.8	2,258.5
S	100.0		100.0	87.6	2,888.6	2,801.0
O	- 100.0		- 100.0	+ 70.0	860.8	930,8
N	- 50.0		- 50.0	+ 35.8	561.9	597.7
D	- 50.0		- 50.0	+ 39.0	517.1	556.1
Total	1,550.0	3.0	1,550.0	1,370.0	25,967.6	24,597.6
1910	1040 A.					
J	- 52.0		- 52.0	+ 37.0	1,158.8	1,195.0
F	- 52.0		- 52.0	+ 37.0	508.6	545.6
M	0		0	0	1,498.7	1,498.7
A	156.0		156.0	111.0	1,710.0	1,599.0
M	312.0		312.0	233.0	3,472.5	3,239.5
J	520.0		520.0	444.7	2,798.1	2,353.4
J	520.0		520.0	407.8	904.5	496.7
A	312.0		312.0	239.0	591.5	353.5
S	104.0		104.0	83.6	366.9	283.3
O	- 104.0		- 104.0	+ 66.0	429.4	495.4
N	- 52.0		- 52.0	+ 33.8	466.9	500.7
D	- 52.0		- 52.0	+ 37.0	426.8	463.8
Total	1,610.0	4.0	1,610.0	1,310.0	14,332.0	13,022.7
1911	1080 A.					
J	- 54.0		- 54.0	+ 35.0	541.5	576.5
F	- 54.0		- 54.0	+ 35.0	742.6	777.6
M	0		0	0	1,067.7	1,067.7
A	162.0		162.0	105.0	1,213.7	1,108.7
M	324.0		324.0	221.0	2,764.9	2,543.9
J	540.0		540.0	425.0	3,818.6	3,393.6
J	540.0		540.0	388.0	3,083.5	2,695.5
A	324.0		324.0	226.0	1,132.0	906.0
S	108.0		108.0	80.0	530.4	450.4
O	- 104.0		- 108.0	+ 62.0	1,756.8	1,818.8
N	- 54.0		- 54.0	+ 30.0	722.4	752.4
D	- 54.0		- 54.0	+ 35.0	465.1	500.1
Total	1,675.0	5.0	1,675.0	1,245.0	17,839.2	16,594.2

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1912	1120 A.					
J	- 56.0		- 56.0	+ 33.0	331.2	364.2
F	- 56.0		- 56.0	+ 33.0	423.7	456.7
M	0		0	0	818.0	818.0
A	168.0		168.0	99.0	1,253.6	1,154.6
M	336.0		336.0	209.0	2,508.5	2,299.5
J	560.0		560.0	405.0	6,397.4	5,992.4
J	560.0		560.0	368.0	2,867.3	2,499.3
A	336.0		336.0	214.0	1,396.6	1,182.6
S	112.0		112.0	76.0	582.0	506.0
O	- 112.0		- 112.0	+ 58.0	676.8	734.8
N	- 56.0		- 56.0	+ 28.0	699.2	727.2
D	- 56.0		- 56.0	+ 33.0	403.4	436.4
Total	1,735.0	6.0	1,741.0	1,185.0	18,357.6	17,173.6
1913	1160 A.					
J	- 58.0		- 58.0	+ 31.0	237.6	268.8
F	- 58.0		- 58.0	+ 31.0	337.0	368.0
M	0		0	0	557.8	557.8
A	174.0		174.0	93.0	1,523.7	1,430.7
M	348.0	0.7	348.6	196.3	2,397.8	2,201.5
J	580.0	4.7	584.7	380.3	2,827.3	2,447.0
J	580.0	2.3	583.2	345.7	1,302.9	957.2
A	348.0	1.0	349.0	201.0	579.6	378.6
S	116.0	0.6	116.6	71.4	524.8	453.4
O	- 116.0	0.5	- 116.0	+ 54.5	634.9	689.4
N	- 58.0		- 58.0	+ 26.0	471.9	497.9
D	- 58.0		- 58.0	+ 31.0	392.9	423.9
Total	1,800.0	11.0	1,811.0	1,109.0	11,788.3	10,679.3
1914	1200 A.					
J	- 60.0		- 60.0	+ 29.0	462.1	491.1
F	- 60.0		- 60.0	+ 29.0	645.7	674.7
M	0		0	0	922.9	922.9
A	180.0		180.0	87.0	1,364.3	1,277.3
M	360.0	1.0	361.0	184.0	3,307.6	3,123.6
J	600.0	7.5	607.5	357.5	6,574.6	6,217.1
J	600.0	3.8	603.8	324.2	3,167.8	2,843.6
A	360.0	1.6	361.6	188.4	1,349.5	1,161.1
S	120.0	1.0	121.0	67.0	591.1	524.1
O	- 120.0	0.8	- 119.2	+ 50.0	839.8	889.8
N	- 60.0		- 60.0	+ 24.0	610.9	634.9
D	- 60.0		- 60.0	+ 29.0	818.2	847.2
Total	1,860.0	16.0	1,876.0	1,044.0	20,654.4	19,610.4

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1915	1240 A.					
J	- 62.0		- 62.0	+ 27.0	562.7	589.7
F	- 62.0		- 62.0	+ 27.0	1,504.7	1,531.7
M	0		0	0	950.9	950.9
A	186.0		186.0	81.0	1,788.7	1,707.7
M	372.0	2.4	374.4	170.6	2,941.1	2,771.5
J	620.0	16.8	636.8	328.2	2,891.7	2,563.5
J	620.0	8.5	628.5	299.5	1,896.6	1,597.1
A	372.0	3.6	375.6	174.4	685.3	510.9
S	124.0	2.2	126.2	61.8	269.9	208.1
O	- 124.0	1.8	- 122.2	+ 47.8	442.1	489.9
N	- 62.0	0.7	- 61.3	+ 22.7	355.8	378.5
D	- 62.0		- 62.0	+ 27.0	353.7	380.7
Total	1,920.0	36.0	1,956.0	964.0	14,643.2	13,679.2
1916	1280 A.					
J	- 64.0		- 64.0	+ 25.0	2,637.0	2,662.0
F	- 64.0		- 64.0	+ 25.0	1,614.9	1,639.9
M	0		0	0	2,201.3	2,201.3
A	192.0		192.0	75.0	2,118.3	2,043.3
M	384.0	4.5	384.5	156.5	3,363.4	3,206.9
J	640.0	31.0	671.0	294.0	3,538.9	3,244.9
J	640.0	15.7	655.7	272.3	2,258.4	1,986.1
A	384.0	6.6	390.6	159.4	1,674.9	1,515.5
S	128.0	4.0	132.0	56.0	736.1	680.1
O	- 128.0	3.3	- 124.7	+ 45.3	1,635.8	1,681.1
N	- 64.0	1.3	- 62.7	+ 21.3	707.1	728.1
D	- 64.0		- 64.0	+ 25.0	454.4	479.4
Total	1,985.0	66.0	2,051.0	869.0	22,940.4	22,071.4
1917	1320.A.					
J	- 66.0		- 66.0	+ 23.0	561.9	584.9
F	- 66.0		- 66.0	+ 23.0	440.4	463.4
M	0		0	0	602.6	602.6
A	198.0		198.0	69.0	1,564.9	1,495.9
M	396.0	5.8	396.0	143.2	3,029.7	2,886.5
J	660.0	40.0	700.0	265.0	5,350.2	5,085.2
J	660.0	20.4	680.4	247.6	5,775.3	5,527.7
A	396.0	8.6	404.6	145.4	1,442.4	1,297.0
S	132.0	5.2	137.2	50.8	535.9	485.1
O	- 132.0	4.3	- 127.7	+ 42.3	465.3	507.6
N	- 66.0	1.7	- 64.3	+ 19.7	422.2	441.9
D	- 66.0		- 66.0	+ 23.0	419.7	442.7
Total	2,045.0	86.0	2,131.0	789.0	20,610.6	19,821.6

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1918	1360 A.					
J	- 68.0		- 68.0	+ 21.0	405.4	426.4
F	- 68.0		- 68.0	+ 21.0	322.7	343.7
M	0		0	0	1,008.2	1,008.2
A	204.0		204.0	63.0	766.6	703.6
M	408.0	5.8	408.0	131.2	1,786.7	1,655.5
J	680.0	40.0	720.0	245.0	3,674.8	3,429.8
J	680.0	20.4	700.4	227.6	2,659.8	2,432.2
A	408.0	8.6	416.6	133.4	710.3	576.9
S	136.0	5.2	141.2	46.8	406.2	359.4
O	- 136.0	4.3	- 131.7	+ 38.3	473.6	511.9
N	- 68.0	1.7	- 66.3	+ 17.7	479.5	497.2
D	- 68.0		- 68.0	+ 21.0	451.4	472.4
Total	2,110.0	86.0	2,196.0	724.0	13,145.3	12,421.3
1919	1400 A.					
J	- 70.0		- 70.0	+ 19.0	231.3	250.3
F	- 70.0		- 70.0	+ 19.0	398.0	417.0
M	0		0	0	543.2	543.2
A	210.0		210.0	57.0	1,224.6	1,167.6
M	420.0	6.5	426.5	118.5	2,221.1	2,102.6
J	700.0	45.0	745.0	220.0	2,043.6	1,823.6
J	700.0	22.7	722.7	205.3	1,242.6	1,037.3
A	420.0	9.6	429.6	120.4	654.1	533.7
S	140.0	5.7	145.7	42.3	306.8	264.5
O	- 140.0	4.8	- 135.2	+ 34.8	325.1	359.9
N	- 70.0	1.9	- 68.1	+ 15.9	605.5	621.4
D	- 70.0		- 70.0	+ 19.0	944.4	963.5
Total	2,170.0	96.0	2,266.0	654.0	10,740.0	10,086.0
1920	1433 A.					
J	- 71.6		- 71.6	+ 17.4	701.5	718.9
F	- 71.6		- 71.6	+ 17.4	2,188.3	2,205.7
M	0		0	0	1,112.9	1,112.9
A	215.0		215.0	52.0	1,211.5	1,159.5
M	429.9	7.0	436.9	108.1	2,841.9	2,733.8
J	716.5	48.0	764.6	200.5	7,690.3	7,489.8
J	716.5	24.4	740.9	187.1	2,646.7	2,459.6
A	429.9	10.3	440.2	109.8	1,080.0	970.2
S	143.3	6.2	149.5	38.5	501.4	462.9
O	- 143.3	5.2	- 138.1	+ 31.9	399.9	431.8
N	- 71.6	2.0	- 69.6	+ 14.4	619.4	633.8
D	- 71.6		- 71.6	+ 17.4	451.9	469.3
Total	2,220.0	103.0	2,323.0	597.0	21,445.8	20,848.8

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1921	1467 A.					
J	- 73.2	0	- 73.2	# 15.8	427.0	442.8
F	-73.2		- 73.2	# 15.8	408.9	424.7
M	0		0	0	824.5	824.5
A	220.0		220.0	47.0	814.2	767.2
M	439.8	7.9	447.2	97.8	2,670.0	2,572.2
J	733.0	51.0	784.0	181.0	6,608.7	6,427.7
J	733.0	25.8	758.8	169.2	2,815.9	2,646.7
A	439.0	10.9	449.9	100.1	2,162.3	2,062.2
S	146.7	6.5	153.2	34.8	1,097.4	1,062.6
O	- 146.7	5.5	- 141.2	# 28.8	551.4	580.2
N	- 146.7	2.2	- 71.0	# 13.0	447.8	460.8
D	- 73.2		- 73.2	# 15.8	636.1	651.9
Total	2,275.0	109.0	2,384.0	536.0	19,464.4	18,923.5
1922	1500 A.					
J	- 74.8		- 74.8	# 14.2	800.1	814.3
F	- 74.8		- 74.8	# 14.2	598.2	612.4
M	0		0	0	997.3	997.3
A	225.0		225.0	42.0	1,137.7	1,095.7
M	449.6	7.8	457.5	87.5	3,436.8	3,349.3
J	749.5	53.6	803.1	161.9	5,816.3	5,654.4
J	749.5	27.2	776.7	151.3	1,945.2	1,793.9
A	449.6	11.5	461.2	88.8	742.0	653.2
S	150.0	6.9	156.9	31.1	524.4	493.3
O	- 150.0	5.8	- 144.2	# 25.8	239.4	265.7
N	- 75.0	2.3	- 72.5	# 11.5	326.3	337.8
D	- 75.0		- 74.8	# 14.2	455.3	469.5
Total	2325.0	115.0	2,440.0	480.0	17,019.5	16,539.5
1923	1540 A.					
J	- 77.0		- 77.0	# 12.0	327.5	339.5
F	- 77.0		- 77.0	# 12.0	321.0	333.0
M	0		0	0	540.0	540.0
A	231.0		231.0	36.0	1,077.0	1,041.0
M	462.0	8.2	470.2	74.8	2,875.0	2,800.0
J	770.0	56.5	826.5	138.5	5,071.0	4,932.5
J	770.0	28.6	798.6	129.4	2,617.0	2,487.6
A	462.0	12.1	474.1	75.9	1,514.0	1,438.1
S	154.0	7.3	161.3	26.7	1,270.8	1,244.1
O	- 154.0	6.3	- 148.0	# 22.0	736.3	714.3
N	- 77.0	2.1	- 74.6	# 9.4	828.0	818.6
D	- 77.0		- 77.0	# 12.0	666.0	638.0
Total	2,390.0	121.0	2,511.0	409.0	17,843.5	17,434.5

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1924	1580 A.					
J	- 79.0		- 79.0	# 10.0	785.0	795.0
F	- 79.0		- 79.0	# 10.0	481.0	491.0
M	0		0	0	520.0	520.0
A	237.0		237.0	30.0	1,316.0	1,286.0
M	474.0	8.6	482.6	62.5	2,563.0	2,500.6
J	790.0	59.2	849.2	115.8	3,169.0	3,080.2
J	790.0	30.0	820.0	108.0	1,123.0	1,015.0
A	474.0	12.7	486.7	63.3	288.0	224.7
S	158.0	7.6	165.6	22.4	184.0	161.6
O	- 158.0	6.4	- 151.6	# 18.4	244.0	262.4
N	- 79.0	2.5	- 76.5	# 7.5	369.0	376.5
D	- 79.0		- 79.0	# 10.0	352.0	362.0
Total	2,450.0	127.0	2,577.0	343.0	11,421.0	11,078.0
1925	1620 A.					
J	- 81.0		- 81.0	# 8.0	213.0	221.0
F	- 81.0		- 81.0	# 8.0	350.0	358.0
M	0		0	0	530.8	530.8
A	243.0		243.0	24.0	1,092.0	1,068.0
M	486.0	9.0	495.0	50.0	1,782.0	1,732.0
J	810.0	62.0	872.0	92.0	2,498.0	2,405.0
J	810.0	31.4	841.4	86.6	1,742.0	1,655.4
A	486.0	13.3	499.3	50.7	738.5	687.8
S	162.0	8.0	168.0	20.0	1,210.0	1,190.0
O	- 162.0	6.7	- 155.3	# 14.7	1,150.0	1,164.7
N	- 81.0	2.7	- 78.3	# 5.7	677.0	682.7
D	- 81.0		- 81.0	# 8.0	474.0	482.0
Total	2,510.0	133.0	2,643.0	277.0	12,457.0	12,180.3
1926	1660. A.					
J	- 83.0		- 83.0	# 6.0	356.0	362.0
F	- 83.0		- 83.0	# 6.0	288.0	294.0
M	0		0	0	446.0	446.0
A	249.0		249.0	18.0	1,410.0	1,392.0
M	498.0	9.5	507.5	37.5	2,776.0	2,738.0
J	830.0	65.5	895.5	69.5	3,560.0	3,490.5
J	830.0	33.1	863.1	64.9	1,417.0	1,352.0
A	498.0	14.0	512.0	38.0	536.0	498.0
S	166.0	8.4	174.4	13.6	260.0	246.4
O	- 166.0	7.0	- 159.0	# 11.0	438.0	449.0
N	- 83.0	2.8	- 80.2	# 3.8	255.0	258.8
D	- 83.0		- 83.0	# 6.0	459.0	465.0
Total	2,570.0	140.0	2,710.0	210.0	12,201.0	11,991.0

TABLE III

RECONSTRUCTION OF RIVER TO 1930 FOR PAST DEPLETION IN UPPER BASIN

Quantities in thousands acre-feet.

Year-Month	Irrigation Diversion	Trans-mountain Diversion	Total	Correction, 1929-Total	Yuma Flow U.S.R.S.	Yuma Flow Corrected
1927	1700 A.					
J	- 85.0		- 85.0	# 4.0	280.0	284.0
F	- 85.0		- 85.0	# 4.0	1,070.0	1,074.0
M	0		0	0	719.0	719.0
A	255.0		255.0	12.0	959.0	947.0
M	510.0	9.9	519.9	25.1	2,990.0	2,965.0
J	850.0	68.0	918.0	47.0	3,450.0	3,402.0
J	850.0	34.5	884.5	43.5	2,670.0	2,626.5
A	510.0	14.6	524.6	25.4	913.0	887.6
S	170.0	8.8	178.8	9.2	1,800.0	1,790.8
O	- 170.0	7.3	- 162.7	# 7.3	1,050.0	1,057.3
N	- 85.0	2.9	- 82.1	# 1.9	732.0	733.9
D	- 85.0		- 85.0	# 4.0	462.0	466.0
Total	2,630.0	146.0	2,776.0	144.0	17,095.0	16,951.0
1928	1740 A.					
J	- 87.0		- 87.0	# 2.0	396.0	398.0
F	- 87.0		- 87.0	# 2.0	445.0	447.0
M	0		0	0	548.0	548.0
A	261.0	10.3	261.0	6.0	803.0	797.0
M	522.0		532.3	12.7	3,270.0	3,257.3
J	870.0	71.0	941.0	24.0	3,830.0	3,806.0
J	870.0	35.9	905.9	22.1	1,568.0	1,545.9
A	522.0	15.2	537.2	12.8	539.0	526.0
S	174.0	9.1	183.1	4.9	248.0	243.1
O	- 174.0	7.6	- 166.4	# 3.6	398.0	401.6
N	- 87.0	3.0	- 84.0	0	444.0	444.0
D	- 87.0		- 87.0	# 2.0	392.0	394.0
Total	2,690.0	152.0	2,842.0	78.0	12,781.0	12,703.0
1929	1780 A.					
J	- 89.0		- 89.0			223.0
F	- 89.0		- 89.0			268.0
M	0		0			678.0
A	267.0		267.0			1,430.0
M	534.0	11.0	545.0			2,720.0
J	890.0	74.7	964.7			4,700.0
J	890.0	37.8	927.8			2,100.0
A	534.0	16.0	550.0			2,115.0
S	178.0	9.6	187.6			1,480.0
O	- 178.0	8.0	- 170.0			935.0
N	- 89.0	3.2	- 85.8			464.0
D	- 89.0		- 89.0			361.0
Total	2,760.0	160.0	2,920.0	0.0		17,474.0

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930.

Quantities in thousands acre-feet

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black-Laguna	Algebraic Total	Hardy. Correct for U.B.	Correct Flow at Black C.	Cumul. Mass, Mill
1899							
J						662.5	0.7
F						762.5	1.4
M						700.0	2.1
A						2,812.5	4.9
M						3,614.0	8.5
J						4,300.3	12,8
J						3,337.2	16.1
A						9.0	16.1
S						265.4	16.4
O						517.0	16.9
N						459.3	17.4
D						462.5	17.9
Total						17,901.5	
1900							
J						660.5	18.6
F						760.5	19.4
M						700.0	20.1
A						2,818.5	22.9
M						3,626.0	26.5
J						4,320.3	30.8
J						2,357.2	33.2
A						21.0	33.2
S						69.4	33.3
O						313.0	33.6
N						157.3	33.7
D						160.5	33.9
Total						15,963.0	
1901							
J						358.5	34.2
F						358.5	34.6
M						400.0	35.0
A						1,324.5	36.3
M						2,138.0	38.4
J						1,840.3	40.2
J						877.2	41.1
A						33.0	41.1
S						273.4	41.4
O						509.0	41.9
N						455.3	42.4
D						458.5	42.9
Total						9,026.0	
1902							

Columns 1 to 4 inclusive do not enter into the corrections at Hardyville. Hardyville corrected for Upper Basin irrigation diversions is the same as the reconstructed river at Black Canyon.

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Hardy. Correct for U.B.	Correct Flow at Black C.	Cumul. Mass, M. A.f.
1902							
J						356.5	43.2
F						356.5	43.6
M						400.0	44.0
A						830.5	44.8
M						1,650.0	46.5
J						1,360.3	47.9
J						397.2	48.3
A						45.0	48.6
S						277.4	48.6
O						505.0	49.1
N						453.3	49.5
D						456.5	50.0
Total						7,088.0	
					Yuma Correct for U.B.		
1903							
J			37.5	37.5	239.4	276.9	50.3
F			37.5	37.5	226.5	274.0	50.6
M			90.0	90.0	367.7	457.7	51.0
A	1.15		90.0	88.8	657.3	746.0	51.7
M	0.08		90.0	89.9	1,623.0	1,713.9	53.4
J			225.0	225.0	2,502.3	2,727.3	56.1
J			90.0	90.0	1,646.3	1,736.3	57.9
A	0.69		90.0	89.3	258.4	347.7	58.3
S	0.41		37.5	37.1	288.5	325.6	58.6
O	13.63		37.5	23.9	618.5	642.4	59.2
N			37,5	37.5	372.1	409.6	59.6
D			37.5	37.5	320.6	358.1	60.0
Total	16.00		900.0	884.0	9,133.6	10,017.6	
1904							
J			37.5	37.5	275.1	312.6	60.3
F			37.5	37.5	269.3	306.8	60.6
M			90.0	90.0	367.7	457.7	61.0
A			90.0	90.0	325.2	415.2	61.4
M			90.0	90.0	1,379.6	1,469.6	62.9
J	5.8		225.0	225.0	2,009.8	2,229.0	65.1
J	139.6		90.0	- 49.6	859.2	809.6	65.9
A	41.6		90.0	48.4	729.1	777.5	66.7
S	32.8		37.5	4.7	578.9	583.6	67.4
O	6.5		37,5	31.0	817.0	848.0	68.1
N			37.5	37.5	414.3	451.8	68.6
D			37.5	37.5	326.3	364.3	69.0
Total	226.4		900.0	673.6	8,351.8	9,025.4	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected	Corrected Flow at Black Can.	Cumul. Mass, M. A.ft
1905							
J	188.9		37.5	- 151.4	548.9	548.9	69.4
F	680.5		37.5	- 643.0	1,609.4	966.4	70.4
M	1,022.2		90.0	- 932.2	3,107.4	2,175.2	72.6
A	768.2		90.0	- 678.2	2,103.6	1,426.4	74.0
M	299.7		90.0	- 209.7	2,288.0	2,078.3	76.0
J	43.1		225.0	181.9	3,985.8	4,167.7	80.2
J	4.3		90.0	85.7	1,355.9	1,421.6	81.6
A			90.0	90.0	434.1	524.1	82.1
S	2.9		37.5	37.5	278.9	313.5	82.4
O	11.2		37.5	37.5	584.2	610.5	83.0
N	270.9		37.5	37.5	759.8	526.4	83.6
D	375.0		37.5	37.5	995.0	658.3	84.3
Total	3,667.2		900.0	-2,567.2	18,031.1	15,436.9	
1906							
J	136.6		37.5	-- 99.1	468.1	369.8	84.9
F	167.9		37.5	- 130.4	577.0	446.6	85.4
M	567.0		90.0	- 477.0	1,562.0	1,085.1	86.5
A	422.3		90.0	- 332.3	1,794.6	1,462.3	88.0
M	122.2		90.0	- 32.2	3,033.7	3,005.1	91.0
J	4.6		225.0	220.4	4,470.5	4,690.9	95.7
J			90.0	90.0	1,892.0	1,982.5	97.7
A	25.1		90.0	64.9	879.0	944.3	98.6
S	4.3		37.5	33.2	596.4	629.2	99.2
O			37.5	37.5	805.0	842.5	100.0
N			37.5	37.5	618.9	656.4	100.6
D			37.5	37.5	1,184.0	1,221.7	101.8
Total	1,459.1		900.0	- 559.1	17,882.0	17,322.9	
1907							
J	141.7		90.0	- 104.2	1,364.0	1,259.8	103.1
F	57.9		90.0	- 20.4	1,084.0	1,063.6	104.2
M	260.7		90.0	- 170.6	1,480.0	1,309.4	105.5
A			90.0	90.0	1,968.0	2,058.0	107.5
N			90.0	90.0	2,055.0	2,145.0	109.6
J			225.0	225.0	5,1253	5,350.3	115.0
J			90.0	90.0	5,542.2	5,542.2	120.5
A	0.4		90.0	89.4	2,030.0	2,119.4	122.6
S	90.2		37.5	- 52.7	1,284.2	1,229.7	123.8
O	58.9		37.5	- 21.4	916.0	894.6	124.7
N	13.7		37.5	23.8	683.3	707.6	125.4
D			37.5	37.5	502.0	539.5	125.9
Total	623.4		900.0	# 276.6	23,942.0	24,218.6	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Correced For U.B.	Corrected Flow at Black Can.	Cumul. Mass, M. A.ft
1908							
J						468.0	126.5
F	391.5	0	37.5	37.5	430.5	504.5	127.0
M	162.6		37.5	- 354.0	858.5	917.4	127.9
A			90.0	-- 72.6	990.0	1,025.5	128.9
M			90.0	90.0	935.5	1,500.0	130.4
J			90.0	90.0	1,410.0	2,285.3	132.7
J			225.0	225.0	2,060.3	1,637.2	134.3
A	94.7		90.0	90.0	1,547.2	1,220.3	135.5
S	44.2		90.0	- 4.7	1,225.0	578.7	136.1
O			37.5	- 6.7	585.0	697.5	136.8
N			37.5	37.5	660.0	556.8	137.4
D	404.0		37.5	37.5	519.3	653.0	138.0
Total	1,097.1		900.0	- 366.5	1,019.2	12,045.9	
				- 197.1	12,243.0		
1909							
J	71.9	11.4	37.5	- 23.0	654.7	631.7	138.6
F	175.1	10.7	37.5	- 126.0	811.8	684.9	139.3
M	147.4	13.6	90.0	- 43.8	975.1	931.3	140.3
A	96.0	13.6	90.0	7.6	1,688.0	1,695.6	142.0
M	14.2	14.1	90.0	89.9	3,079.7	3,169.6	145.2
J		13.9	225.0	238.9	5,775.8	6,014.7	151.2
J	21.0	14.5	90.0	83.5	4,469.1	4,552.6	155.8
A	54.5	14.1	90.0	49.6	2,258.5	2,308.1	158.1
S	81.0	10.7	37.5	- 32.8	2,801.0	2,768.2	160.9
O		13.7	37.5	51.2	930.8	982.0	161.9
N		13.1	37.5	50.6	597.7	648.3	162.5
D		13.6	37.5	51.1	556.1	607.2	163.1
Total	661.2	158.0	900.0	397.8	24,597.6	24,995.4	
1910							
J	213.0	16.3	37.5	- 159.2	1,195.0	1,036.6	164.0
F	9.2	15.4	37.5	43.7	545.6	589.3	164.6
M	0.3	19.4	90.0	109.1	1,498.7	1,607.8	166.2
A	1.5	19.4	90.0	107.9	1,599.0	1,706.9	167.9
M		20.1	90.0	110.1	3m239.5	3,349.6	171.2
J		19.9	225.0	244.9	2,353.4	2,598.3	173.8
J		20.8	90.0	110.8	496.7	607.5	174.4
A		20.1	90.0	110.1	353.5	463.6	175.1
S		16.7	37.5	54.2	283.3	337.5	175.4
O		19.6	37.5	57.1	495.4	552.5	175.9
N		18.7	37.5	56.2	500.7	556.9	176.4
D		19.4	37.5	56.9	463.8	530.7	176.9
Total	224.0	226.0	900.0	902.0	13,022.7	13,924.7	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected for U.B.	Corrected Flow at Black C.	Cumul. Mass, M. A.f
1911							
J	+ 35.7	16.3	37.5	18.1	576.5	594.6	177.5
F	+ 20.2	15.4	37,5	32.7	777.6	810.3	178.3
M	83.9	19.4	90.0	25.5	1,067.7	1,093.2	179.4
A		19.4	90.0	109.4	1,108.7	1,218.1	180.6
M		20.1	90.0	110.1	2,543.9	2,654.2	183.3
J		19.9	225.0	244.9	3,393.6	3,638.5	186.9
J	34.7	20.8	90.0	76.1	2,695.5	2,771.6	189.7
A		20.1	90.0	110.1	906.0	1,016.1	190.7
S		16.7	37.5	54.2	450.4	504.6	191.2
O	30.2	19.6	37.5	26.9	1,818.0	1,845.1	193.0
N	17.3	18.7	37.5	38.9	752.4	791.3	193,8
D		19.4	37.5	56.9	500.1	557.0	194.4
Total	222.0	226.0	900.0	904.0	16,594.2	17,498.2	
1912							
J		22.4	37.5	59.9	364.2	424.1	194.8
F		21.2	37.5	58.7	456.7	515.4	195.3
M	121.0	26.8	90.0	- 4.2	8.8.0	813.8	196.1
A	70.0	27.7	90.0	46.8	1,154.6	1,201.4	197.7
M	0.6	2.7	90.0	117.1	2,299.5	2,416.6	199.7
J		27.4	225.0	152.4	5,992.4	6,144.8	205.9
J	12.5	28.6	90.0	106.1	2,499.3	2,605.4	208.5
A	25.4	27.7	90.0	92.3	1,182.6	1,274.9	209.8
S		23.0	37.5	60.5	506.0	566.5	210.5
O	1.4	27.0	37.5	63.1	734.8	797.9	211.3
N		26.8	37.5	63.3	727.2	790.6	212.1
D		25.8	37.5	64.3	436.4	500.7	212.6
Total	231.0	311.0	900.0	980.0	17,173.6	18,152.6	
1913							
J		28.7	37.5	66.3	268.8	334.8	212.9
F	0.6	27.1	37.5	64.0	368.0	432.0	213.3
M	57.5	34.2	90.0	66.7	557.8	624.5	214.0
A	15.7	34.2	90.0	108.5	1,430.7	1,539.2	215.5
M		53.4	90.0	125.4	2,201.5	2,326.9	217.8
J		35.0	225.0	260.0	2,447.0	2,707.0	220.5
J		37.6	90.0	127.6	957.2	1,084.8	221.6
A		35.4	90.0	135.4	378.6	514.0	222.1
S		29.4	37.5	66.9	453.4	520.3	222.6
O		34.6	37.5	72.1	689.4	761.5	223.4
N		33.1	37.5	70.6	497.9	568.5	224.0
D		34.2	37.5	71.7	423.9	495.6	224.5
Total	73.8	398.0	900.0	1,224.2	10,679.3	11,903.5	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected for U.B.	Corrected Flow at Black C.	Cumul. Mass, M. A.Ft
1914							
J	1.2	37.2	37.5	73.5	491.1	564.6	225.1
F	118.6	35.1	37.5	- 46.0	674.1	628.7	225.7
M	17.6	44.5	90.0	116.9	922.9	1,039.8	226.7
A		44.5	90.0	134.5	1,277.3	1,411.8	228.1
M		46.0	90.0	136.0	3,123.7	3,259.6	231.4
J		45.5	225.0	270.5	6,217.1	6,487.6	237.9
J	2.0	47.5	90.0	135.5	2,843.6	2,979.1	240.9
A	25.6	46.0	90.0	110.3	1,161.1	1,271.4	242.2
S	11.0	38.2	37.5	64.6	524.1	588.8	242.8
O	10.3	45.0	37.5	72.2	889.8	962.0	243.8
N	10.5	42.8	37.5	69.8	634.9	704.8	244.5
D	356.9	44.5	37.5	-274.9	847.2	572.3	245.0
Total	553.8	517.0	900.0	863.2	19,610.4	20,473.6	
1915							
J	139.6	45.8	37.5	- 56.3	589.7	533.4	245.5
F	694.2	43.2	37.5	- 613.5	1,531.7	918.2	246.4
M	320.9	54.7	90.0	- 176.2	950.9	774.7	247.2
A	389.1	54.7	90.0	- 244.4	1,707.7	1,463.3	248.7
M	367.0	56.6	90.0	- 220.4	2,771.5	2,551.1	251.3
J	16.9	56.0	225.0	264.1	2,563.5	2,827.6	254.1
J	2.4	58.5	90.0	146.1	1,597.1	1,743.3	255.8
A	21.8	56.6	90.0	124.8	510.9	635.7	256.4
S		47.0	37.5	84.6	208.1	292.6	256.7
O		55.4	37.5	92.9	489.9	582.8	257.3
N		52.8	37.5	90.3	378.5	468.8	257.8
D		54.7	37.5	92.2	380.7	472.9	258.3
Total	1,951.9	636.0	900.0	- 415.9	13,679.2	13,263.3	
1916							
J	2,093.0	54.4	37.5	-2,001.1	2,662.0	660.9	259.0
F	690.0	51.3	37.5	- 601.2	1,639.9	1,038.7	260.0
M	747.7	65.0	90.0	- 592.7	2,201.0	1,608.6	261.6
A	559.3	65.0	90.0	- 404.3	2,043.3	1,639.0	263.2
M	27.1	67.2	90.0	130.1	3,206.9	3,337.0	266.5
J	2.5	66.5	225.0	289.0	3,244.9	2,145.6	272.1
J		69.5	90.0	159.5	1,986.1	1,672.6	273.8
A		67.2	90.0	157.2	1,515.5	702.6	274.5
S	70.9	55.9	37.5	22.5	680.1	1,569.1	276.1
O	222.3	65.6	37.5	- 119.2	1,681.1	774.8	276.9
N	53.7	62.6	37.5	46.4	728.1	544.4	277.5
D	27.5	65.0	37.5	75.0	479.4	3,533.9	270.0
Total	4,494.0	755.0	900.0	-2,839.0	22,071.4	19,232.4	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected for U.B.	Corrected Flow at Black C.	Cumul. Mass, M.A.Ft
1917							
J	163.8	63.0	37.5	- 63.5	584.9	521.4	278.0
F	83.3	59.5	37.5	13.7	463.5	477.1	278.5
M	132.9	75.2	90.0	32.3	602.6	634.9	279.1
A	448.2	75.3	90.0	- 283.0	1,495.9	1,212.9	280.3
M	243.7	77.8	90.0	- 75.9	2,886.5	2,810.6	283.1
J	0.5	77.0	225.0	302.0	5,085.2	5,387.2	288.5
J		80.5	90.0	170.5	5,527.7	5,698.2	294.2
A	82.3	77.8	90.0	85.5	1,297.0	1,382.5	295.6
S		84.7	37.5	122.2	485.1	607.3	296.2
O		76.0	37.5	113.5	507.6	621.3	296.8
N		72.5	37.5	110.0	441.9	551.9	297.3
D		75.2	37.5	112.7	442.7	555.4	297.9
Total	1,154.7	874.0	900.0	619.3	19,821,6	20,440.9	297.9
1918							
J	1.6	71.4	37.5	107.3	426.4	533.7	298.4
F	12.4	67.4	37.5	92.5	343.7	436.2	298.9
M	243.4	65.2	90.0	- 88.2	1,008.2	920.0	299.7
A	17.2	65.2	90.0	138.0	703.6	841.6	300.5
M		88.2	90.0	178.1	1,655.5	1,833.6	302.3
J		87.2	225.0	312.2	3,429.8	3,842.0	306.0
J		91.2	90.0	181.2	2,432.2	2,613.4	308.6
A	52.3	88.2	90.0	125.9	576.9	702.8	309.3
S		73.3	37.5	110,8	359.4	470.2	309.8
O		86.2	37.5	123.7	511.9	635.6	310.4
N		82.2	37,5	119.7	497.3	616.9	311.0
D	m 2.8	65.2	37.5	99.9	472.4	572.3	311.6
Total	329.7	991.0	900.0	1,561.3	12,421.3	13,982.6	
1919							
J	11.9	79.9	37.5	105.5	250.3	355.8	312.3
F	24.4	75.5	37.5	88.6	417.0	505.6	312.8
M	18.9	95.5	90.0	166.6	533.2	709.8	313.5
A	60.1	95.5	90.0	125.4	1,167.6	1,293.0	314.8
M	3.1	98.8	90.0	185.7	2,102.6	2.288.3	317.1
J		97.6	225.0	322.6	1,823.6	2,146.2	319.2
J	42.6	102.0	90.0	149.4	1,037.3	1,186.7	320.4
A	54.2	98.8	90.0	134.6	533.7	668.3	321.1
S	8.7	82.0	37.5	110.8	264.5	375.3	321.5
O	21.2	96.5	37.5	112.8	359.9	472.7	322.0
N	188.1	92.1	37,5	- 58.5	621.4	562.9	322.5
D	306.0	95.5	37.5	- 173.6	963.6	789.8	323.3
Total	739.9	1,110.0	900.0	1,270.1	10,086.0	11,356.1	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected for U.B.	Corrected Flow at Black C.	Cumul. Mass, M.A.Ft
1920							
J	40.0	88.6	37.5	86.1	2,205.7	805.0	324.1
F	424.4	83.5	37.5	- 303.4	718.9	1,902.3	326.0
M	190.5	105.8	90.0	5.3	1,112.6	1,118.2	327.1
A	108.2	105.8	99000	87.6	1,159.0	1,247.1	328.3
M	14.6	109.5	90.0	184.9	2,733.8	2,818.7	331.1
J		108.2	225.0	233.2	7,489.8	7,723.0	338.8
J		113.0	90.0	203.0	2,459.6	2,662.6	341.5
A		109.5	90.0	199.5	970.2	1,169.7	342.7
S		91.0	37.5	128.5	462.9	591.4	343.3
O		107.0	37.5	144.5	431.8	576.3	343.9
N	9.4	102.0	37.5	130.1	633.8	763.9	344.7
D	13.6	105.8	37.5	127.7	469.3	597.0	345.3
Total	800.8	1,230.0	900.0	1,329.2	20,848.8	22,178.0	
1921							
J	22.9	85.5	37.5	100.1	442.8	542.9	346.0
F	8.4	80.5	37.5	109.6	424.7	534.3	346.5
M	1.0	101.5	90.0	190.5	824.5	1,015.0	347.5
A		101.5	90.0	191.5	767.2	958.7	348.5
M		105.2	90.0	195.2	2,572.2	2,767.4	351.3
J		104.0	225.0	329.0	6,427.7	6,756.7	358.0
J		108.0	90.0	198.0	2,646.7	2,844.7	360.8
A	341.1	105.2	90.0	- 145.9	2,062.2	1,916.3	362.7
S	41.1	87.5	37.5	83.9	1,062.6	1,146.5	363.8
O	15.2	102.8	37.5	125.1	580.2	705.3	364.5
N	5.7	98.3	37.5	130.1	460.8	590.9	365.1
D	42.9	101.5	37.5	96.1	651.9	748.0	365.9
Total	478.3	1,182.0	900.0	1,603.7	18,923.5	20,527.2	
1922							
J	329.7	91.0	37.5	- 201.2	814.3	613.1	366.6
F	82.4	85.9	37.5	41.0	612.4	653.4	367.3
M	164.3	108.5	90.0	34.2	997.0	1,031.5	368.3
A	34.2	108.5	90.0	164.3	1,095.7	1,260.0	369.6
M	2,8	112.1	90.0	199.3	3,348.3	3,548.6	373.1
J		111.0	225.0	336.0	5,654.5	5,990.4	379.0
J		116.0	90.0	206.0	1,794.0	1,999.9	381.0
A		112.1	90.0	202.1	653.0	855.3	381.6
S	7.0	93.5	37.5	124.0	493.3	617.3	382.2
O		109.6	37.5	147.0	265.7	412.7	382.6
N		104.5	37.5	142.0	337.8	479.8	383.1
D	52.1	108.5	37.5	93.9	469.5	563.4	383.8
Total	672.5	1,260.0	900.0	1,487.5	16,539.5	18,027.0	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected for U.B.	Corrected Flow at Black C.	Cumul. Mass, M.A.Ft.
1923							
J	16.5	91.0	37.5	112.0	339.5	451.5	384.6
F	5.5	85.9	37.5	117.9	333.0	450.9	384.9
M	95.0	108.5	90.0	103.5	540.0	643.5	385.5
A	2.0	108.5	90.0	196.5	1,041.0	1,237.5	386.7
M		112.1	90.0	202.1	2,800.0	3,002.3	389.7
J		111.0	225.0	336.0	4,932.5	5,268.4	395.0
J		116.0	90.0	206.0	2,487.6	2,693.6	397.7
A		112.1	90.0	202.1	1,438.1	1,640.2	399.3
S		93.5	37.5	131.0	1,244.1	1,375.1	400.7
O	2.7	109.6	37.5	144.3	714.3	858.6	401.6
N	83.0	104.5	37.5	59.0	818.6	877.6	402.5
D	224.0	108.5	37.5	- 78.0	638.0	600.0	403.1
Total	428.7	1,260.0	900.0	1,731.1	17,434.5	19.165.8	
1924							
J	317.0	91.0	37.5	- 188.5	795.0	606.5	403.8
F	22.3	85.9	37.5	101.1	491.0	592.1	404.4
M	4.7	108.5	90.0	193.8	520.0	713.8	405.1
A	30.6	108.5	90.0	168.0	1,286.0	1,454.0	406.6
M	2.0	112.1	90.0	200.1	2,500.6	2,700.7	409.3
J		111.0	225.0	336.0	3,080.3	3,416.2	412.7
J		116.0	90.0	206.0	1,015.0	1,221.0	413.9
A		112.1	90.0	202.1	224.7	426.8	414.3
S		93.5	37.5	131.0	161.6	292.6	414.6
O		109.6	37.5	147.0	262.4	409.4	415.0
N		104.5	37.5	142.0	376.5	518.5	415.5
D		108.5	37.5	146.0	362.0	508.0	416.0
Total	376.4	1,260.0	900.0	1,783.6	11,078.0	12,861.6	
1925							
J		89.3	37.5	126.8	221.0	347.8	416.4
F		84.3	37.5	121.8	358.0	479.8	416.9
M		106.5	90.0	196.5	530.8	727.3	417.6
A		106.5	90.0	196.5	1,068.0	1,264.5	418.9
M		110.5	90.0	200.5	1,732.0	1,932.5	420.8
J		109.0	225.0	334.0	2,405.0	2,739.0	423.5
J		114.0	90.0	205.0	1,655.4	1,859.4	425.4
A		110.5	90.0	200.5	687.8	888.3	426.3
S	65.3	91.8	37.5	64.0	1,190.0	1,254.0	427.6
O	10.7	108.0	37.5	134.8	1,164.7	1,299.5	428.9
N	0.4	103.0	37.5	140.1	682.7	822.8	429.7
D	1.8	106.5	37.5	142.2	482.0	624.2	430.3
Total	78.4	1,240.0	900.0	2,061.6	12,180.3	14,241.9	

TABLE IV

RECONSTRUCTION OF RIVERAT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected for U.B.	Corrected Flow at Black C.	Cumul. Mass, M.A.Ft.
1926							
J	1.0	89.3	37.5	125.8	362.0	487.8	430.8
F	0.2	84.3	37.5	121.6	294.0	415.6	431.2
M		106.5	90.0	196.5	446.0	642.5	431.8
A	228.0	106.5	90.0	- 31.5	1,392.0	1,360.5	433.2
M	21.3	110.5	90.0	179.2	2,738.0	2,917.7	436.1
J		109.0	225.0	334.0	3,490.5	3,824.5	439.9
J		114.0	90.0	204.0	1,352.0	1,556.1	441.5
A		110.5	90.0	200.5	498.0	698.5	442.2
S		91.8	37.5	129.3	246.4	375.7	442.6
O	61.7	108.0	37.5	83.7	449.0	532.8	443.1
N		103.0	37.5	140.5	258.8	399.3	443.5
D	45.1	106.5	37.5	98.9	465.0	563.9	444.2
Total	357.3	1,240.0	900.0	1,783.7	11,991.0	13,773.7	
1927							
J	36.6	89.3	37.5	90.2	284.0	374.2	444.5
F	415.0	84.3	37.5	- 293.2	1,074.0	780.8	445.3
M	116.0	106.5	90.0	80.5	719.0	798.5	446.1
A	8.5	106.5	90.0	188.0	947.0	1,135.0	447.2
M		110.5	90.0	200.2	2,965.0	3,162.5	450.4
J		109.0	225.0	334.0	3,402.0	3.737.0	454.1
J		114.0	90.0	204.0	2,626.5	2,830.5	456.9
A	2.0	110.5	90.0	198.5	887.0	1,086.1	458.0
S	54.8	91.8	37.5	74.5	887.6	1,865.3	459.9
O		108.0	37.5	145.5	1,057.3	1,202.8	461.1
N		103.0	37.5	140.5	733.9	874.4	462.0
D		106.5	37.5	144.0	466.0	610.0	462.6
Total	633.2	1,240.0	900.0	1,506.8	16,951.0	18,457.8	
1928							
J		89.3	37.5	126.8	398.0	524.8	463.1
F	22.6	84.3	37.5	100.0	447.0	547.0	463.6
M		106.5	90.0	196.5	548.0	744.5	464.3
A		106.5	90.0	196.5	797.0	993.5	465.3
M		110.5	90.0	200.5	3,257.3	3,457.8	468.8
J		109.0	225.0	334.0	3,806.0	4,140.0	472.9
J		114.0	90.0	200.5	1,545.9	1,746.4	474.6
A		110.5	90.0	204.0	526.0	730.2	475.3
S		91.8	37.5	129.3	243.1	372.4	475.7
O		108.0	37.5	145.5	401.6	547.1	476.2
N		103.0	37.5	140.5	444.0	584.5	476.8
D		106.0	37.5	144.0	394.0	538.0	477.3
Total	22.6	1,240.0	900.0	2,117.8	12,703.0	14,820.4	

TABLE IV

RECONSTRUCTION OF RIVER AT BLACK CANYON TO 1930

Quantities in thousands acre-feet.

Year-Month	Gila Flow U.S.R.S.	Laguna Diversion	Losses, Black to Laguna	Algebraic Total	Yuma Corrected for U.B.	Corrected Flow at Black C.	Cumul. Mass, M.A.Ft.
1929							
J		88.8	37.5	126.3	223.0	349.3	477.7
F		83.3	37.5	120.8	268.0	388.8	478.1
M		106.0	90.0	196.0	678.0	874.0	479.0
A		106.4	90.0	196.4	1,430.0	1,626.0	480.6
M		110.1	90.0	200.1	2,720.1	2,920.1	483.5
J		108.7	225.0	333.7	4,700.0	5,033.7	488.5
J		113.4	90.0	203.4	2,100.0	2,303.4	490.8
A		110.6	90.0	200.6	2,115.0	2,315.6	493.1
S	3.6	90.7	37.5	125.0	1,480.0	1,605.0	494.7
O	1.9	107.1	37.5	143.0	935.0	1,078.0	495.8
N		102.2	37.5	139.7	464.0	603.7	496.4
D		106.6	37.5	144.1	361.0	505.1	496.9
Total	5.5	1,234.1	900.0	2,128.6	17,474.0	19,602.6	

TABLE V

FUTURE FLOW AT BLACK CANYON

QUantities in millions acre-feet

Year-Month	Future Additional Diversion, Thousands A.Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1899				
J	20.0	0.02	0,7	0.6
F	30.0	0.1	1.4	1.3
M	50.0	0.1	2.1	2.0
A	315.0	0.4	4.9	4.5
M	1,050.0	1.5	8.5	7.0
J	1,605.0	3.1	12.8	9.7
J	660.0	3.7	16.1	12.4
A	196.0	3.9	16.1	12.2
S	55.0	3.9	16.4	12.5
O	# 20.0	3.9	16.9	13.0
N	# 40.0	3.9	17.4	13.5
D	# 10.0	3.9	17.9	14.0
Total	- 3,910.0	- 3.9		
1900				
J	20.0	3.9	18.6	14.7
F	30.0	3.9	19.4	14.7
M	50.0	4.0	20.1	16.1
A	315.0	4.3	22.9	18.6
M	1,050.0	5.3	26.5	21.2
J	1,605.0	6.9	30.8	23.9
J	660.0	7.6	33.2	25.6
A	196.0	7.8	33.2	25.4
S	55.0	7.9	33.3	25.4
O	20.0	7.9	33.6	25.7
N	40.0	7.8	33.7	25.9
D	10.0	- 7.8	33.9	26.1
1901				
J	20.0	7.8	34.2	26.4
F	30.0	7.8	34.6	26.8
M	50.0	7.9	35.0	27.1
A	315.0	8.2	36.3	28.1
M	1,050.0	9.2	38.4	29.2
J	1,605.0	10.8	40.2	29.4
J	660.0	11.5	41.1	29.6
A	195.0	11.7	41.1	29.4
S	55.0	11.8	41.4	29.6
Ø	20.0	11.8	41.9	30.1
N	40.0	11.7	42.9	31.2
D	10.0	11.7	42.9	31.2

TABLE V

FUTURE FLOW AT BLACK CANYON.

Quantities in millions acre-feet.

Year-Month	Future Additional Diversion, Thousands A. Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1902				
J	20.0	11.7	43.2	31.5
F	30.0	11.7	43.6	31.9
M	50.0	11.8	44.0	32.2
A	315.0	12.1	44.8	32.7
M	1,050.0	13.1	46.5	33.4
J	1,605.0	14.7	47.9	33.2
J	660.0	15.4	48.3	32.9
A	195.0	15.6	48.3	32.7
S	55.0	15.7	48.6	32.9
O	20.0	15.7	49.1	33.4
N	40.0	15.7	49.5	33.8
D	10.0	15.6	50.0	34.4
Total	-3,910.0			
1903				
J	20.0	15.6	50.3	34.7
F	50.0	15.6	50.6	35.0
M	30.0	15.7	51.0	35.3
A	315.0	16.0	51.7	35.7
M	1,050.0	17.0	53.4	36.4
J	1,605.0	18.6	56.1	37.5
J	660.0	19.3	57.4	38.6
A	195.0	19.5	58.3	38.8
S	55.0	19.6	58.6	39.0
O	20.0	19.6	59.2	39.6
N	40.0	19.5	59.6	40.1
D	10.0	19.5	60.0	40.5
1904				
J	20.0	19.5	60.3	40.8
F	30.0	19.5	60.6	41.1
M	50.0	19.6	61.0	41.4
A	315.0	19.9	61.4	41.5
M	1,050.0	20.9	62.9	42.9
J	1,605.0	22.5	65.1	42.6
J	660.0	23.2	65.9	42.7
A	195.0	23.4	66.7	43.3
S	55.0	23.5	67.3	43.8
O	20.0	23.5	68.1	44.6
N	40.0	23.4	68.6	45.2
D	10.0	23.4	69.0	45.6

TABLE V

FUTURE FLOW AT BLACK CANYON

Quantities in millions acre-feet.

Year-Month	Future Additional Diversion, Thousands A. Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1905				
J	20.0	23.4	69.4	46.0
F	30.0	23.4	70.4	47.0
M	50.0	23.5	72.6	49.1
A	315.0	23.8	74.0	50.2
M	1,050.0	24.8	76.0	51.2
J	1,605.0	26.4	80.2	53.8
J	660.0	27.1	81.6	54.5
A	195.0	27.3	82.1	54.8
S	55.0	27.4	82.4	55.0
O	20.0	27.4	83.0	55.6
N	40.0	27.3	83.6	56.3
D	10.0	27.3	84,3	57.0
Total	-3,910.0			
1906				
J	20.0	27.3	84.9	57.6
F	30.0	27.3	85.4	58.1
M	50.0	27.4	86.5	59.1
A	315.0	27.7	88.0	60.3
M	1,050.0	28.7	91.0	62.3
J	1,605.0	30.3	95.7	65.4
J	660.0	31.0	97.7	66.7
A	195.0	31.2	98.6	67.4
S	55.0	31.3	99.2	67.9
O	20.0	31.3	100.0	68.7
N	40.0	31.2	100.6	69.4
D	10.0	31.2	101.8	70.6
1907				
J	20.0	31.2	103.1	71.9
F	30.0	31.2	104.2	73.0
M	50.0	31.3	105.5	74.2
A	315.0	31.6	107.5	75.9
M	1,050.0	32.6	109.6	77.0
J	1,605.0	34.2	115.0	80.8
J	660.0	34.9	120.5	85.6
A	195.0	35.1	22.6	87.5
S	55.0	35.2	23.8	88.6
O	20.0	35.2	24.7	89.5
N	40.0	35.1	25.4	90.3
D	10.0	35.1	25.9	90.8

TABLE V

FUTURE FLOW AT BLACK CANYON

Quantities in millions acre-feet.

Year-Month	Future Additional Diversion in U.B., Thousands A. Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1908				
J	20.0	35.1	126.5	91.4
F	30.0	35.1	127.0	91.9
M	50.0	35.2	127.9	29.7
A	315.0	35.5	128.9	93.4
M	1,050.0	36.5	30.4	93.9
J	1,605.0	38.1	132.7	94.6
J	660.0	38.8	34.3	95.7
A	195.0	39.0	135.5	96.5
S	55.0	39.1	136.1	97.0
O	20.0	39.1	36.8	97.7
N	40.0	39.1	37.4	98.3
D	10.0	39.1	138.0	98.9
Total	-3,910.0			
1909				
J	20.0	39.1	138.6	99.5
F	30.0	39.1	139.3	100.2
M	50.0	39.2	140.3	101.1
A	315.0	39.5	142.0	102.5
M	1,050.0	40.5	145.2	104.7
J	1,605.0	42.1	151.2	109.1
J	660.0	42.8	155.8	113.0
A	195.0	43.0	158.1	115.1
S	55.0	60.9	160.9	117.8
O	20.0	43.1	161.9	118.8
N	40.0	43.0	162.5	119.5
D	10.0	43.0	163.1	120.1
1910				
J	20.0	43.0	164.0	121.0
F	30.0	43.0	164.6	121.6
M	50.0	43.1	166.2	123.1
A	315.0	43.4	67.9	124.5
M	1,050.0	44.4	171.2	126.8
J	1,605.0	46.0	173.8	127.8
J	660.0	46.7	174.4	129.7
A	195.0	46.9	175.1	128.2
S	55.0	47.0	175.4	128.4
O	20.0	47.0	175.9	128.9
N	40.0	46,9	176.4	129.5
D	10.0	46.9	176.9	130.0

TABLE V

FUTURE FLOW AT BLACK CANYON

Quantities in millions acre-feet

Year-Month	Future Additional Diversion in U.B., Thousands A. Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1911				
J	20.0	46.9	177.5	130.6
F	30.0	46.9	178.3	131.4
M	50.0	47.0	179.4	132.4
A	315.0	47.3	180.6	133.3
M	1,050.0	48.3	183.3	135.0
J	1,605.0	49.9	186.9	137.0
J	660.0	50.6	189.7	139.1
A	195.0	50.8	190.7	139.9
S	55.0	50.9	191.2	140.3
O	20.0	50.9	193.0	142.1
N	40.0	50.8	193.8	143.0
D	10.0	50.8	194.4	143.6
Total	-3,910.0			
1912				
J	20.0	50.8	194.8	144.0
F	30.0	50.8	195.3	144.5
M	50.0	50.9	196.1	145.2
A	315.0	51.2	197.3	146.1
M	1,050.0	52.2	199.7	147.5
J	1,605.0	53.8	205.9	152.1
J	660.0	54.5	208.5	154.0
A	195.0	54.7	209.8	155.1
S	55.0	54.8	210.5	155.7
O	20.0	54.8	211.3	156.5
N	40.0	54.7	212.1	157.4
D	10.0	54.7	212.6	157.9
1913				
J	20.0	54.7	212.9	158.2
F	30.0	54.7	213.3	158.6
M	50.0	54.8	214.0	159.2
A	315.0	55.1	215.5	160.4
M	1,050.0	56.1	217.8	161.7
J	1,605.0	57.7	220.5	162.8
J	660.0	58.4	221.6	163.2
A	195.0	58.6	222.1	163.5
S	55.0	58.7	222.6	163.9
O	20.0	58.7	223.4	164.7
N	40.0	58.6	224.0	165.4
D	10.0	58.6	224.5	165.9

TABLE V

FUTURE FLOW AT BLACK CANYON

Quantities in millions acre-feet.

Year-Month	Future Additional Diversion in U.B., Thousands A. Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1914				
J	20.0	58.6	225.1	166.5
F	30.0	58.6	225.7	167.1
M	50.0	58.7	226.7	168.0
A	315.0	59.0	228.1	171.4
M	1,050.0	60.0	231.4	171.4
J	1,605.0	61.6	237.9	176.3
J	660.0	62.3	240.9	178.6
A	195.0	62.5	242.2	179.7
S	55.0	62.6	242.8	180.2
O	20.0	62.6	243.8	181.2
N	40.0	62.5	244.5	182.0
D	10.0	62.5	245.0	182.5
Total	-3,910.0			
1915				
J	20.0	62.5	245.5	183.0
F	30.0	62.5	246.4	183.9
M	50.0	62.6	247.2	184.6
A	315.0	62.9	248.7	185.8
M	1,050.0	63.9	251.3	187.4
J	1,605.0	65.5	254.1	188.6
J	660.0	66.2	255.8	189.6
A	195.0	66.4	256.4	190.0
S	55.0	66.5	256.7	190.2
O	20.0	66.5	257.3	190.8
N	40.0	66.4	257.8	191.4
D	10.0	66.4	258.3	191.9
1916				
J	20.0	66.4	259.0	192.6
F	30.0	66.4	260.0	193.6
M	50.0	66.5	261.6	195.1
A	315.0	66.8	263.2	196.4
M	1,050.0	67.8	266.5	198.7
J	1,605.0	69.4	270.0	200.6
J	660.0	70.1	272.1	202.0
A	195.0	70.3	273.8	203.5
S	55.0	70.4	274.5	204.1
O	20.0	70.4	276.1	205.7
N	40.0	70.3	276.9	206.6
D	10.0	70.3	277.5	207.2

TABLE V

FUTURE FLOW AT BLACK CANYON

Quantities in millions acre-feet.

Year-Month	Future Additional Diversion in U.B., Thousands A. Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cunulative Mass
1917				
J	20.0	70.3	278.0	207.7
F	30.0	70.3	278.5	208.2
M	50.0	70.4	279.1	208.7
A	315.0	70.7	280.3	209.6
M	1,050.0	71.7	283.1	211.4
J	1,605.0	73.3	288.5	215.2
J	660.0	74.0	294.2	220.2
A	195.0	74.2	295.6	221.4
S	55.0	74.3	296.2	221.9
O	20.0	74.3	296.8	222.5
N	40.0	74.2	297.3	223.1
D	10.0	74.2	297.9	223.7
Total	-3,910.0			
1918				
J	20.0	74.2	298.4	224.2
F	30.0	74.2	298.8	224.6
M	50.0	74.3	299.7	225.4
A	315.0	74.6	300.5	225.9
M	1,050.0	75.6	302.3	226.7
J	1,605.0	77.2	306.0	228.8
J	660.0	77.9	308.6	230.7
A	195.0	78.1	309.3	231.2
S	55.0	78.2	309.8	231.6
O	20.0	78.2	310.4	232.2
N	40.0	78.2	311.0	232.8
D	10.0	78.1	311.6	233.5
1919				
J	20.0	78.2	312.3	234.1
F	30.0	78.2	312.8	234.6
M	50.0	78.3	313.5	235.2
A	315.0	78.6	314.8	236.2
M	1,050.0	79.6	317.1	237.5
J	1,605.0	81.2	319.2	238.0
J	660.0	81.9	320.4	238.5
A	195.0	82.1	321.1	239.0
S	55.0	82.2	321.5	239.3
O	20.0	82.2	22.0	239.8
N	40.0	82.1	322.5	240.4
D	10.0	82.1	323.3	241.2

TABLE V

FUTURE FLOW AT BLACK CANYON

Quantities in millions acre-feet

Year-Month	Future Additional Diversion in U.B., Thousands A. Ft.	Cumulative Mass	Present Massmat Black Canyon	Net Future Cumulative Mass
1920				
J	20.0	82.1	324.1	242.0
F	30.0	82.1	326.0	243.9
M	50.0	82.2	327.1	244.9
A	315.0	82.5	328.3	245.8
M	1,050.0	83.5	331.1	247.6
J	1,605.0	58.1	338.8	253.7
J	660.0	85.8	341.5	255.7
A	195.0	86.0	342.7	256.7
S	55.0	86.1	343.3	257.2
O	20.0	86.0	343.9	257.8
N	40.0	86.0	344.7	258.7
D	10.0	86.0	345.3	259.3
Total	-3,910.0			
1921				
J	20.0	86.0	346.0	260.0
F	30.0	86.0	346.5	260.5
M	50.0	86.1	347.5	261.4
A	315.0	86.4	348.5	262.1
M	1,050.0	87.4	351.3	263.9
J	1,605.0	89.0	358.0	269.0
J	660.0	89.7	360.8	271.1
A	196.0	89.9	362.7	272.8
S	55.0	90.0	363.8	273.8
O	20.0	90.0	364.5	274.5
N	40.0	89.9	365.1	275.2
D	10.0	89.9	365.9	276.0
1922				
J	20.0	89.9	366.6	276.7
F	30.0	89.9	367.3	277.4
M	50.0	90.0	368.3	278.3
A	315.0	90.3	369.6	279.3
M	1,050.0	91.3	373.1	281.8
J	1,605.0	92.9	379.0	286.1
J	660.0	93.6	381.0	287.4
A	195.0	93.8	381.6	287.8
S	55.0	93.9	382.2	288.3
O	20.0	93.9	382.6	288.7
N	40.0	93.8	383.1	289.3
D	10.0	93.8	383.8	290.0

TABLE V

FUTURE FLOW AT BLACK CANYON

Quantities in millions acre-feet

Year-Month	Future Additional Diversion in U.B., Thousands A. Ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1923				
J	20.0	93.8	384.5	290.7
F	30.0	93.8	384.9	291.1
M	50.0	93.9	385.5	291.6
A	315.0	94.2	386.7	292.5
M	1,050.0	95.2	389.7	294.5
J	1,605.0	96.8	395.0	298.2
J	660.0	97.5	397.7	300.2
A	195.0	97.7	399.3	301.6
S	55.0	97.8	400.7	302.9
O	20,0	97.8	401.6	303.8
N	40.0	97.7	402.5	304.8
D	10.0	97.7	403.1	305.4
Total	-3,910.0			
1924				
J	20.0	97.7	403.8	306.1
F	30.0	97.7	404.4	306.7
M	50.0	97.8	405.1	307.3
.A	315.0	98.1	406.6	308.5
M	1,050.0	99.1	409.3	310.2
J	1,605.0	100.7	412.7	312.0
J	660.0	101.4	413.9	312.5
A	195.0	101.6	414.3	3127
S	55.0	101.7	414.6	312.9
O	20.0	101.7	415.0	313.3
N	40.0	101.6	415.5	313.9
D	10.0	101.6	416.0	314.4
1925				
J	20.0	101.6	416.4	314.8
F	30.0	101.6	416.9	315.3
M	50.0	101.7	417.6	315.9
A	315.0	102.0	418.9	316.9
M	1,050.0	103.0	420.8	317.8
J	1,605.0	104.6	423.5	318.9
J	660.0	105.3	425.4	320.1
A	195.0	105.5	426.3	320.8
S	55.0	105.6	427.6	322.0
O	20.0	105.6	428.9	323.3
N	40.0	105.5	429.7	324.2
D	10.0	105.5	430.3	324.8

TABLE V

FUTURE FLOW AT BLACK CANYON

Year-Month	Future Additional Diversion in U.B., Thousands acre ft.	Cumulative Mass	Present Mass at Black Canyon	Net Future Cumulative Mass
1926				
J	20.0	105.5	430.8	325.3
F	30.0	105.5	431.2	325.7
M	50.0	105.6	431.8	326.2
A	315.0	105.9	433.2	327.3
M	1,050.0	106.9	437.1	329.2
J	1,605.0	108.5	439.9	331.4
J	660.0	109.2	441.5	332.3
A	195.0	109.4	442.2	332.8
S	55.0	109.5	442.6	333.1
O	20.0	109.5	443.1	333.6
N	40.0	109.4	443.5	334.1
D	10.0	109.4	444.1	334.7
1927				
J	20.0	109.4	444.6	335.1
F	30.0	109.4	445.3	335.9
M	50.0	109.5	446.1	336.6
A	315.0	109.8	447.2	337.4
M	1,050.0	110.8	450.4	339.6
J	1,605.0	112.4	454.1	341.7
J	660.0	113.1	456.9	343.8
A	196.0	113.3	458.0	344.7
S	55.0	113.4	461.1	347.7
O	20.0	113.4	461.1	347.7
N	40.0	113.3	462.0	348.7
D	10.0	113.3	462.6	349.3
1928				
J	20.0	113.3	463.1	349.8
F	30.0	113.3	463.6	350.3
M	50.0	113.4	464.3	350.9
A	315.0	113.7	465.3	351.6
M	1,050.0	114.7	468.8	354.1
J	1,605.0	116.3	472.9	356.6
J	660.0	117.0	474.6	357.6
A	196.0	117.2	475.3	358.1
S	55.0	117.3	475.7	358.4
O	20.0	117.3	476.2	358.9
N	40.0	117.2	476.8	359.6
D	10.0	117.2	477.3	360.1
1929				
J	20.0	117.3	477.7	360.4
F	30.0	117.3	478.1	360.8
M	50.0	117.4	479.0	361.6
A	315.0	117.7480.6	480.6	362.9
M	1,050.0	118.7	483.5	364.8
J	1,605.0	120.3	488.5	368.2
J	660.0	121.0	490.8	369.8
A	195.0	121.2	493.1	371.9
S	55.0	121.3	494.7	373.5
O	20.0	121.3	495.8	374.5
N	40.0	121.2	496.4	375.2
D	10.0	121.2	496.9	375.7

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	PRESENT Head Feet	PRESENT Horse Power, Thousands Primary	PRESENT Horse Power, Thousands Secondary	FUTURE Head Feet	FUTURE Horse Power, Thousands Primary	FUTURE Horse Power, Thousands Seconda
1899						
J	480	775		482	547	
F	477	771		480	545	
M	473	765		480	545	
A	488	790		497	565	
M	5111	826		510	579	
J	538	870		528	600	
J	538	870	2,000	537	610	666
A	538	870		535	608	
S	538	870		532	605	
O	537	868		529	600	
N	532	860		527	598	
D	527	853		523	595	
1900						
J	523	845		532	595	
F	520	840		515	585	
M	517	836		522	593	
A	532	860		535	608	
M	537	870	1,550	537	610	1,330
J	537	870	2,670	537	610	1,580
J	537	870	1,080	537	610	750
A	537	870		537	610	
S	537	870		537	610	
O	537	870		537	610	
N	537	870		537	610	
D	537	870		537	610	
1901						
J	537	870	667	537	610	
F	537	870		537	610	
M	533	863		533	605	
A	534	864		535	608	
M	537	870	500	538	612	
J	537	870	583	533	605	
J	537	870		528	600	
A	537	870		519	590	
S	531	858		513	583	
O	525	850		510	579	
N	520	840		508	577	
D	515	833		507	576	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	PRESENT Head Feet	PRESENT Horse Power, Thousands Primary	PRESENT Horse Power, Thousands Spilled	FUTURE Head, Feet	FUTURE Horse Power, Thousands Primary	FUTURE Horse Power, Thousands Spilled
1902						
J	508	821		502	570	
F	502	812		498	566	
M	495	800		495	562	
A	493	797		495	562	
M	498	799		492	558	
J	502	812		482	547	
J	495	800		472	536	
A	488	790		463	526	
S	477	772		457	519	
O	473	765		453	515	
N	455	736		450	511	
D	460	744		447	508	
1903						
J	452	731		442	502	
F	442	714		438	498	
M	435	703		433	492	
A	432	697		428	486	
M	438	708		428	486	
J	455	736		430	488	
J	462	747		433	492	
A	455	736		428	486	
S	448	725		418	475	
O	441	713		415	471	
N	433	700		412	468	
D	425	687		405	460	
1904						
J	415	672		398	452	
F	403	653		392	445	
M	393	636		385	437	
A	383	620		375	426	
M	388	628		383	435	
J	404	654		367	417	
J	400	648		355	403	
A	397	643		353	401	
S	390	631		348	395	
O	383	620		348	395	
N	376	608		345	392	
D	365	591		338	384	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

	PRESENT			FUTURE		
Year-Month	Head, Feet	Horse Power, Thousands Primary	Spilled	Head, Feet	Horse Power, Thousands Primary	Spilled
1905						
J	345	573		330	375	
F	352	570		333	381	
M	370	598		355	403	
A	375	607		360	409	
M	387	626		364	413	
J	430	696		390	443	
J	433	701		388	441	
A	427	691		380	432	
S	415	671		372	423	
O	408	660		368	418	
N	400	647		367	417	
D	395	639		365	415	
1906						
J	388	628		363	412	
F	378	611		358	407	
M	378	611		362	411	
A	383	620		367	417	
M	412	667		385	437	
J	453	735		417	474	
J	462	748		423	481	
A	460	745		422	480	
S	455	738		418	475	
O	452	734		418	475	
N	448	725		415	471	
D	449	726		422	480	
1907						
J	451	730		428	487	
F	451	730		432	491	
M	453	734		435	494	
A	463	748		445	506	
M	470	761		447	508	
J	508	822		477	542	
J	537	870	1,000	513	583	
A	537	870	833	523	595	
S	537	870		527	598	
O	537	870		528	599	
N	537	870		528	599	
D	537	870		525	597	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	PRESENT Head, Feet	PRESENT Horse Power, Thousands Primary	PRESENT Horse Power, Thousands Spilled	FUTURE Head, Feet	FUTURE Horse Power, Thousands Primary	FUTURE Horse Power, Thousands Spilled
1908						
J	540	1,130		520	805	
F	532	1,115		515	798	
M	527	1,100		513.	795	
A	523	1,095		508	787	
M	523	1,095		503	780	
J	532	1,115		500	775	
J	533	1,117		500	775	
A	530	1,111		497	770	
S	523	1,095		491	761	
O	517	1,080		488	756	
N	509	1,062		483	750	
D	505	1,055		478	740	
1909						
J	498	1,040		473	734	
F	492	1,028		470	728	
M	487	1,018		467	724	
A	490	1,025		470	728	
M	505	1,055		480	744	
J	537	1,122	750	510	790	
J	537	1,122	2,670	535	829	
A	537	1,122	750	537	833	583
S	537	1,122	1,165	537	833	1,332
O	536	1,122		537	833	
N	537	1,122		537	833	
D	537	1,122		537	833	
1910						
J	536	1,122		537	833	
F	537	1,122		537	833	
M	537	1,122		537	833	
A	537	1,122	333	537	833	333
M	537	1,122	1,582	537	833	250
J	537	1,122	167	537	833	1,082
J	537	1,122	167	536	833	
A	537	1,122		537	833	
S	537	1,122		533	827	
O	537	1,122		528	819	
N	537	1,122		523	811	
D	537	1,122		518	803	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	Present: Head, Feet	Present: Horse Power, Thousands: Primary	Present: Horse Power, Thousands: Spilled	Future: Head, Feet	Future: Horse Power, Thousands: Primary	Future: Horse Power, Thousands: Spilled
1911						
J	536	1,122		513	795	
F	533	1,115		510	790	
M	530	1,108		509	788	
A	528	1,105		508	787	
M	537	1,122	250	513	795	
J	537	1,122	1,750	522	809	
J	537	1,122	1,165	530	821	
A	537	1,122		527	817	
S	537	1,122		521	807	
O	537	1,122		527	817	
N	537	1,122		525	814	
D	537	1,122		521	807	
1912						
J	537	1,122		515	798	
F	533	1,105		508	788	
M	527	1,102		505	782	
A	528	1,104		502	780	
M	523	1,095		507	785	
J	537	1,122	2,915	537	833	
J	537	1,122	1,665	537	833	667
A	536	1,122		537	833	
S	537	1,122		537	833	
O	537	1,122		536	831	
N	537	1,122		534	828	
D	537	1,122		530	821	
1913						
J	537	1,122		523	812	
F	537	1,122		517	801	
M	534	1,108		512	793	
A	535	1,110	500	513	794	
M	537	1,122	1,082	515	798	
J	537	1,122		515	798	
J	537	1,122		508	788	
A	537	1,122		502	779	
S	535	1,110		495	767	
O	530	1,108		492	762	
N	523	1,094		488	756	
D	515	1,075		482	746	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	PRESENT Head, Feet	PRESENT Horse Power, Thousands Primary	PRESENT Horse Power, Thousands Spilled	FUTURE Head, Feet	FUTURE Horse Power, Thousands Primary	FUTURE Horse Power, Thousands Spilled
1914						
J	507	1,060		477	739	
F	500	1,045		473	734	
M	497	1,038		470	728	
A	496	1,036		493	765	
M	513	1,072		482	747	
J	537	1,122	1,915	517	802	
J	537	1,122	1,332	528	818	
A	537	1,122		528	818	
S	537	1,122		522	810	
O	537	1,122		520	806	
N	537	1,122		517	802	
D	537	1,122		512	793	
1915						
J	536	1,120		507	785	
F	532	1,113		505	783	
M	527	1,102		502	778	
A	527	1,102		503	779	
M	537	1,122	1,167	508	786	
J	537	1,122	167	507	785	
J	537	1,122		500	775	
A	535	1,118		493	765	
S	528	1,104		487	755	
O	518	1,082		482	747	
N	537	1,122		507	785	
D	510	1,065		477	738	
1916						
J	504	1,053		472	731	
F	500	1,045		472	731	
M	502	1,049		476	737	
A	503	1,051		478	740	
M	520	1,087		488	757	
J	537	1,122		497	770	
J	537	1,122	583	499	773	
A	537	1,122	250	502	778	
S	537	1,122		498	772	
O	532	1,113		502	778	
N	527	1,102		500	775	
D	520	1,087		495	767	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	Present: Head, Feet	Present: Horse Power, Thousands: Primary	Present: Horse Power, Thousands: Spilled	Future: Head, Feet	Future: Horse Power, Thousands: Primary	Future: Horse Power, Thousands: Spilled
1917						
J	512	1,070		490	760	
F	504	1,053		484	750	
M	497	1,038		478	741	
A	495	1,033		477	740	
M	507	1,060		483	749	
J	537	1,122	417	507	786	
J	537	1,122	2,750	537	833	417
A	537	1,122	833	537	833	
S	537	1,122		536	832	
O	537	1,122		533	827	
N	537	1,122		528	818	
D	537	1,122		524	812	
1918						
J	537	1,122		518	803	
F	533	1,115		512	793	
M	529	1,106		508	787	
A	522	1,093		504	780	
M	526	1,100		502	778	
J	537	1,122	833	510	790	
J	537	1,122	1,000	517	802	
A	537	1,122		510	790	
S	537	1,122		505	781	
O	534	1,115		500	775	
N	528	1,105		496	769	
D	521	1,090		493	765	
1919						
J	515	1,075		488	756	
F	507	1,060		482	747	
M	508	1,062		478	740	
A	498	1,040		477	739	
M	507	1,058		478	740	
J	513	1,075		473	734	
J	510	1,065		467	723	
A	504	1,050		462	716	
S	495	1,035		455	705	
O	485	1,115		447	692	
N	478	1,000		441	685	
D	472	987		438	678	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	PRESENT Head, Feet	PRESENT Horse Power, Thousands Primary	PRESENT Horse Power, Thousands Spilled	FUTURE Head, Feet	FUTURE Horse Power, Thousands Primary	FUTURE Horse Power, Thousands Spilled
1920						
J	476	976		435	674	
F	470	982		443	688	
M	468	978		442	687	
A	465	972		440	682	
M	478	1,000		448	695	
J	534	1,115		495	767	
J	537	1,122	750	503	780	
A	537	1,122		503	780	
S	535	1,117		497	770	
O	530	1,108		492	763	
N	523	1,094		490	760	
D	516	1,079		485	751	
1921						
J	510	1,065		481	746	
F	503	1,050		475	736	
M	498	1,040		473	734	
A	495	1,033		469	727	
M	507	1,058		476	737	
J	537	1,122	1,415	512	793	
J	537	1,122	1,165	521	809	
A	537	1,122	416	525	814	
S	536	1,122		524	813	
O	537	1,122		521	809	
N	537	1,122		518	803	
D	537	1,122		515	798	
1922						
J	537	1,122		510	790	
F	534	1,116		508	788	
M	530	1,108		505	783	
A	528	1,103		505	783	
M	537	1,122	1,000	500	775	
J	537	1,122	2,915	537	833	750
J	537	1,122	1,250	537	833	
A	537	1,122		537	833	
S	537	1,122		534	827	
O	537	1,122		529	804	
N	537	1,122		525	813	
D	537	1,122		521	807	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	PRESENT Head, Feet	PRESENT Horse Power, Thousands Primary	PRESENT Horse Power, Thousands Spilled	FUTURE Head, Feet	FUTURE Horse Power, Thousands Primary	FUTURE Horse Power, Thousands Spilled
1923						
J	537	1,122		517	802	
F	537	1,122		510	790	
M	532	1,113		505	783	
A	520	1,087		503	780	
M	517	1,080		512	793	
J	537	1,122	2,915	534	828	
J	537	1,122	2,000	537	833	500
A	537	1,122	167	537	833	250
S	537	1,122		537	833	167
O	537	1,122		537	833	
N	537	1,122		537	833	
D	537	1,122		537	833	
1924						
J	537	1,122		535	830	
F	537	1,122		532	825	
M	537	1,122		502	778	
A	537	1,122		503	780	
M	537	1,122	1,000	533	826	
J	537	1,122	1,665	538	835	
J	537	1,122		534	829	
A	537	1,122		527	818	
S	537	1,122		517	803	
O	537	1,122		510	791	
N	537	1,122		507	786	
D	537	1,122		502	779	
1925						
J	528	1,103		495	768	
F	521	1,090		490	760	
M	512	1,070		485	752	
A	510	1,065		483	750	
M	515	1,075		482	748	
J	527	1,102		482	748	
J	530	1,108		483	750	
A	527	1,102		478	742	
S	525	1,097		480	745	
O	523	1,093		482	748	
N	518	1,082		478	742	
D	510	1,065		475	736	

TABLE VI

POWER VARIATIONS AT BLACK CANYON DAM.

Year-Month	PRESENT Head, Feet	PRESENT Horse Power, Thousands Primary	PRESENT Horse Power, Thousands Spilled	FUTURE Head, Feet	FUTURE Horse Power, Thousands Primary	FUTURE Horse Power, Thousands Spilld
1926						
J	503	1,050		468	726	
F	495	1,033		463	719	
M	487	1,015		457	708	
A	486	1,013		457	708	
M	500	1,044		465	721	
J	521	1,090		475	736	
J	523	1,095		473	733	
A	515	1,075		467	724	
S	507	1,058		458	711	
O	498	1,040		453	703	
N	490	1,022		447	693	
D	483	1,110		441	685	
1927						
J	473	990		433	672	
F	467	976		430	667	
M	461	964		425	659	
A	457	955		422	655	
M	475	993		435	675	
J	497	1,038		445	690	
J	508	1,060		455	706	
A	505	1,055		453	704	
S	509	1,062		472	783	
O	507	1,058		462	716	
N	503	1,050		460	713	
D	497	1,038		456	708	
1928						
J	488	1,018		450	698	
F	479	1,000		443	688	
M	472	987		438	680	
A	468	987		433	672	
M	488	1,018		448	695	
J	512	1,070		463	718	
J	514	1,074		462	716	
A	517	1,080		456	707	
S	498	1,040	44	447	693	
O	490	1,022		442	686	
N	483	1,010		437	678	
D	475	993		430	667	
1929						
J	465	973		420	652	
F	456	953		410	635	
M	450	940		405	628	
A	452	945		408	633	
M	467	976		418	648	
J	500	1,045		445	690	
J	507	1,058		450	698	
A	515	1,075		460	713	
S	518	1,082		465	721	
O	514	1,073		463	718	
N	498	1,040		460	713	
D	478	1,000		455	706	